

# SERVICE AND MAINTENANCE

## D1, D2





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# Safety Information

This chapter describes how safety precautions are presented in the manual and on the product. Read the chapter through very carefully before you start the engine or do any maintenance or service. It has to do with your safety; an incorrect operation can lead to personal injury and damage to products or property. It also gives you an introduction to the basic safety rules for using and looking after the engine.

If anything remains unclear or if you are unsure of something, contact your Volvo Penta dealer for assistance.

## **IMPORTANT:**

Always follow local safety instructions and regulations.

### **Safety texts have the following order of priority:**

#### **DANGER!**

Indicates a hazardous situation, which, if not avoided, result in death or serious injury.

#### **WARNING!**

Indicates a hazardous situation, which, if not avoided, could result in death or serious personal injury.

#### **CAUTION!**

Indicates a hazardous situation, which, if not avoided, could result in minor or moderate personal injury.

#### **IMPORTANT:**

Indicates a situation, which, if not avoided, could result in property damage.

**NOTICE!** Used to draw attention to important information that facilitates work or operations.



This symbol is may be used on the product to call your attention to the fact that this is safety information. Always read such information very carefully.

Make sure that warning and information symbols on the engine are clearly visible and legible. Replace symbols that have been damaged or have been painted over.



In some cases, this symbol is used on our products and refers to important information in the Operator's Manual.

Most chemicals such as engine and transmission oils, glycol, petrol and diesel oil and chemicals used in workshops such as degreasing agents, paint and solvents are harmful to health.

Carefully read the instructions on the product packaging! Always follow the safety regulations, such as the use of protective masks, goggles, gloves, etc. Make sure that other personnel are not exposed to substances that are hazardous to health. Ensure good ventilation.

Manage used and leftover chemicals in the prescribed manner.

### Personal safety equipment

#### **⚠ CAUTION!**

Always use appropriate safety equipment. Personal protective equipment does not eliminate the risk of injury but it will reduce the degree of injury if an accident does happen.

Some examples are ear protection, eye and face protection, protective footwear, personal protective equipment, head protection, protective clothing, gloves and respirators.

#### **⚠ WARNING!**

Ensure that all machine guards and safety devices are in place and are functional.

#### **⚠ CAUTION!**

Never use tools or products that show signs of damage.

### Protect your eyes

#### **⚠ CAUTION!**

Wear safety glasses.

Always wear safety glasses if there is a risk of splintering, sparks and spray from the electrolyte (so-called battery acid), or other chemicals. Your eyes are very delicate and damage can result in loss of sight!

### Protect your skin

#### **⚠ CAUTION!**

Risk of skin damage.

Avoid getting oil on your skin! Prolonged or repeated exposure to oil can dry out the skin. Thereafter, irritation, dryness and eczema and other skin problems may occur.

Use protective gloves and avoid oil-soaked clothes and rags. Wash regularly, especially before eating. Wear suitable protective creams to prevent skin from drying out and to facilitate cleaning.



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## Fire safety

### ⚠ WARNING!

Fire and Explosion Risk!  
Accidental spark could ignite fuel vapors.

All fuels – as well as many lubricants and chemicals – are flammable. Do not allow open flames or sparks near them. **Smoking forbidden!** Hydrogen from the batteries is also very flammable and explosive in certain mixture with air.

Ensure that the workplace is well ventilated and take the necessary precautions before welding or grinding begins. Always ensure that there is a fire extinguisher close at hand in the work area.

## Spare parts - safety

### ⚠ WARNING!

Always use Volvo Penta genuine spare part to minimize the risk of an explosion or fire.

Components in fuel systems and electrical systems on Volvo Penta engines are designed and manufactured to minimize the risk of explosions and fire, in accordance with applicable legal requirements.

## Used oils, filters and chemicals etc.

### ⚠ WARNING!

Risk of fire.  
Store fuel soaked rags and other flammable material so that there is no danger of them catching fire.

Oil-soaked rags can spontaneously ignite under certain circumstances.

### IMPORTANT:

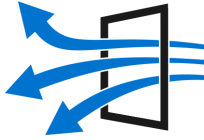
Used fuel and oil filters are environmentally hazardous waste and must be taken to an approved waste management facility for correct handling, as must any used lubricating oil, contaminated fuel, paint residue, solvents, degreasers and wash residue.

## Prevent start of the engine

### ⚠ WARNING!

Immobilize the engine by turning off the power supply with the main switch(es) and lock it (them) in the off position before starting work. Place a warning notice at the main switch.

If the engine is equipped with BMS (Battery Management System), always disconnect both battery cables from the battery terminals.



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### Ventilation when running the engine

**⚠ WARNING!**

Only start the engine in a well-ventilated area. If operating the engine in a closed area ensure that there is exhaust ventilation leading out of the work area to remove exhaust gases and crankcase ventilation emissions.

The engine must not be operated in areas where there are explosive materials or stored gas.

### Rotating parts and hot surfaces

**⚠ DANGER!**

Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.

If the engine is in operation and operates another device, you must not, under any circumstances, staying close to the engine.

Work on running engines is strictly prohibited. There are however adjustments that require the engine to be run. Approaching a running engine is a safety risk. Loose clothing and long hair can get caught in the rotating parts; careless movements or a dropped tool can lead to serious personal injury.

Be careful to avoid hot surfaces (exhaust pipes, turbochargers, charge air manifolds, start elements etc.) and hot fluids in pipes and hoses on engines that are running or have just stopped. Re-install all protective covers that were removed during maintenance work before starting the engine.

### Information on the engine

**IMPORTANT:**

Make sure that all warning and information decals on the product are always visible. Replace decals which have been damaged or painted over.



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## Prohibition on use of start spray

### **▲ WARNING!**

Never use start spray or similar agents to start an engine. This may cause an explosion in the inlet manifold. Risk of personal injury.

## Before start of engine

### **▲ WARNING!**

Never start the engine if there is reason to suspect fuel and/or gas leaks, or if there is explosive material nearby.

### **IMPORTANT:**

Only start the engine with the air filter and protective caps fitted. Foreign objects in the inlet line could cause machine damage. Also make sure that no tools or other parts have been left next to the engine.

### **▲ WARNING!**

Never start the engine with the valve cover removed. There is a risk of personal injury. For engines with turbochargers, the rotating compressor turbine can in addition cause serious personal injuries.

## Before any work on the electrical system

### **▲ WARNING!**

Always stop the engine first. Then disconnect the current at the main switches and any external power supply before working on the electrical system – to minimize the risk of electrical hazards.

### **IMPORTANT:**

Never disconnect the current using the main switches when the engine is running or by disconnecting the battery cables.

The alternator and electronics could be damaged.

## Avoid damage to the engine control module and other electronics

### **IMPORTANT:**

Switch off the main switch before connecting or disconnecting a connector.

## Before any work on the cooling system

### **▲ WARNING!**

Stop the engine and let it cool before starting work on the cooling system. Hot fluids and hot surfaces can cause burns.



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### Risk of water penetration/sinking

**⚠ WARNING!**

If a launched boat is equipped with sea water tap and safety valve, **ensure that these are closed** before any work is allowed to begin on the cooling system. Remember to open the tap and valve before starting the engine!

### Hot coolant under pressure

**⚠ CAUTION!**

Hot coolant can cause burns. Avoid opening the filler cap for the coolant when the engine is still hot. Steam or hot coolant can spray out and system pressure is lost.

Open the filler cap slowly, and release the pressure in the cooling system if the filler cap or valve has to be opened, or if a plug or coolant hose must be removed from a hot engine.

### Hot oil under pressure

**⚠ CAUTION!**

Hot oil can cause burns. Avoid getting hot oil on the skin. Ensure that the lubrication system is not pressurized before starting any work. Never start or operate the engine without the oil filler cap is on. There is a risk that hot oil can spray out.

### At any leak detection on the fuel system

**⚠ WARNING!**

Wear safety goggles!  
Be extremely careful when searching for leaks in the fuel system high-pressure circuits. There is very high pressure in the jet from pipes and injectors. The fuel may penetrate the tissue and cause serious risk of blood infection (septicemia).



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### Handling of fuel pipes

**IMPORTANT:**

High pressure pipes for fuel must not be bent or straightened under any circumstances. Cracks may occur. Damaged pipes must be replaced.

### Before any work on the fuel system — Cleanliness

**IMPORTANT:**

Take great care to keep the fuel system components clean. Even minimal amounts of dirt can cause engine breakdown.

## Safe handling of batteries

### **⚠ WARNING!**

Risk of fire and explosion. Never allow an open flame or electric sparks near the batteries.

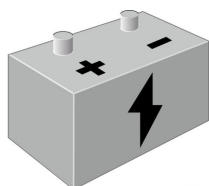
A spark caused by an incorrectly connected battery can be sufficient for the battery to explode resulting in serious injury and damage.

Do not touch the connections during a starting attempt. Spark hazard! Do not lean over batteries.

## Correct polarity of the batteries

### **IMPORTANT:**

Make sure that the positive (+) and negative (-) battery cables are correctly connected to the corresponding battery terminals. Wrong connection may cause severe damage to electrical equipment.



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## Risks of electrolyte in batteries

### **⚠ WARNING!**

Always wear protective goggles when charging or handling batteries.

Battery electrolyte is highly corrosive.

Rinse immediately with copious amounts of water if the electrolyte gets in your eyes. Search directly after the rinsing help by medical staff.

If it comes electrolyte to unprotected skin, wash immediately with soap and water.

## After finished work with the engine

### **IMPORTANT:**

Always perform a leakage and function check.

## Cleaning the engine and components

**NOTICE!** Follow the instructions *Cleaning engine and transmission*, page 78.



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## Cleanliness for sensitive components

### **IMPORTANT:**

Observe meticulous cleanliness when handling system components.

Even minimal amounts of dirt could cause a breakdown.



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## Lifting the engine

### **⚠ WARNING!**

Never work alone when removing heavy components, even when using lifting devices such as locking tackle lifts.

### **IMPORTANT:**

When using a lifting device, two people are usually required to do the work – one to take care of the lifting device – and the other to ensure that components are lifted clear and not damaged during the lifting operations.

## Proper lifting equipment

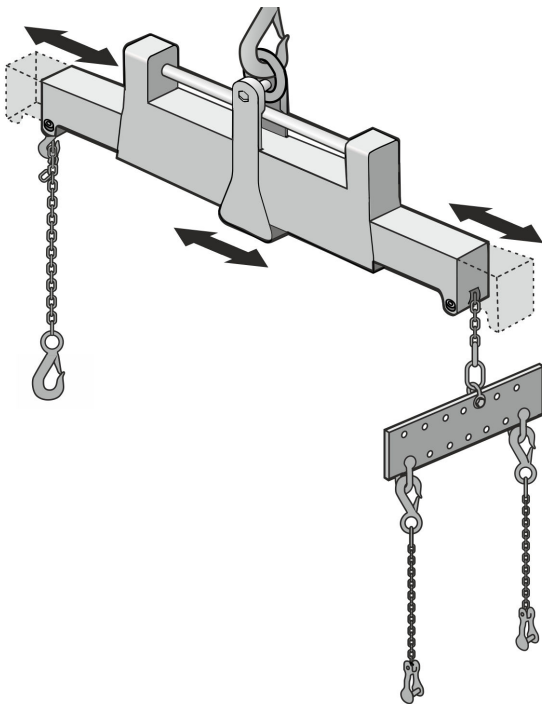
### **⚠ DANGER!**

The existing lugs on the engine should be used for lifting. **Always check that the lifting equipment used is in good condition and has the load capacity to lift the engine** (engine weight including transmission and extra equipment). For safe handling and to avoid damaging components fitted to the top of the engine, the engine must be lifted with a correctly adjusted lifting boom.

**Never perform any work on an engine that is only suspended from the lifting equipment.**

### **IMPORTANT:**

All chains or wires must run parallel to each other and as perpendicular to the engine as possible. If other equipment attached to the engine has altered its center of gravity, special lifting devices may be needed to obtain the correct balance for safe handling.



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Example of an adjustable lifting yoke and a lifting tool.

# General Information

## General information

This service and maintenance manual contains descriptions and instructions for the service of the above-mentioned Volvo Penta products in their standard models. The design and servicing items may vary between different products. Applicable service intervals and service procedures are described in the maintenance schedule for the product.

The product designation, serial number and specification are indicated on the engine decals or type plate. This information must always be provided in all correspondence concerning the product.

The manual has been produced primarily for use in Volvo Penta workshops. It is assumed that persons using the manual have fundamental knowledge of the product and are capable of carrying out mechanical and electrical work to industry standards.

Volvo Penta continually develops its products. We therefore reserve the right to make changes. All of the information in the manual is based on product data available when the manual was published.

**NOTICE!** The owner is responsible for ensuring that scheduled maintenance is carried out. Warranty claims to Volvo Penta may be declined if neglected maintenance results in faults in the specified product. Refer to the warranty terms supplied with the engine.

## Specific terms for the U.S. market

This engine is certified as being in compliance with federal and Californian exhaust restriction regulations. Parts related to exhaust restrictions are covered by the warranty commitment for exhaust restricting systems. Terms and the parts covered are specified under "What is covered by the warranty undertaking for emissions" in "Emission Control System Warranty Statement". Repairs and service covered by the warranty are carried out by an authorized Volvo Penta distributor or dealer at no charge for diagnostics, labor or parts using genuine Volvo Penta parts in all areas of the exhaust restriction system covered by the warranty and found to be defective.

The use of the service and repair workshop other than a Volvo Penta authorized distributor or dealer or the use of exhaust-related components from other manufacturers than Volvo Penta do not affect the scope of the warranty undertaking for emission-restricting systems. If emission-related components/items are included in scheduled service, such parts are marked with a diamond (◆) in the maintenance schedule and service must be carried out at the specified intervals in order to meet the requirements of the warranty undertaking for emission-restricting systems. The full warranty terms can be found in "Emission Control System Warranty Statement".

## Certified engines

The engine is exhaust-certified, and if it is used in an area where exhaust emissions are regulated by law, this places special demands on the care and maintenance of the engine.

**NOTICE!** Neglect or failure to follow the items required here may invalidate the engine emissions certificate.

This means that AB Volvo Penta will no longer be able to assume liability for engine specification compliance with the certified model. Volvo Penta is not responsible for damages or costs arising as a result of this.

- Certification means that an engine type has been inspected and approved by the competent authorities. The engine manufacturer guarantees that all engines made of the same type are equivalent to the certified engine.
- It is the responsibility of the user to make sure no intentional misuse of the engine takes place.
- Volvo Penta maintenance and service intervals must be followed.
- All faults must be remedied as soon as possible.
- Only use genuine Volvo Penta replacement parts or parts of the same quality as Volvo Penta replacement parts.
- The engine may not be converted or modified in any way, except with accessories and service kits which Volvo Penta has approved for the engine.
- Volvo Penta recommends that service on injection pumps, pump settings and injectors always be carried out by a qualified workshop.
- No changes may be made to the installation of the exhaust pipe and engine air inlet ducts.
- Any tampering with the engine will hamper EU type-approval of the engine concerned.
- No warranty seals (if present on the product) may be broken by unauthorized persons.

## Explanation of the relationship between service intervals and operating conditions

Because operating conditions may vary depending on how the component is used, it is important that the service interval (expressed in hours or months) is not exceeded.

Example: 1000 hours / 24 months. Whichever is the sooner applies. If the component is used for 1000 hours in 18 months, the service must be carried out when the 1000-hour interval is reached.

This is to retain the component's best quality and service life. The warranty will be void if this is not complied with.

Typical examples are: Propeller shaft seals operating in sandy waters. Air filters exposed to heavily polluted air

Action codes used in the service schedule:

C = Cleaning

R = Replacement

A = Adjustment

L = Lubricate

I = Inspection (includes where necessary also adjustment, cleaning, lubrication and replacement)

## Service Protocol

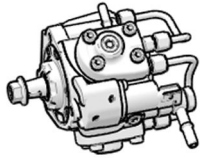
To maintain the product's functionality, the Service Protocol must be followed. Some operations can be carried out by the owner or other person with sufficient technical competence, in accordance with the Service Protocol. Please consult an authorized Volvo Penta dealer in the event of doubt regarding how service work should be performed.

The Service Protocol contains the required maintenance points for your engine in a single document. See more at the Volvo Penta website: [volvopenta.com](http://volvopenta.com).

## Preventive repair

Here is an overview of the components that may be included in preventive maintenance. May vary depending on the engine's design and construction.

These components form the basis for calculating service contracts and the costs in the service calculator in Product Center.



### Fuel system

Fuel pump  
Unit injectors

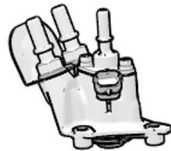
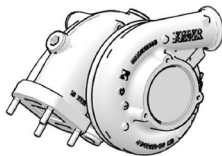


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### Exhaust system

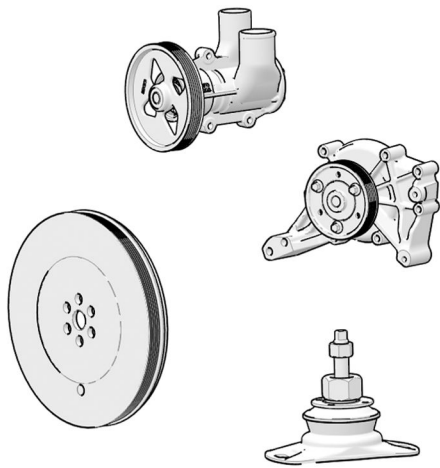
Turbocharger, low-pressure  
Turbocharger, high pressure  
Overflow valve (Lisk)  
Silencer  
Diesel particulate filter (DPF), replacement



### After-treatment system

Pump unit  
Dosage valve

P0026296



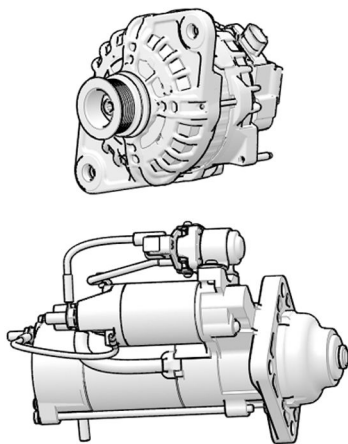
P0026297

**Cooling system**

Seawater pump  
Coolant pump

**Engine**

Vibration dampers  
Engine pads, kit



P0026298

**Electrical system**

Alternator  
Starter motor



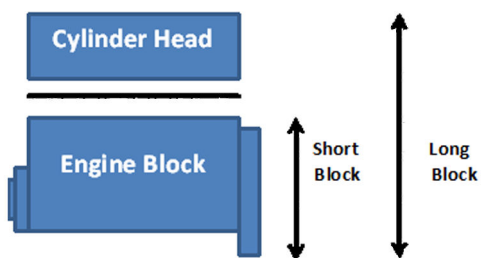
**Engine, overhaul**

Here is an overview of the components that may be included in a complete overhaul. May vary depending on the engine's design and construction.

E.g. liners may not be replaced on certain engines. In this case, cylinders must be measured to see if new pistons can be installed or if the engine block should be replaced.

The components below provide the basis for calculating service contracts and the costs in the service calculator in Product Center.

**Engine:** May be overhauled twice, after which the engine is considered spent and is replaced by a long block or new engine.



**Overhaul**

- Long block
- Short block
- Cylinder head (replacement)
- Cylinder head, gasket

P0026299



- Engine, overhaul kit
- Cylinder head, overhaul kit
- Gaskets, kit
- Flat gaskets
- Valve cover, gasket

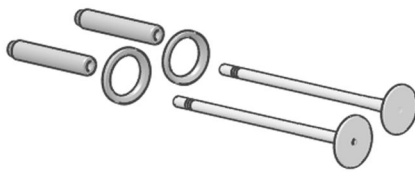
P0026300



Cylinder liners, kit  
Main bearings, kit  
Big end bearings, kit  
Thrust washers, kit  
Camshaft bearings, kit

P0026301

Exhaust valve  
Valve seat



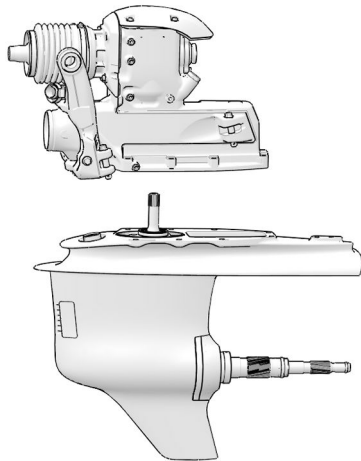
P0026302

**Transmission, overhaul**

Here is an overview of the components that may be included in a complete overhaul/replacement. May vary depending on the transmission's design and construction.

The components below provide the basis for calculating service contracts and the costs in the service calculator in Product Center.

The transmission is overhauled once, then the complete unit is replaced



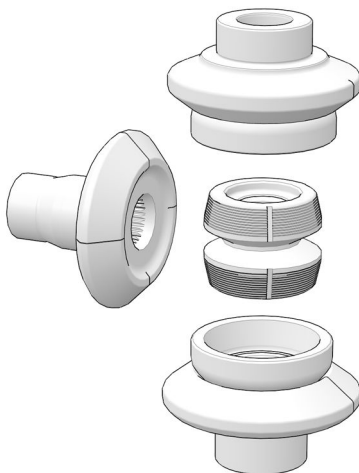
**Overhaul, Aquamatic**

Aquamatic sterndrive, replacement

Upper gear

Lower gear

P0026303



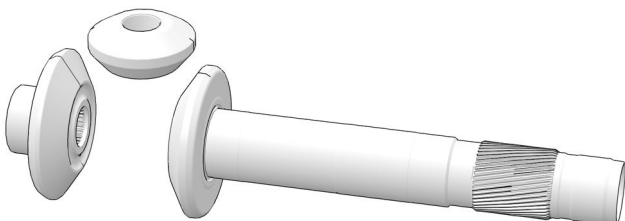
**Repair, Aquamatic**

Upper gear, kit

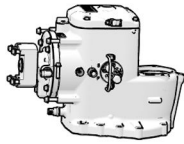
Sliding sleeve

P0026304

Lower gear, kit



P0026305

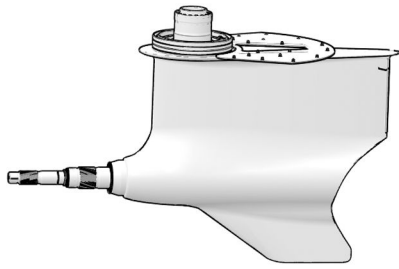


**Overhaul, IPS**

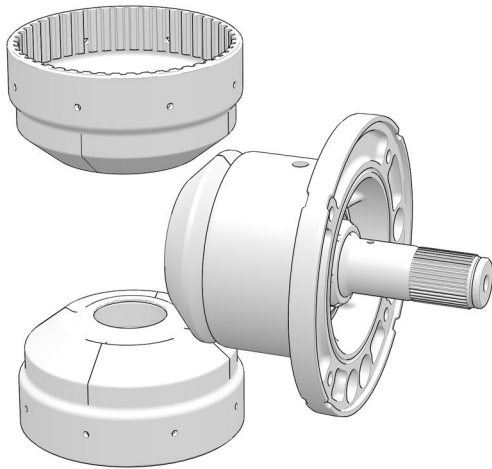
IPS Drive, replacement

Upper gear

Lower gear



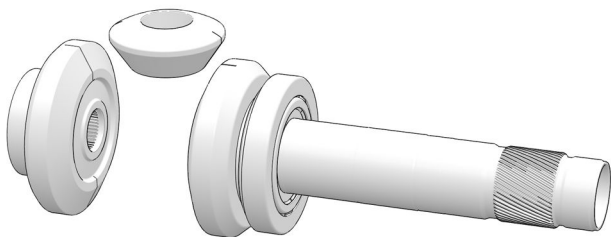
P0026306



**Repair, IPS**

Upper gear, kit

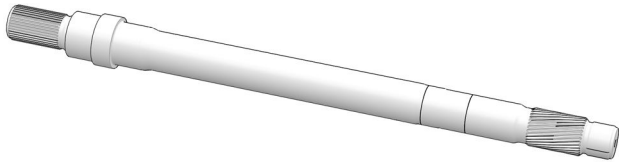
P0026307



Lower gear, kit

P0026308

Propeller shaft



P0026309

## Genuine Volvo Penta Parts

Volvo Penta products are designed and manufactured to achieve the highest quality. All parts are manufactured so that together they provide the best possible reliability. For this reason, we always recommend the use of Genuine Volvo Penta Parts as they are manufactured based on the same stringent specifications as the factory-installed parts in Volvo Penta powertrains.

## Lube oils

Volvo Penta supplies a wide range of lubricants developed especially for Volvo Penta engines. VDS (Volvo Drain Specification) is a Volvo standard that specifies Volvo's oil grade requirements. We recommend the use of the specified oil to ensure engine function and a long service life.

## Transmission oil

In a marine environment it is vitally important that the correct gear lubricant is used for the product concerned.

In Volvo Penta's extensive testing we pick out those oils that meet our requirements for functionality and that within the oil change intervals ensure the product's service life.

While oils from various suppliers meet both SAE class (viscosity) and API class (quality), their additives often differ. Additives can be up to 35% of the total volume, and are crucial to how oil can handle a given water content while still maintaining the necessary lubricating properties. The additives also affect the friction in, for example, the IPS unit clutch assembly. The correct oil is crucial for the proper functioning of the transmission.

### **IMPORTANT:**

It is extremely important not to use other oil than specified for the IPS unit.

**NOTICE!** Volvo Penta will deny all warranty claims if it emerges that the wrong oil has been used in the IPS unit.

**NOTICE!** For reverse gears, the oil change intervals and maintenance instructions recommended by the manufacturer must be adhered to.

## Coolant

The main function of a coolant is to absorb heat from the engine. The coolant also protects against freezing, lime deposits and corrosion. Volvo Penta Coolant VCS (yellow) and Volvo Penta Coolant (green) are two completely different types of coolants, which contain different types of inhibitors. Different types of coolants (colors) must not be mixed.

If the concentrated coolant must be diluted with water, the water's chemical composition may impair the corrosion protection. In areas with high levels of sodium and calcium in tap water, the coolant must be diluted with distilled water. Alternatively, Volvo Penta coolant is available for purchase ready diluted.

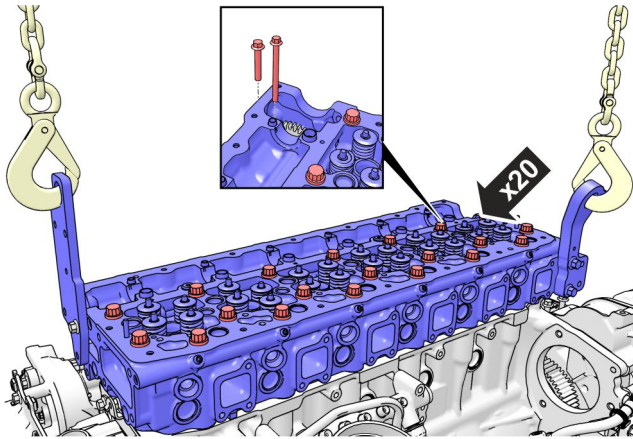
<b>Mixing the concentrated coolant</b>	<b>Protection against freeze bursting down to:</b>
40 %	-25 °C
46 %	-30 °C
54 %	-38 °C
60 %	-46 °C

**NOTICE!** It is important to use coolant with a concentration of 40-60 % in the cooling system even where there is no risk of freezing. The coolant also prevents corrosion and deposits. A mixture with a concentration above 60 % will impair antifreeze protection.

## Illustrations

### Colors used in illustrations

Most illustrations include a highlighted component which is secured by a bolt or similar as part of a (light gray) engine or transmission.



P0022106

- Highlighted components (blue)
- Fastener (red)
- Assembly (light gray)
- Background (white)
- Special tools (yellow)
- Seals (green)  
(as of 06/2018)

**Other types of symbols used in the images are divided into the following categories:**

- Safety
- Important
- Cleanliness
- Position
- Movement
- Measured value
- Tools
- Chemicals
- Sealant
- Units



# Chemical products

## Chemical products

The following is a selection of Volvo Penta recommended chemical products. The products are available for purchase at regional Volvo Penta dealerships. Deviations may occur in the range, see Specifications.

For correct part numbers, refer to the Parts catalogue.



Thread locking fluid



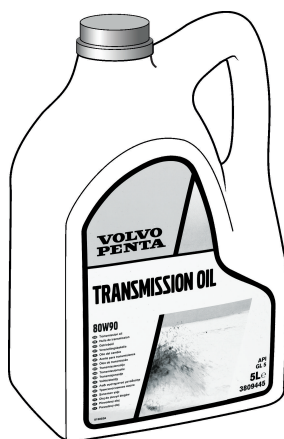
Corrosion protection



Sealant

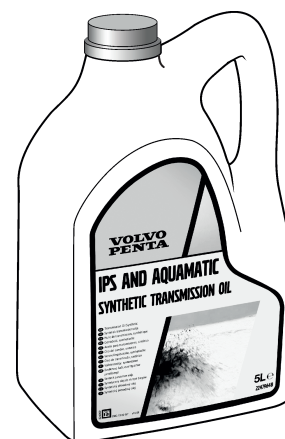


Engine oil



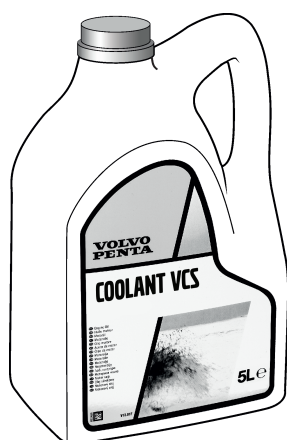
P0022835

Transmission oil



P0022817

IPS synthetic gear lubricant



P0023031

VCS Coolant



P0022805

Grease



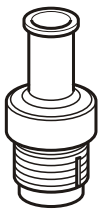
ATF oil

# Special Tools

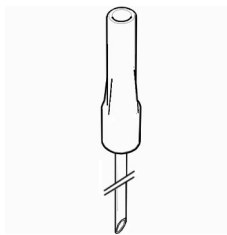


## Other Special Equipment

There are special equipment and tools to be used when working with the engine. For some operations/ service points special tools are required in order to carry out the work in a correct manner.



**3889988 Adapter**

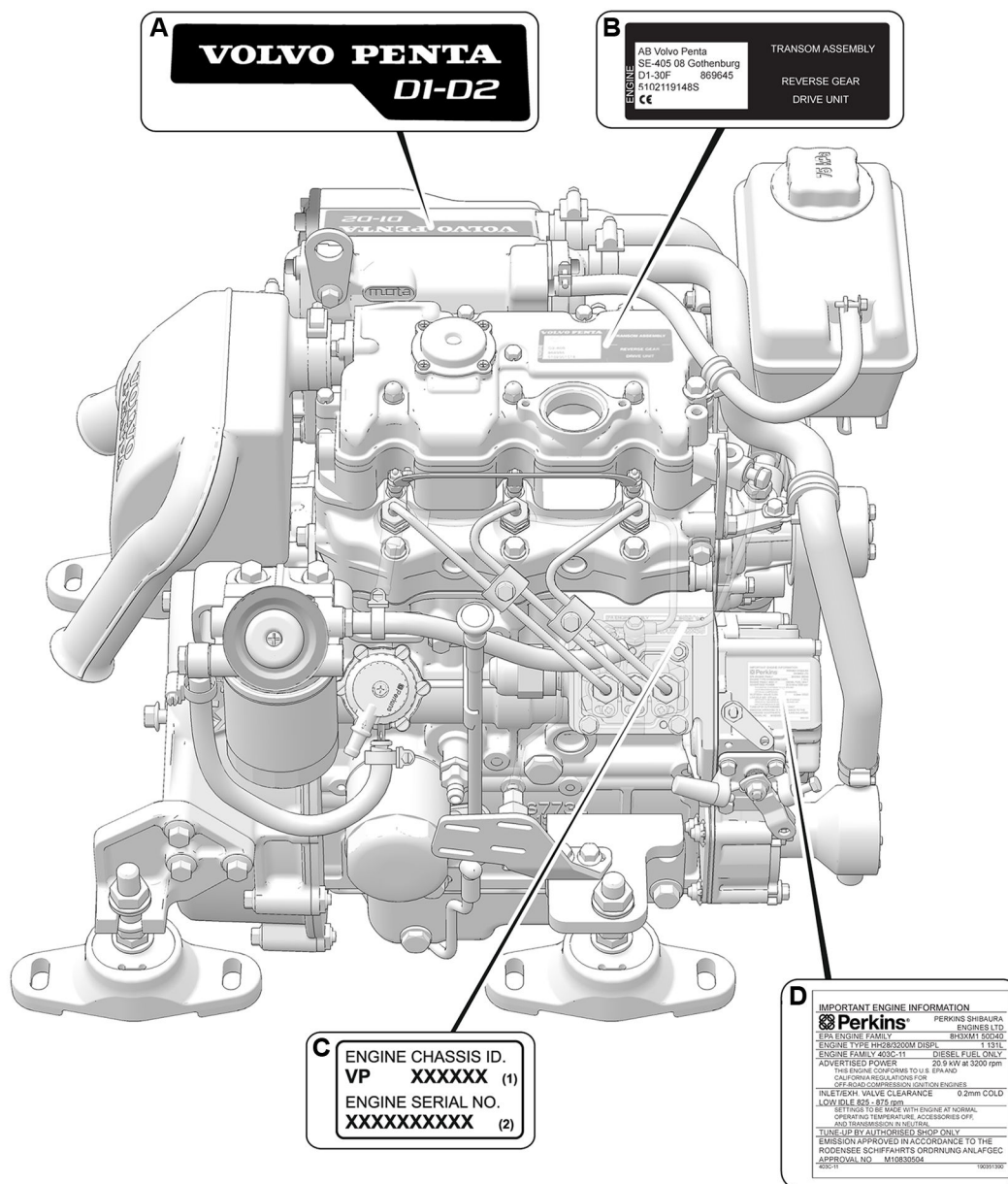


**22767251 Hose**

# Specifications

## Engine Decals

There are type plates on the engine, and in the case of marine applications, also on the drive-lines. Some type plates are marked identity numbers. This information should always be used as a reference when ordering service and replacement parts or when contacting Volvo Penta retailers.



**A**  
**VOLVO PENTA**  
**DI-D2**

**B**  
 AB Volvo Penta  
 SE-405 08 Gothenburg  
 D1-30F 869645  
 5102119148S  
 CE  
 TRANSOM ASSEMBLY  
 REVERSE GEAR  
 DRIVE UNIT

**C**  
 ENGINE CHASSIS ID.  
**VP XXXXXX** (1)  
 ENGINE SERIAL NO.  
**XXXXXXXXXX** (2)

**D**  
 IMPORTANT ENGINE INFORMATION  
 PERKINS SHIBaura  
**Perkins** ENGINES LTD  
 EPA ENGINE FAMILY 845XMT 800AD  
 ENGINE TYPE M10B3500M DISPL. 1.5LTL  
 ENGINE FAMILY 403C-11 DIESEL FUEL ONLY  
 ADVERTISED POWER 20.9 kW @ 3200 rpm  
 THIS ENGINE CONFORMS TO U.S. EPA AND  
 CALIFORNIA REGULATIONS FOR  
 OFF ROAD/COMPRESSION IGNITION ENGINES  
 INLET VALVE VALVE CLEARANCE 0.2mm COLD  
 LOW IDLE 825 - 875 rpm  
 SETTINGS TO BE MADE WITH ENGINE AT NORMAL  
 OPERATING TEMPERATURE, ACCESSORIES OFF,  
 AND TRANSMISSION IN NEUTRAL.  
 TUNE-UP BY AUTHORIZED SHOP ONLY  
 EMISSION APPROVED IN ACCORDANCE TO THE  
 RODENSEE SCHIFFFAHRTS ORDNRUNG ANLAFGEC  
 APPROVAL NO. M10B35004  
 10091330

P0030924

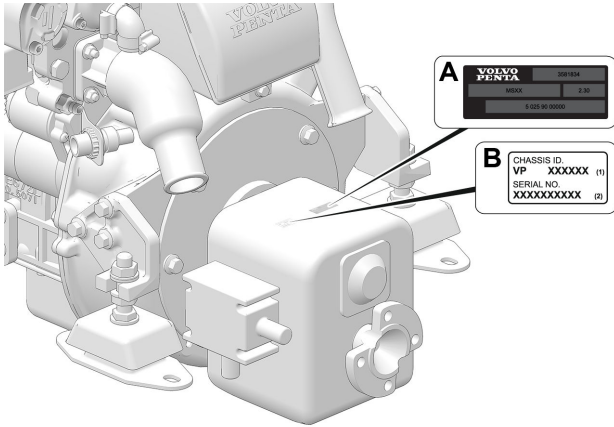
- A Engine ID
- B Engine/Transmission/Address
- C CHASSIS ID Engine
- D Certification

## Transmission Decals

Reverse gear

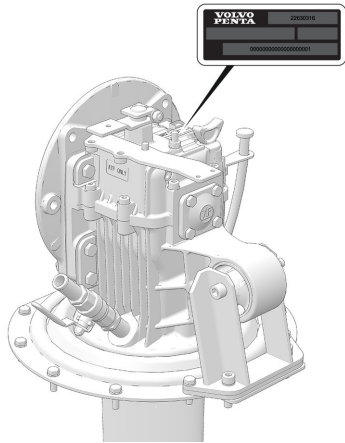
A Reverse gear ID

B CHASSIS ID reverse gear



P0030930

S Drive, ID



P0023977

## General Tightening Torques

<b>Bolt</b>	<b>Nm</b>
M6 standard bolt	10
M8 standard bolt	24
M10 standard bolt	48
M12 standard bolt	85
M14 standard bolt	140
M16 standard bolt	220

**NOTICE!** Check the bolts intended for installation. Damaged bolts with e.g. shear marks under the heads, must be scrapped.

## Specifications

### Volvo Penta products, all markets excluding North America

<b>Oil quantity in engine, including filter</b> D1-13 D1-20 D1-30 D2-40 D2-50 – D2-75	1.9 liters 2.8 liters 3.5 liters 6.5 liters 10.6 liters
<b>VDS-4.5 SAE15W-40</b> Part number: 23571951 Part number: 23039848 Part number: 23039851 Part number: 23039853	1 liter 5 liters 20 liters 208 liters
<b>Oil volume, reverse</b> MS15 A-B / L-B MS25 A-A / A-L HS25 A-A / A-L	0.56 liters 0.75 liters 1.8 liters
<b>Oil volume S-drive</b> 130/150S-C	3.4 liters
S-drive uses engine oil SAE 15W-40 Part number: 23219282	1 liter
Use MS reverse gear engine oil SAE 15W-40 Part number: 23219282	1 liter
The HS-25 reverse gear uses ATF/Dextron transmission oil Part number: 1161995	5 liters
<b>Coolant, VCS yellow, concentrated</b> Part number: 22567295 Part number: 22567307 <b>Coolant, VCS yellow, ready-mixed</b> Part number: 22567314 Part number: 22567340 <b>Coolant volume, (empty system)</b> D1-13 D1-20 D1-30 D2-40 D2-50 – D2-75	5 liters 210 liters 5 liters 210 liters 2.7 liters 3 liters 4.1 liters 6.4 liters 9.5 liters
<b>Propeller shaft grease.</b> Part number: 828250	25 grams

**NOTICE!** Old model engines have green coolant, which must NOT be mixed with newer VCS yellow coolant. Check that the engine is using the same type.

**NOTICE!** Yellow and red Volvo Penta ATF Dextron III oil may be mixed without causing any problems.

**Volvo Penta products for North America**

<b>Oil quantity in engine, including filter</b> D1-13 D1-20 D1-30 D2-40 D2-50 – D2-75	0.50 gallons 0.74 gallons 0.92 gallons 1.72 gallons 2.80 gallons
<b>VDS-4.5</b> Part number: 23219282 Part number: 23219274 Part number: 23219264 Part number: 23219260 Part number: 23219246	1 US quart 1 US gallon 5 gallons 55 gallons 330 gallons
<b>Oil volume, reverse</b>	
MS15 A-B / L-B MS25 A-A / A-L HS25 A-A / A-L	0.15 gallons 0.20 gallons 0.48 gallons
<b>Oil volume S-drive</b> 130/150S-C	0.90 gallons
S-drive uses engine oil SAE 15W-40 Part number: 23219282	0.26 gallons
Use MS reverse gear engine oil SAE 15W-40 Part number: 23219282	0.26 gallons
The HS-25 reverse gear uses ATF/Dextron transmission oil Part number: 3851039	1.32 gallons
<b>Coolant, VCS yellow, concentrated</b> Part number: 22567295 Part number: 22567307 <b>Coolant, VCS yellow, ready-mixed</b> Part number: 22567314 Part number: 22567340 <b>Coolant volume, (empty system)</b> D1-13 D1-20 D1-30 D2-40 D2-50 – D2-75	1.32 gallons 55.47 gallons 1.32 gallons 55.47 gallons 0.71 gallons 0.79 gallons 1.08 gallons 1.69 gallons 2.51 gallons
<b>Propeller shaft grease</b> Part number: 828250	25 grams

**NOTICE!** Old model engines have green coolant, which must NOT be mixed with newer VCS yellow coolant. Check that the engine is using the same type.

**NOTICE!** Yellow and red Volvo Penta ATF Dextron III oil may be mixed without causing any problems.

# Engine

## Component location

### General inspection

Make a habit of visually inspecting the engine and engine compartment before the engine is started and after operation once the engine is stopped. This will help you to discover quickly if anything abnormal has happened, or is about to happen.

Look especially carefully for oil, fuel and coolant leakages, loose bolts, worn or poorly-tensioned drive belts, loose cable connections, damaged electrical cables and hoses. This inspection only takes a few minutes, but can prevent serious malfunctions and expensive repairs.

 **WARNING!**

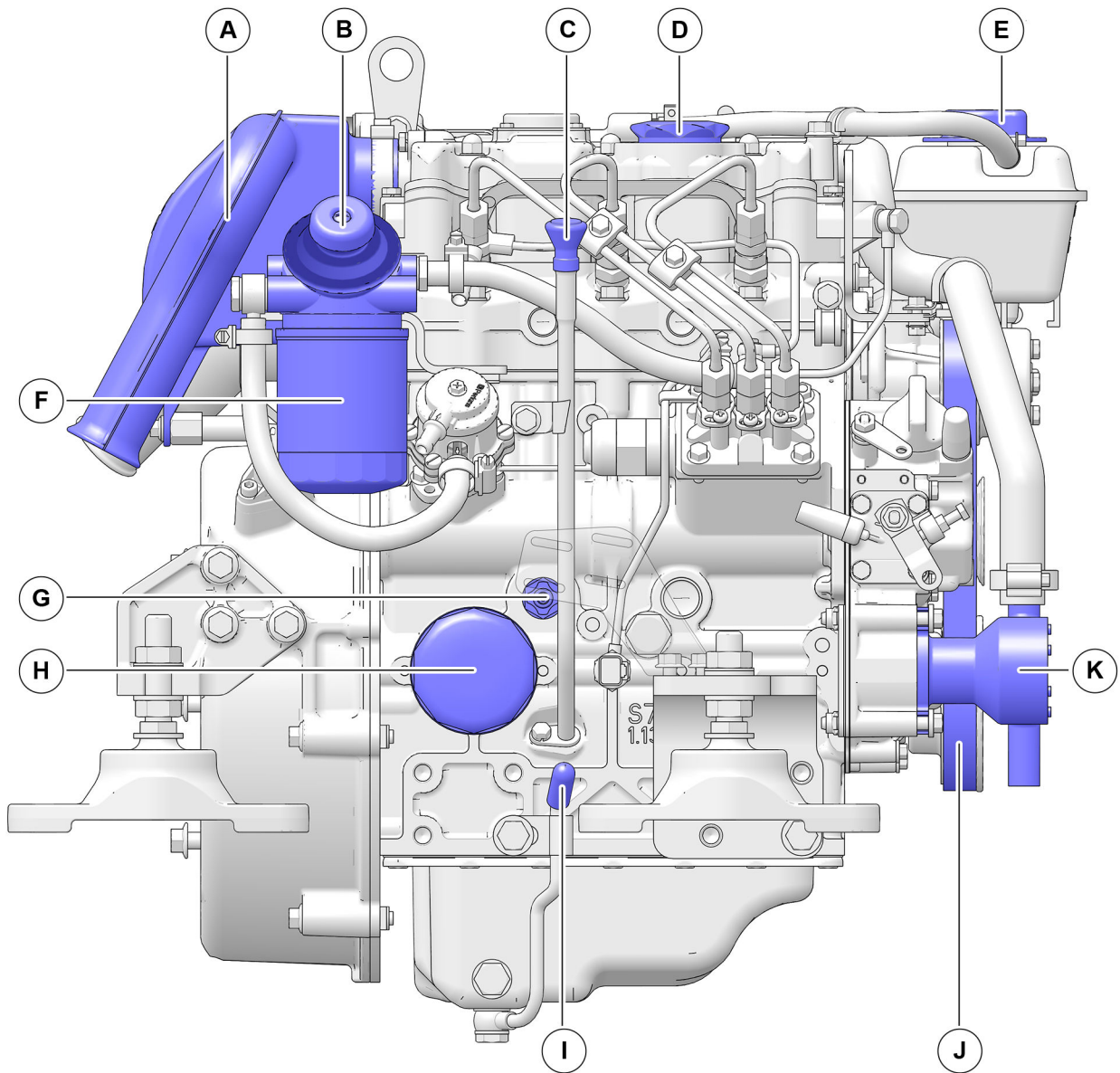
Risk of fire.

Remove all accumulations of fuel, oil and grease when detected on the engine or in the engine room.

 **WARNING!**

If an oil, fuel or coolant leak is detected, the cause must be investigated and the fault rectified before the engine is started.



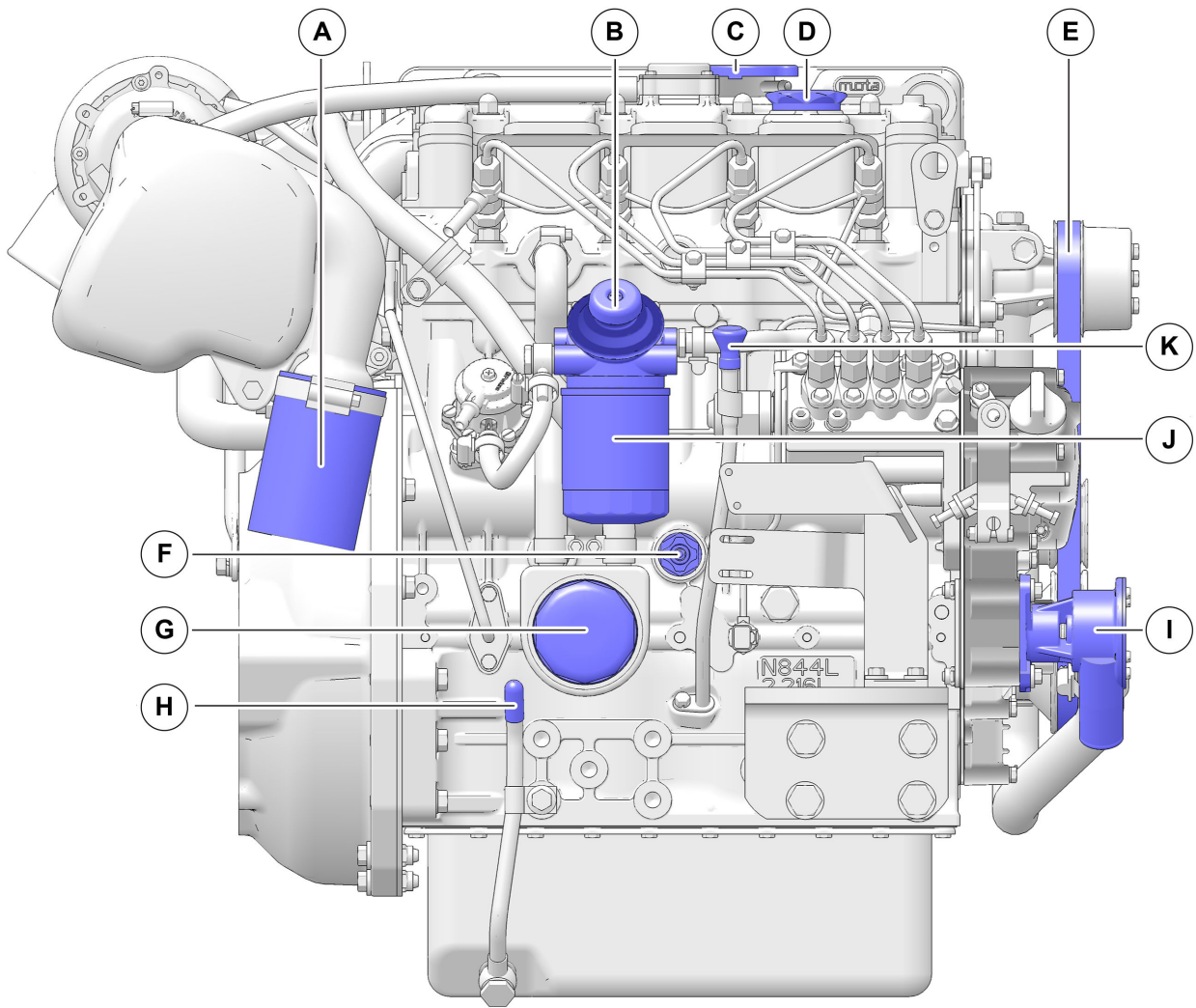


P0030923

**D1-13/20/30 - D2-40**

- |   |                               |   |                                   |
|---|-------------------------------|---|-----------------------------------|
| A | Air filter                    | F | Fuel filter                       |
| B | Hand pump, fuel filter        | G | Draining coolant, engine block    |
| C | Dipstick, engine oil          | H | Oil filter                        |
| D | Engine oil filler             | I | Draining engine oil               |
| E | Expansion tank, cooling water | J | Drive belt, alternator/water pump |
|   |                               | K | Impeller pump, seawater           |

Drain seawater on the other side of the engine; the drain is mounted on the heat exchanger.



P0030933

### D2-50/55/60/75

- |   |                                   |   |                                |
|---|-----------------------------------|---|--------------------------------|
| A | Air filter                        | F | Draining coolant, engine block |
| B | Hand pump, fuel filter            | G | Oil filter                     |
| C | Filling coolant/expansion level   | H | Draining engine oil            |
| D | Engine oil filler                 | I | Impeller pump, seawater        |
| E | Drive belt, alternator/water pump | J | Fuel filter                    |
|   |                                   | K | Dipstick, engine oil           |

Drain seawater on the other side of the engine; the drain is mounted on the heat exchanger.

## Maintenance Schedule

The Volvo Penta engine and its equipment are designed for high reliability and long life. The engine is built so as to have minimal environmental impact. These qualities will be retained and unnecessary malfunctions avoided if service is provided according to the maintenance schedule.

### Service intervals

Service items can be found in the Service Record available for download at [www.volvopenta.com](http://www.volvopenta.com).  
Search under tab: Manuals.

### Extended service intervals

The interval between engine oil changes may be extended in certain circumstances. To determine whether the service interval may be extended, Volvo Penta's conditions for extended service intervals must be met and an oil analysis performed, see *Lubrication System, page 45*.

The Volvo Penta dealer has further information.

Where both operating hours and calendar times are specified, perform the maintenance item at whichever time is the sooner.

## General inspection

### General inspection

Make a habit of visually inspecting the engine and engine compartment before the engine is started and after operation once the engine is stopped. This will help you to discover quickly if anything abnormal has happened, or is about to happen.

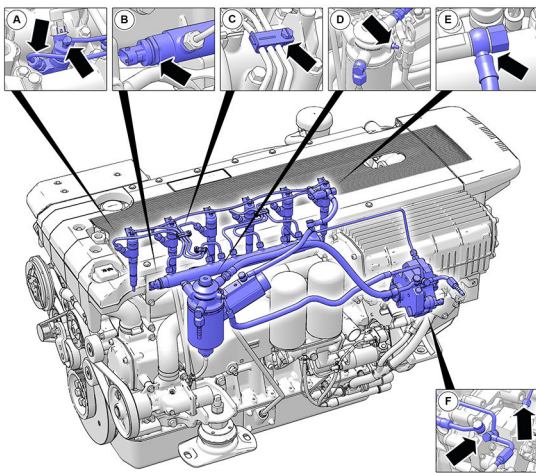
This inspection only takes a few minutes, but can prevent serious malfunctions and expensive repairs.

The images are generic and applicable to all engine installations. They show only a selection of components and systems.

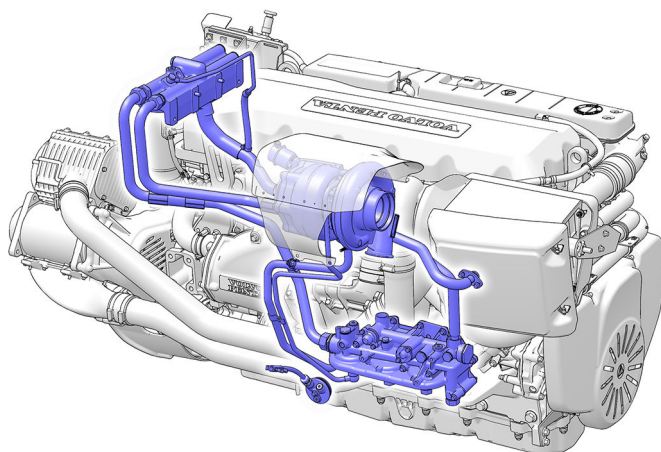
The inspection applies to all components in the systems.

### Look especially carefully for fuel leakage at:

- Injector connections
- Common rail, replacement
- Check all clamped items
- Fuel filter
- Fuel pipe/hoses
- Fuel pump

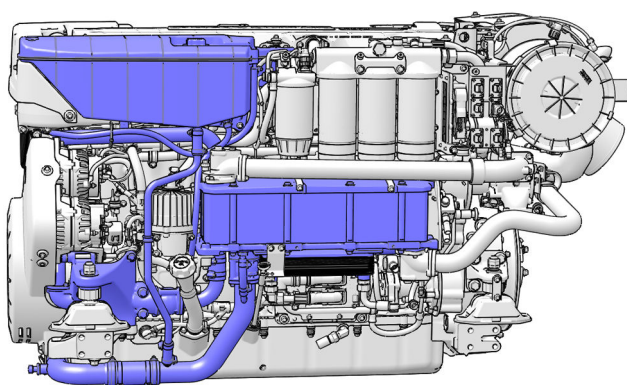


P0026583



Oil leaking turbocharger connections, oil pipes/hoses, oil sensors, oil filter and oil sump. Check all clamped items.

P0026582



Coolant leakage on the coolant pump, expansion tank, coolant cooler, oil cooler, charge air cooler, coolant sensors, coolant hoses. Check all clamped items.

P0026581

### Also check:

- Drive belts
- Damaged wiring
- Loose wiring
- Loose fasteners
- Exhaust hoses
- Hoses/hose connections to transmissions

### **▲ WARNING!**

Accumulations of fuel, oil and grease on the engine or in the engine compartment are a fire hazard and must be removed as soon as they are discovered.

### **▲ WARNING!**

If you discover a leakage of oil, fuel or coolant, investigate the cause and fix the fault before starting the engine to avoid the risk of fire.

**The following advice must be followed to avoid damage to the engine control unit and other electronics.**

**IMPORTANT:**

Switch off the main switch before connecting or disconnecting a connector.

## **General advice for electronic protection**

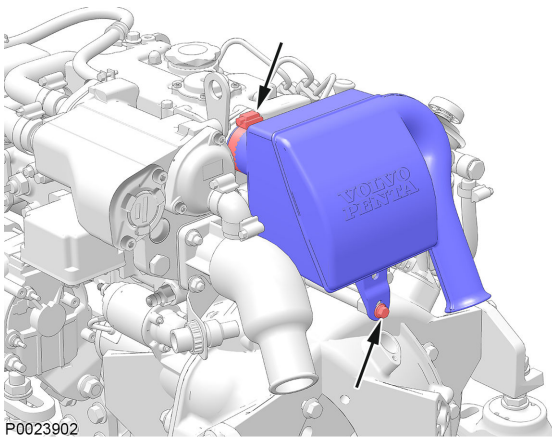
- Never switch off the current at the main switch when the engine is running.
- Never disconnect a battery cable when the engine is running.
- Switch off the main switches or disconnect the battery cables when fast-charging the batteries.
- **NOTICE!** It is not necessary to switch off the main switches during normal maintenance charging.
- Only batteries may be used for start help. A jump start unit is able to supply very high voltage which may damage the control unit and other electronics.
- Take extreme care so that the harness terminals do not come into contact with oil, water or dirt if a connector is removed from a sensor.

## Air Filter

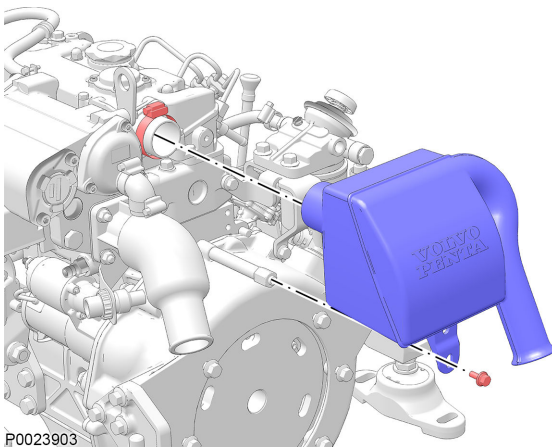
D1-13/20/30 - D2-40

### Replacing the air filter

- Remove the hose clamp around the filter connection.
- Remove the bolt at the bottom of the filter.



- Remove the pump by pulling it straight out.
- Install the new filter.
- Secure the hose clamps.
- Install the lower bolt.

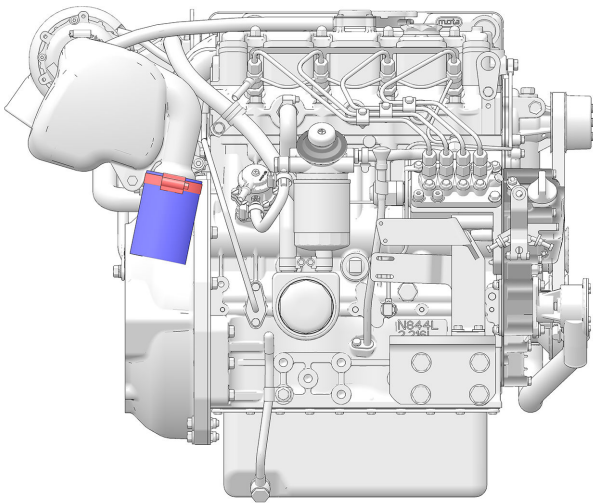


**NOTICE!** Scrap the old filter. It cannot be cleaned.

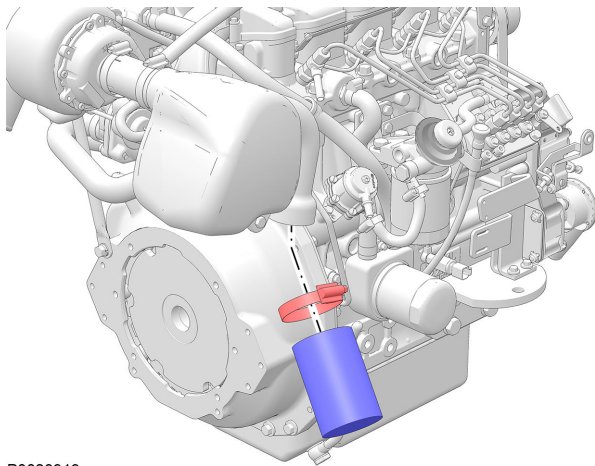
## D2-50/55/60/75

### Replacing the air filter

- Remove the hose clamp.



P0023918



P0023919

- Remove the filter.
- Install the new filter.
- Secure the hose clamps.

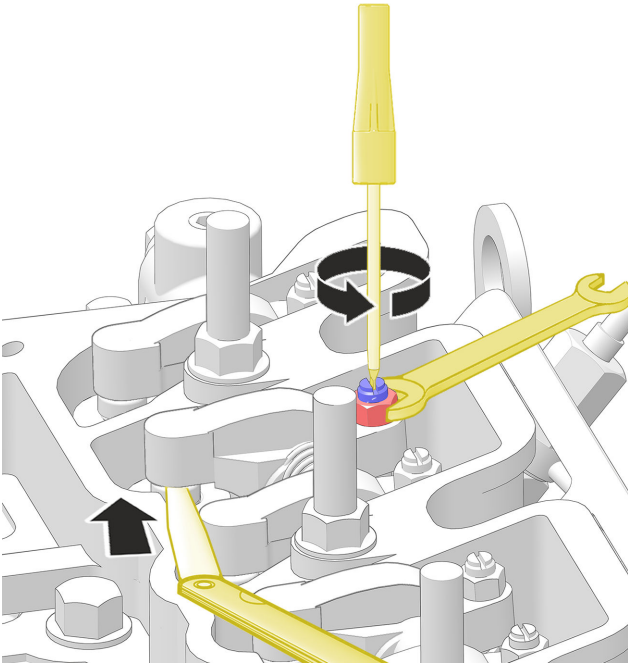
**NOTICE!** Scrap the old filter. It is not designed to be cleaned.



## Valves, Adjustment

Adjusting valve clearance is a servicing item. Note the servicing intervals for the engine. Detailed instructions are available in the workshop manual.

**NOTICE!** When adjusting the valve clearance, the engine must be cold.



P0026752

# Lubrication System

## When you work with Chemicals, Fuel and Lubrication Oil, Change

**NOTICE!** Apply barrier cream to your hands and always use protective gloves for work which involves contact with oil, fuel and similar. Continuous skin contact with engine oil dries the skin and can be hazardous.

## Engine Oil, Level Check

**NOTICE!** It is very important that engine oil be kept at a suitable level for correct engine lubrication.

**A high oil level** leads to increased oil consumption and may cause clogging of the silencer and/or the closed crankcase ventilation.

**A low oil level** may lead to seizing pistons, engine wear and engine overheating.

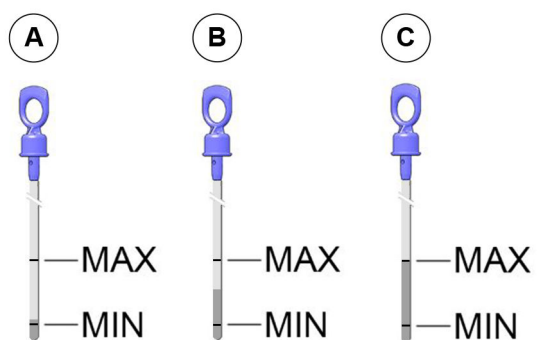
### Oil level check, hot engine.

- Make sure the engine is level.
- Stop the engine; wait a at least 15 minutes and then measure the level.

### Oil level check, cold engine. (recommended)

- Make sure the engine is level.
- Oil level measurement is most reliable before the engine is started

Check that the oil level is between the dipstick's min and max markings.



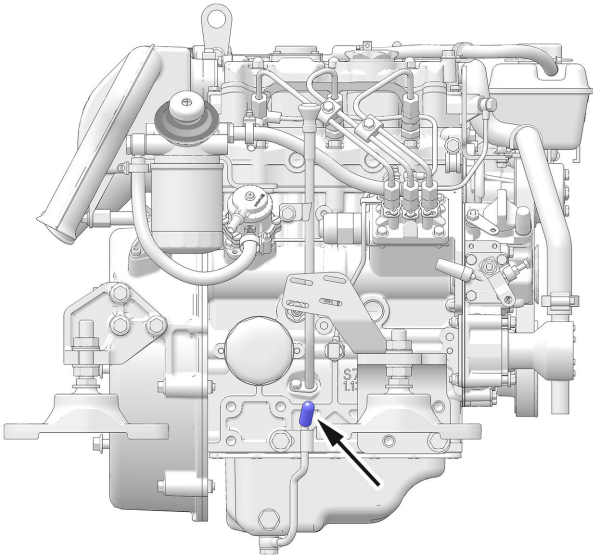
- A Oil level on the MIN marking: add oil until the level is between min and max.
- B **Optimal oil level**, do **NOT** add oil.
- C Oil level at max marking; do **NOT** add oil.

P0028585

**NOTICE!** Never add too much engine oil.

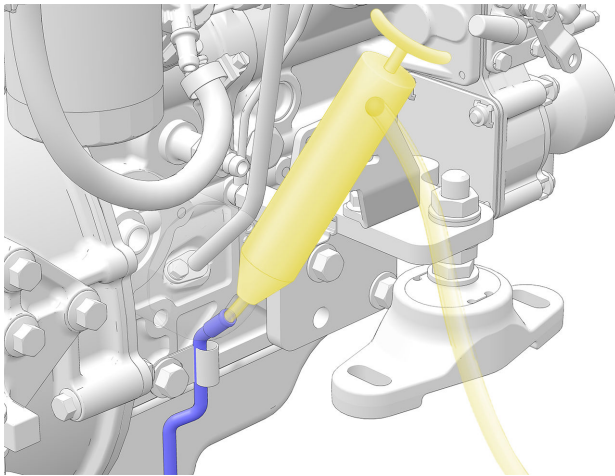
## Engine oil, Replace

- Drain the engine oil by first removing the plug in the pipe below the dipstick holder.



P0023883

- Connect a vacuum pump and draw the oil out through the pipe.



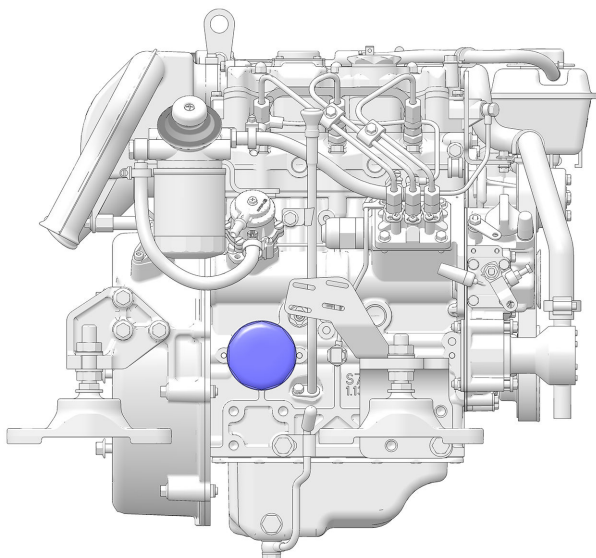
P0026753

**NOTICE!** If the engine oil is hot, it will drain out faster.

**NOTICE!** Hand the old oil in to a re-cycling station.

## Oil filter, Replace

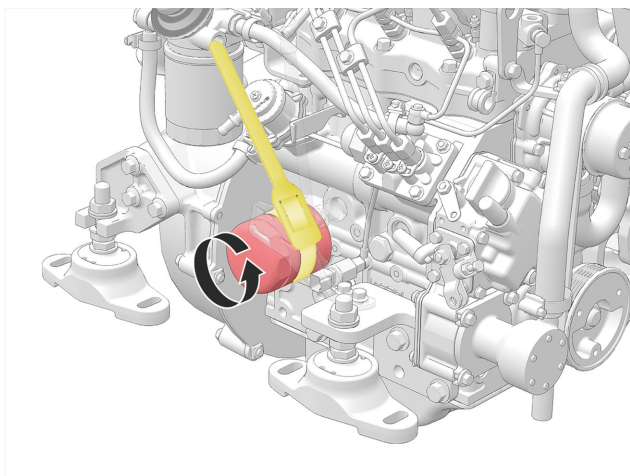
Volvo Penta strongly recommends that only oil filters approved by Volvo Penta be used. The wrong type of oil filter can lead to increased wear and damage, e.g. to bearings and crankshaft.



P0023885

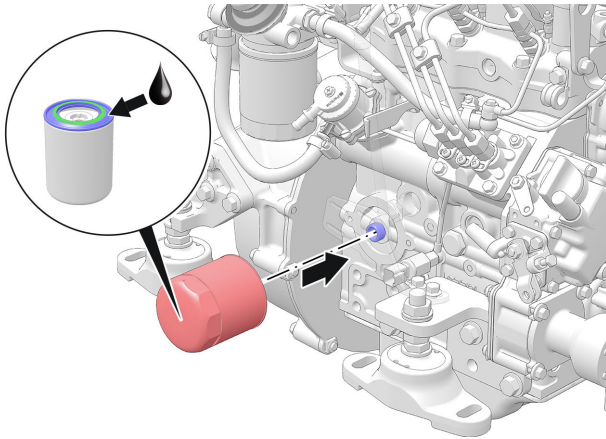
## Removal

- Clean around the filter.
- Undo the filter using filter pliers.
- Be prepared to gather up oil spills.



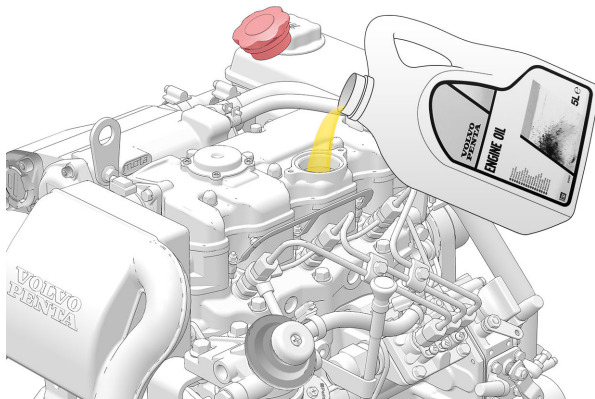
P0026754

## Installation



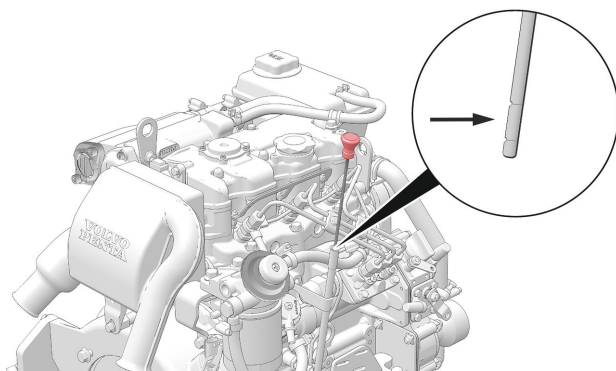
- Lubricate the gasket with engine oil before installing.
- Install the filter. Tighten by hand until it slows up and then a further half turn.

P0030926



- Fill with the required volume of oil; see *Specifications, page 28*.
- Start the engine.
- Check that no leakage occurs.

P0030925



- Stop the engine, and check the oil level after a few minutes.
- Top up as necessary.

P0026757

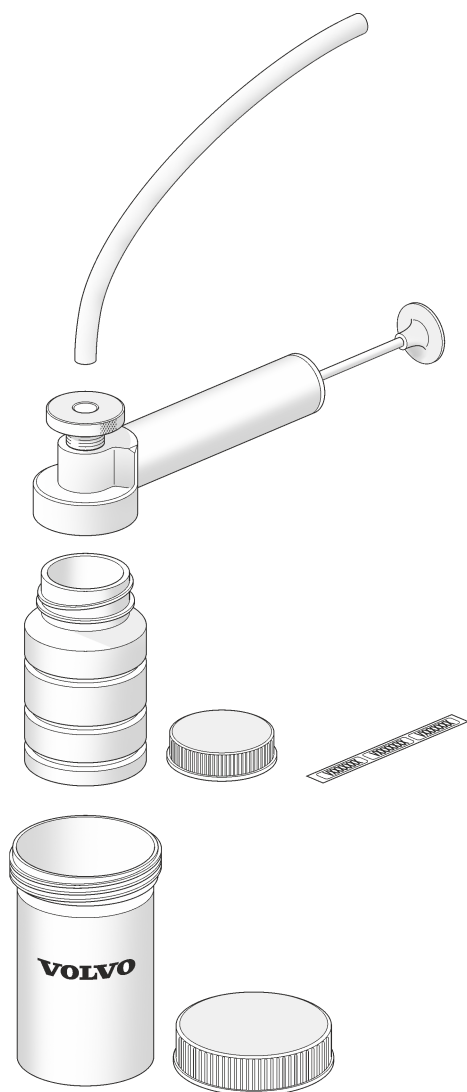
## Volvo Penta oil analysis

Volvo Penta oil analysis provides an extensive diagnostic check on the driveline condition. The oil analysis provides information for example on water content, fuel content, dirt and the amount of metallic particles in the oil as a result of component wear.

Thanks to early warning signs given by oil analysis, preventive maintenance and component replacement can be planned, so that unplanned shutdowns can be avoided.

Some engines allow the oil change intervals to be extended. There are two different service records available for these engines. Refer to the Volvo Penta Product Center

In order to find out more about Volvo Penta Oil Analysis, we recommend our on-line training.

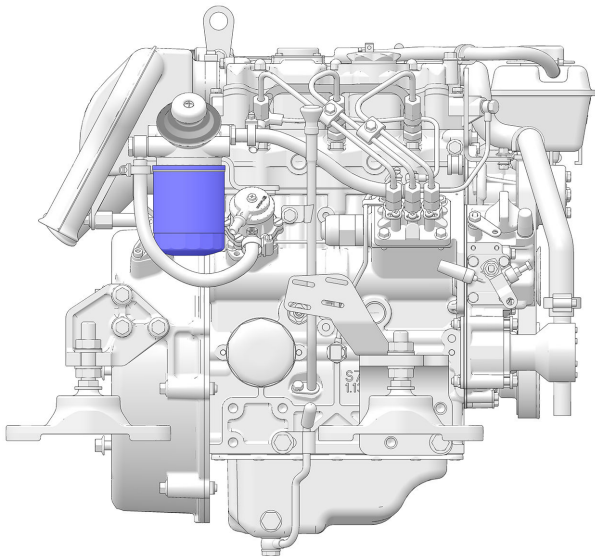


P0022867

# Fuel System

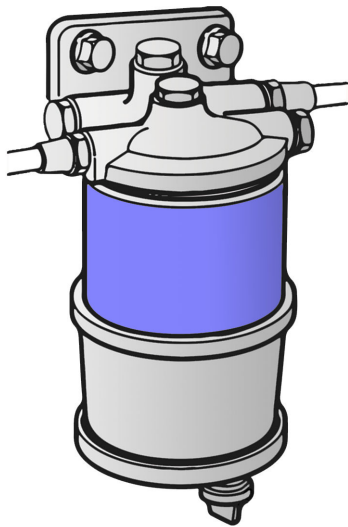
## General

The fuel system has a fine filter fitted to the engine as standard. Furthermore, the installation often has a pre-filter whose insert must also be changed.



P0023872

The illustration shows a typical fuel pre-filter.



P0026758



## Fuel filter, Change

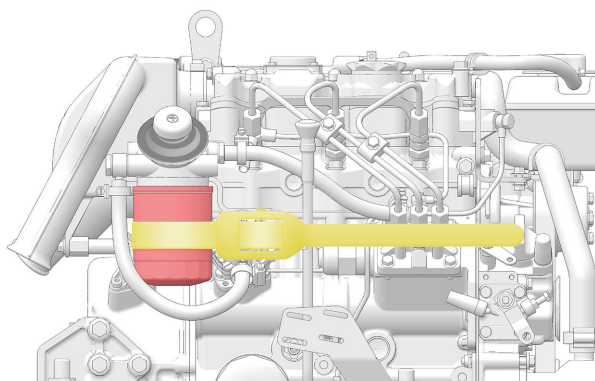
### **⚠ WARNING!**

Fire hazard. When carrying out work on the fuel system make sure the engine is cold. A fuel spill onto a hot surface or an electrical component can cause a fire. Store fuel soaked rags so that they cannot cause fire.

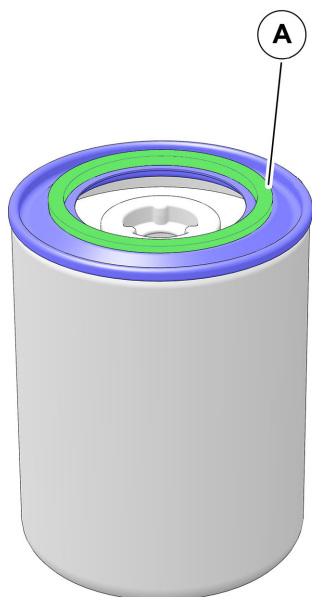
### **IMPORTANT!**

Do not fill the new filter with fuel before installation; there is a risk that contaminants will enter the system and cause malfunctions or damage

- Clean around the fuel filter.
- Remove the fuel filter with the aid of a suitable filter puller.
- Wipe up any fuel spills.



P0026759



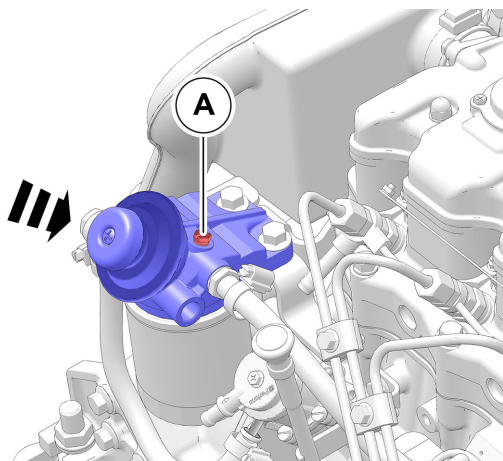
P0030635

- Lubricate the sealing surface (A) with diesel and install the new fuel filter. Torque tighten the filter in accordance with the instructions on the filter, or else until it tightens up and then a further ½ turn.
- Bleed the fuel system.
- Replace the insert in the fuel pre-filter at the same time, if one is fitted.

## Fuel system, bleeding

**⚠ CAUTION!**

Never disconnect a fuel line or component after the fuel pump to bleed. The fuel is under very high pressure and can penetrate the skin.



P0030918

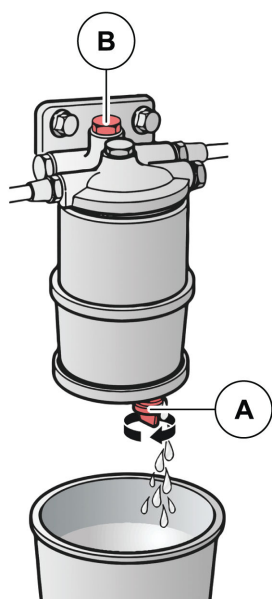
- Vent with the hand pump above the filter.
- Open the vent screw (A).
- Pump by hand until fuel flows out without any air bubbles.
- Close the vent screw.

**Venting the fuel pre-filter.**

When replacing the pre-filter, the filter assembly must be vented after the replacement.

- Vent the filter unit by opening screw (B) on top and then pumping the engine fuel pump by hand.
- Close screw (B) once fuel flows out without any air bubbles.

**NOTICE!** The fuel pump vent screw on the engine must not be open when venting the pre-filter.



P0023893

**Draining the fuel pre-filter.**

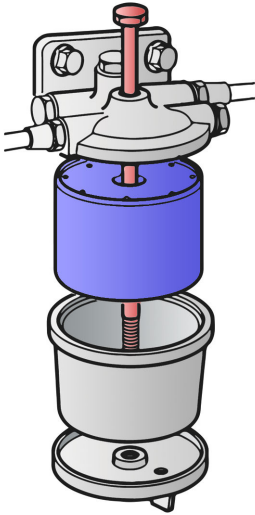
- Place a recovery container under the filter to collect fuel spills.
- Open the drain screw (A) at the bottom and the vent screw (B) on top.
- Check that it clean fuel is coming out.
- Close the drain screw (A) and the vent screw (B).

**NOTICE!** The drain screw (A) is made of plastic; do not tighten it too far. Screw until a slight resistance is felt and then tighten no more than 1/4 turn more.

**NOTICE!** If water comes out of the fuel pre-filter, the fuel tank must be drained and cleaned.

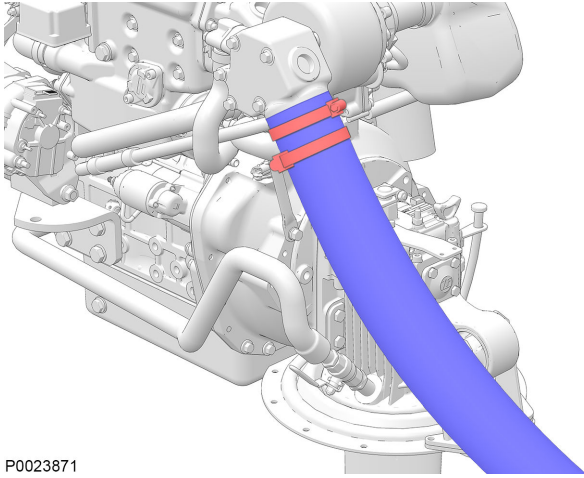
**Pre-filter**

Disassemble the fuel pre-filter according to the figure with the pass-through bolt in its center.



P0023894

# Exhaust System



P0023871

## Exhaust hose

### Reverse gear/S Drive:

Inspect the exhaust hose. Check that it has no cracks or leaks (exhaust, cooling water).

If there is any leakage, replace the hose.

Check that all hose clamps are tightened.

# Cooling System

## Coolant Level, Checking and Topping Up

**⚠ WARNING!**

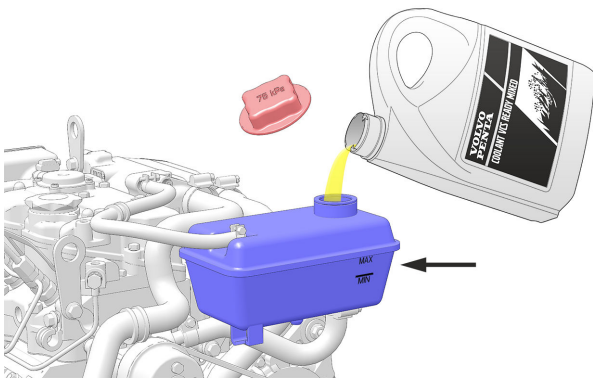
Do not open the coolant filler cap when the engine is hot. Steam or hot fluid could spray out, causing severe burns.

**NOTICE!** We strongly recommend that only VCS coolant approved by Volvo Penta is used

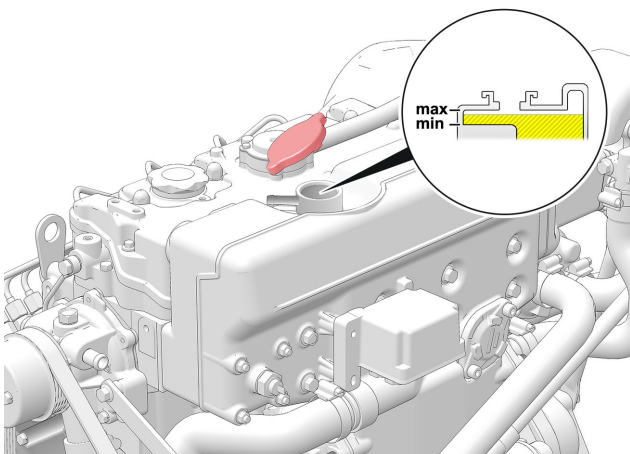
**NOTICE!** Check the protection capacity (freezing point) of the anti-freeze every year, if the coolant is not being replaced.

Check the fluid level in the expansion tank when the engine is cold. Top up with coolant as necessary.

In the case of D1-D2/40 engines, check the level against the mark on the outside of the vessel.



P0026760

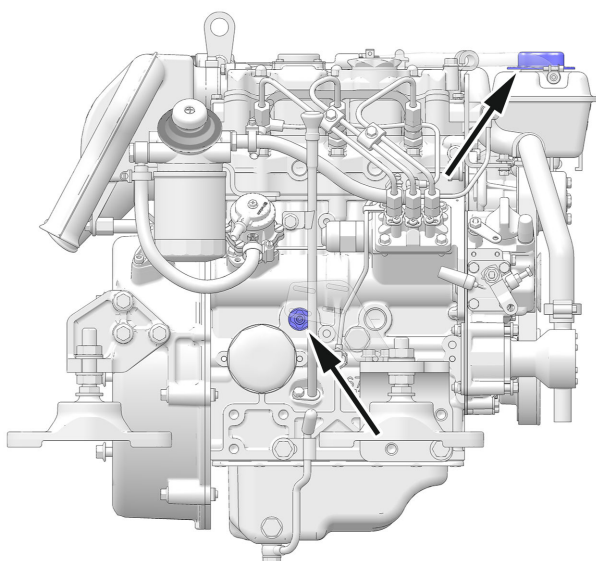


P0026761

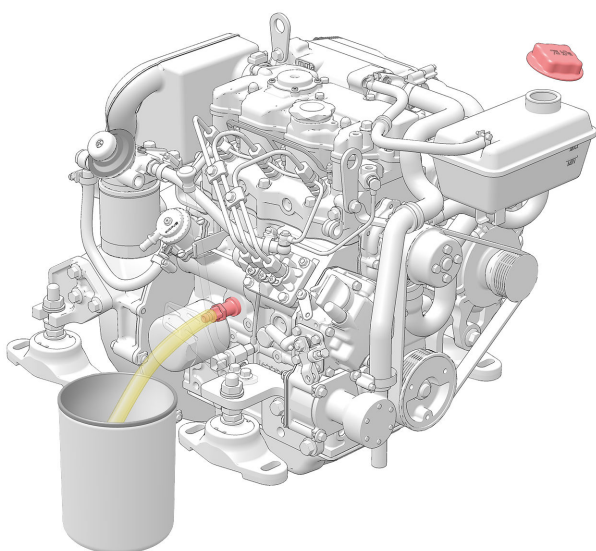
In the case of D2-50/55/60/75 engines, check the level beneath the radiator cap.

## When changing coolant

- Connect a hose to the coolant drain nipple on the side of the engine.



P0023877



P0026762

- Place a recovery container next to the engine.
- Open the drain and the expansion tank cap.
- Drain the coolant.
- Close the drain on the side and refill with new coolant.
- Start the engine and let it idle for a few minutes to vent.
- Switch the engine off and check the level.

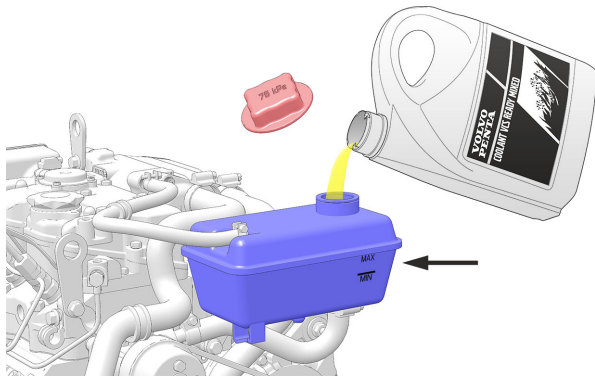
**NOTICE!** If the boat has a heating element connected to the engine cooling system, it must also be drained when changing the engine coolant.

**NOTICE!** Hand in the old coolant to a recycling station for disposal.

## Filling an empty system

**NOTICE!** Mix the coolant in advance to ensure that the cooling system is filled with the correct mixture, (applies to concentrated coolant). Do not start the engine until the system is completely filled.

**NOTICE!** If a heating unit is connected to the engine cooling system, the heat control valve for the system must be opened and the installation vented during filling.



P0026760

- Check that all drain points are closed.
- Fill with coolant until the level is above the MIN mark in the expansion tank.
- When the cooling system is filled, start the engine and let it idle for a few minutes.
- Open any venting nipples for a while to allow trapped air to escape.
- Increase engine speed to 1600-1700 rpm and run for a few more minutes.
- Stop the engine and let it cool down. Then check the coolant level.
- Start the engine. Start the engine again and run it until it reaches normal operating temperature (when the thermostat opens). Allow to cool, and check the coolant level.

**NOTICE!** Do not drain the system if the engine is to be in storage for a longer period of time. The coolant contains corrosion protection additives.

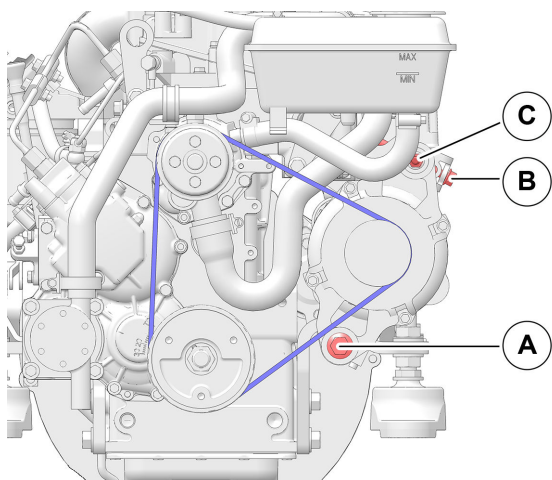


## Drive Belt, Replace

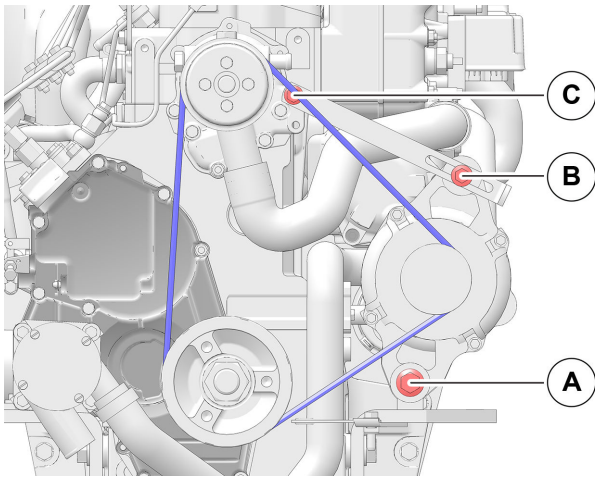
The engine has a belt that drives the alternator and the coolant pump.

### Belt replacement D1-13/20 — 30/D2-40

- Undo the bolts (A) and (C).
- Move the alternator toward the engine by screwing in bolt (B) and free the belt.
- Replace the belt.
- Tension the alternator belt by screwing bolt (B) until a play of about 3–4 mm is achieved. Next, tighten the bolts (A) and (C).



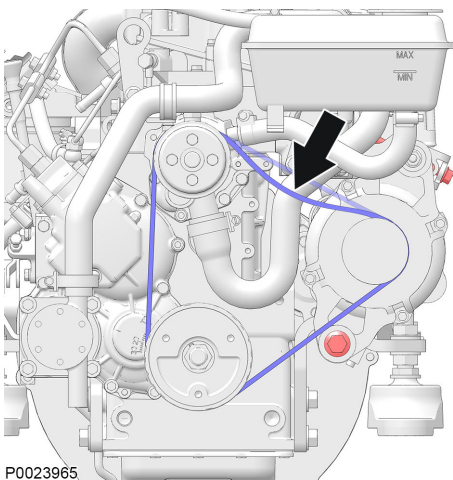
P0030921



P0030932

### Belt replacement D2-50/60/55/75

- Undo bolts (A), (B) and (C) to allow alternator adjustment by hand.
- Push the alternator toward the engine and free the belt.
- Replace the belt.
- Tighten the alternator belt until a play of about 3–4 mm is achieved. Tighten the bolts.



P0023965

### Belt tensioning, D1 and D2 engines (all)

Check the drive belt after operation, when the belt is hot. It should be possible to depress the drive belt about 3-4 mm between the pulleys.

## Seawater Pump, Impeller, Change

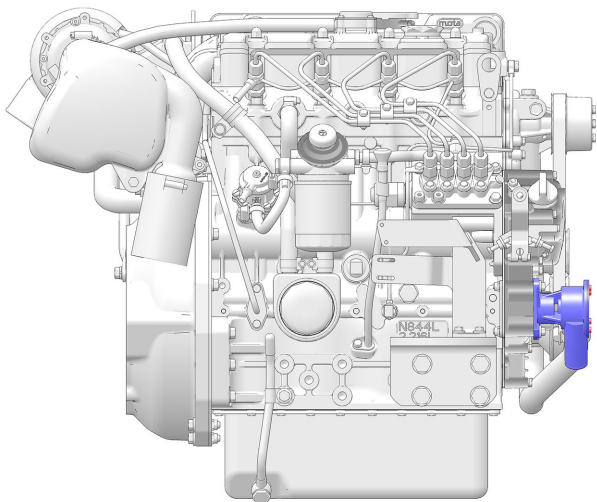
### **▲ WARNING!**

Risk of water entry. Close and drain the raw water system before starting any work on the system.

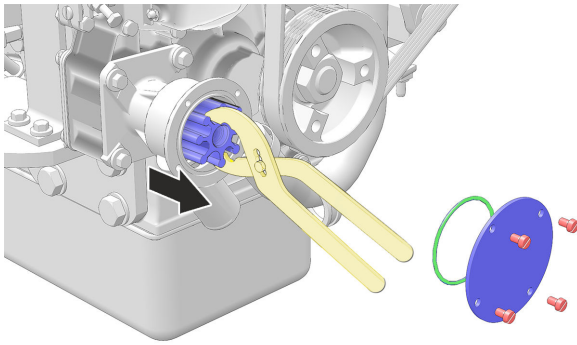
Clean and inspect the seawater pump's internal and external components such as the impeller and impeller cover. Replace if there is damage to the cover or the rubber. Otherwise change the impeller at the intervals in the maintenance schedule.

Also check the water hoses to and from the impeller pump. If they are dry, swollen or show other signs of damage, they must be replaced with new ones.

**NOTICE!** The illustration shows the impeller pump on D2-50/55/60/75 engines. The position is the same on D1-13/20/30– D2-40 engines.



P0023895



P0030929

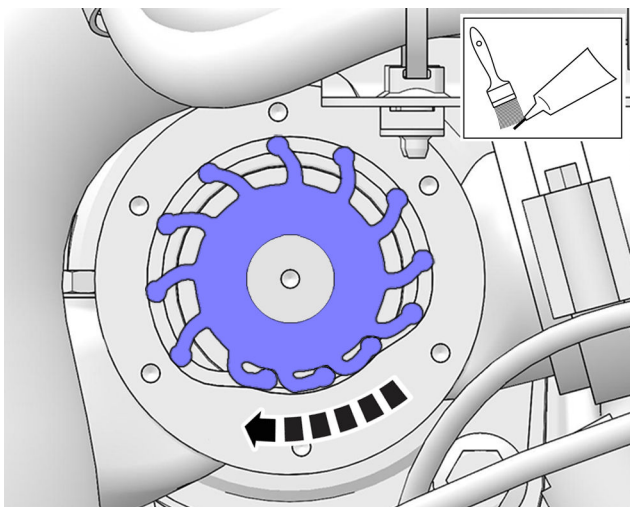
## Removal

- Close the engine cooling water cock if the boat is in the water.
- Remove the bolts holding the cover on the impeller pump.
- Pull out the impeller with a universal impeller puller; note the direction of rotation.
- Replace the impeller if it has cracks or other defects.

## Installation

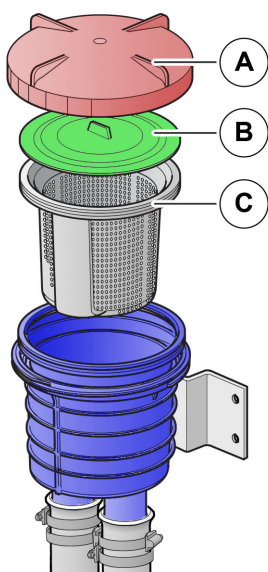
- Lubricate the inside of the pump housing and the impeller with glycerin.
- Push the impeller in with a rotating movement in the direction of flow, (the same direction as the replaced impeller).
- Install the cover; use a new gasket. Tightening torque: **6 Nm**
- Open the cooling water cock.
- Start the engine. Check that there are no leaks when the engine is started.

**NOTICE!** The impeller may be damaged if any types of lubricant other than glycerin are used.



P0026764

## Seawater Filter, Check and Cleaning

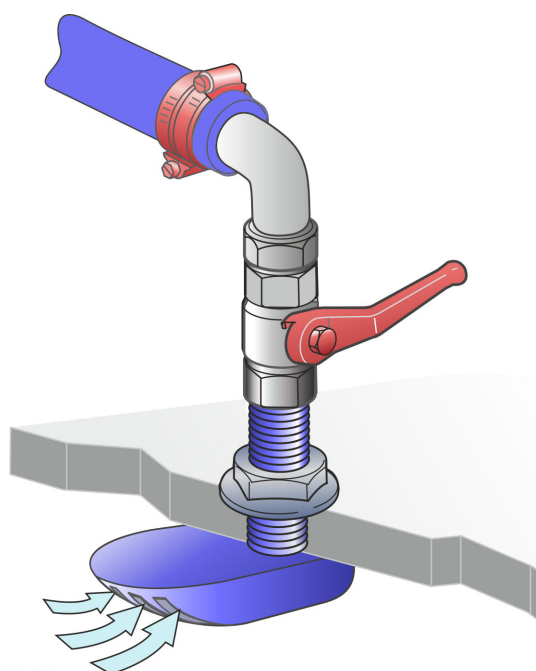


P0030928

FSC water filter is fitted to the engine this must be cleaned according to the maintenance schedule. If the waters where the boat is used contain a lot of contamination, seaweed etc., the filter must be checked more often than indicated in the maintenance schedule. Otherwise there is a risk that the filter may become blocked, resulting in engine overheating.

- Close the sea cock.
- Unscrew the cover (A).
- Remove the sealing plate (B).
- Lift out the insert (C) and clean it.
- Install in the reverse order and tighten the cover by hand.
- Open the sea cock and check that there are no leaks when the engine is being started.

**NOTICE!** Check the hose clamps are tight and water hose(s) undamaged.



P0026225

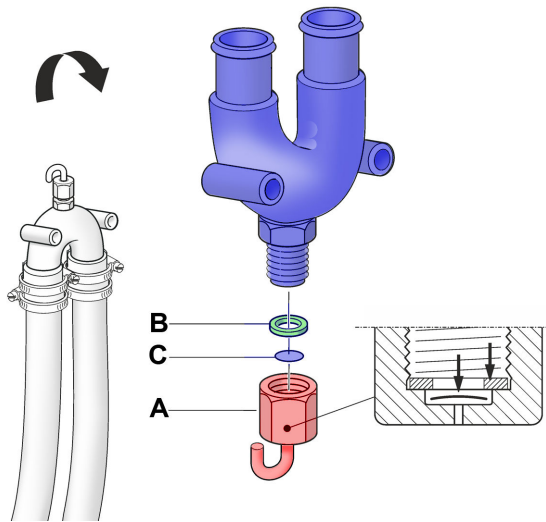
### Cooling water intake

Check the cooling water cock operation at every service.

It must be possible to open and shut the cock for e.g. impeller maintenance.

Clean the cooling water intake (outer grille) when the boat is on dry land.

**NOTICE!** Check the hose clamps are tight and water hose(s) undamaged.



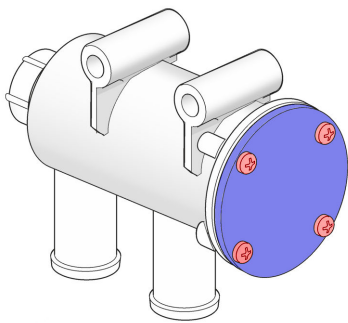
P0030654

### Anti-siphon valve

Some configurations have a vacuum valve installed in the seawater pipe.

- Close the sea cock before working on the valve.
- Remove the valve. Unscrew the hexagonal cover (A).
- The cover contains a gasket (B) and membrane (C).
- Clean all the components.
- Turn the valve housing over. First insert the membrane and then the gasket.
- Screw the cover down. If the cover is screwed on too tightly, the valve may stop working.  
Tightening torque: **2 Nm**
- Install the vacuum valve onto the hoses.
- Open the sea cock.
- Check that there is no leakage when the engine starts.

**NOTICE!** There are different versions of the vacuum valve, but they all operate on the same principle.



P0026743

# Transmission

## Reversing gear

### Reversing gear, oil and filter change

#### Volvo Penta original transmission oil

In a marine environment it is vitally important that the correct gear lubricant is used for the product concerned.

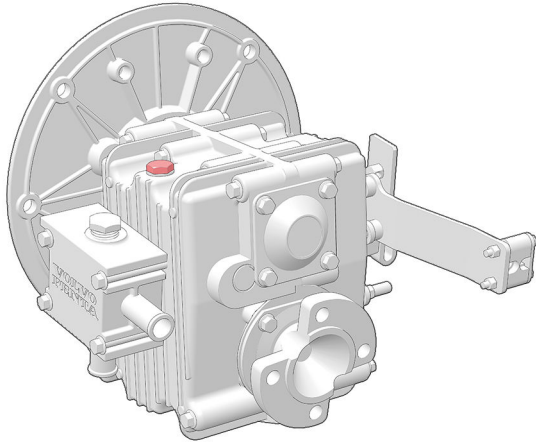
In Volvo Penta's extensive testing, we pick out those oils that meet the requirements for functionality and which, within the oil change intervals, will ensure the product's service life.

While oils from various suppliers meet both SAE class (viscosity) and API class (quality), their additives often differ. Additives can be up to 35% of the total volume, and are crucial to how oil can handle a given water content while still maintaining the necessary lubricating properties. The additives also affect friction in the clutch package.

The correct oil is crucial for the proper functioning of the transmission.

**NOTICE!** For reverse gear, comply with the oil change intervals and maintenance instructions recommended by the manufacturer.

The reverse gears are hydraulic and the lubrication system is equipped with an oil filter and oil cooler.



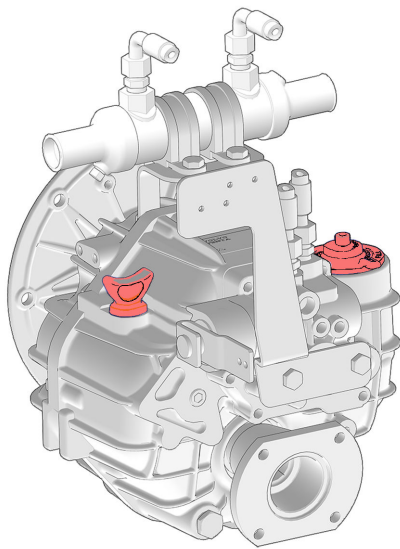
**The reverse gears to D1/D2:**

MS15A-B/A-L

MS25A-A/A-L

HS25 A-C

P0026766

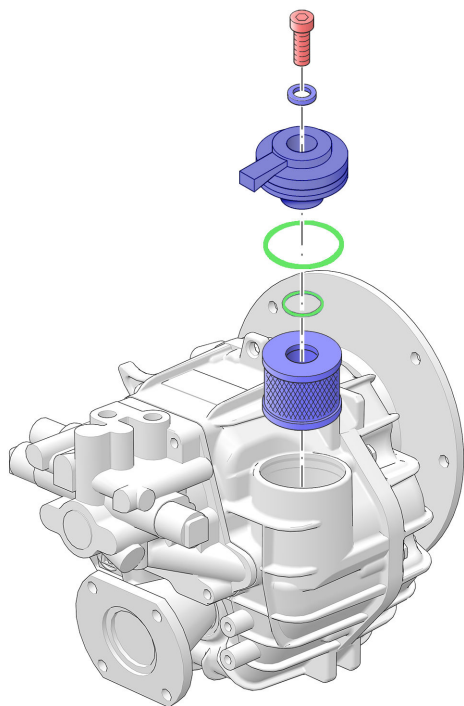


**NOTICE!** Reverse gear designs differ. During oil changes, HS25 engines have oil filters that must be replaced.

Not all reverse gears have oil filters.

P0026232



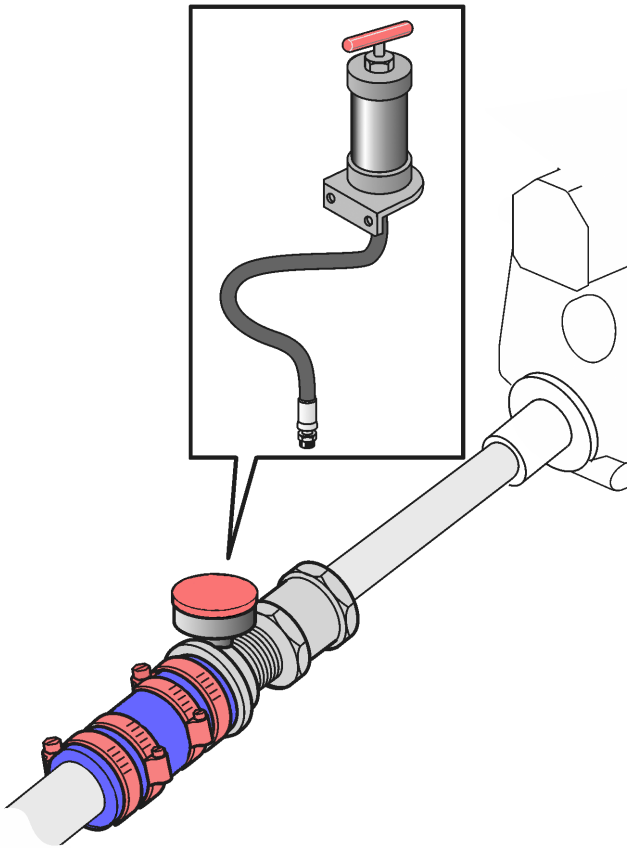


P0030647

### Changing the oil

- Clean around the oil filler/filter so there is no risk of dirt entering.
- Remove the oil filter (HS25).
- Drain/draw out the oil from the designated drain location (the plug at the bottom or through the dipstick or oil filter hole).
- Lubricate the gasket/O-ring on the new filter with a thin film of oil (HS25).
- Install the new oil filter (HS25).
- Fill with new oil. Check the level using the dipstick.
- Start the engine and run it at 1500 rpm for a few minutes, (engage a gear forward/reverse).
- Stop the engine and check the oil level again.
- Top up as necessary.

**NOTICE!** Oil in accordance with *Specifications, page 28*.

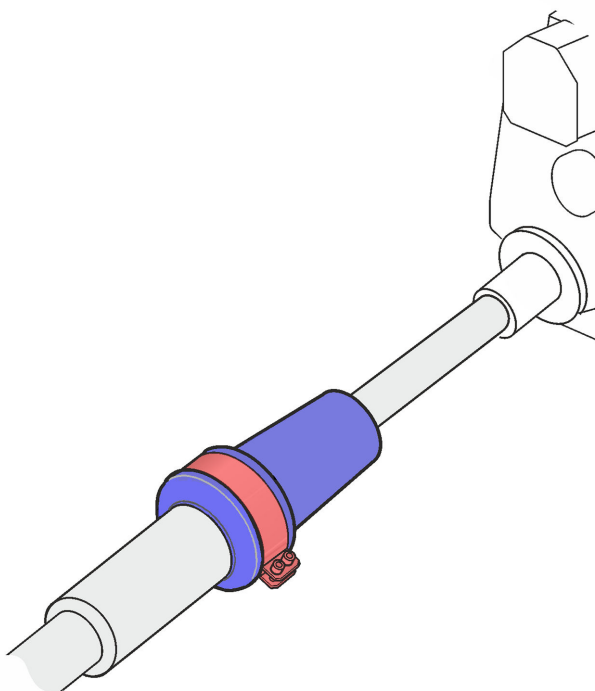


P0026233

**Grease-lubricated shaft**

- Check that there is grease in the grease cup.
- Lubricate the shaft at each service.
- Check the shaft stuffing box. If there is any leakage, the seal must be replaced.

**NOTICE!** Check that the hose clamps are tightened.



P0026234

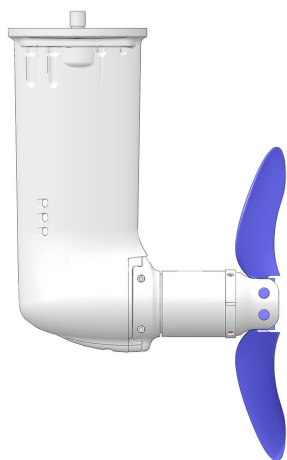
**Water-lubricated shaft**

The propeller shaft rubber sleeve is checked on launching to ensure it is leak-tight and that there are no cracks. Check during the season for leakage of water into the boat through the stuffing box; if so, the rubber sleeve must be changed.

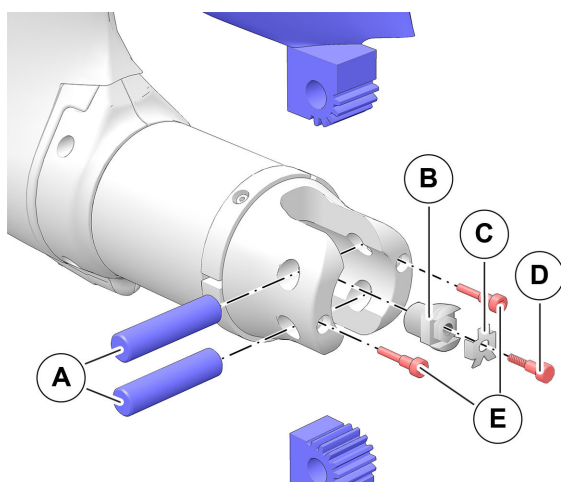
If the boat is fitted with a Volvo Penta propeller shaft, the propeller shaft seals must be purged and lubricated immediately before launching. Press approximately 1/4 teaspoonful of water resistant grease into the seal. Purge the seal glands by pressing them together, at the same time as they are pressed down onto the shaft.

**NOTICE!** Check that the clamp on the rubber sleeve is tight.

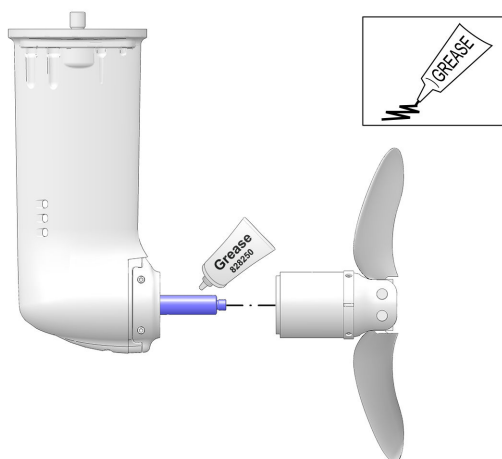
# Sterndrive



P0023898



P0030927



P0023964

## Propeller

### Checking for damage

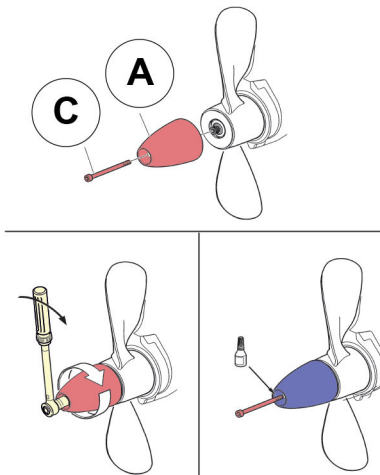
Check the propeller blades for damage. If there is damage, this must be rectified. Have a propeller workshop carry out repairs and balancing.

### Lubricating the propeller shafts

Dismantle, clean and grease the spindles with water-resistant grease. This must be done annually otherwise the folding function may seize. Also lubricate the propeller shaft splines with water-resistant grease.

### Folding propeller

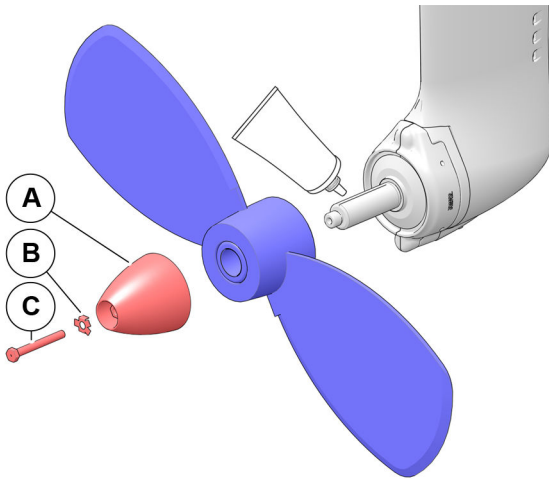
- Remove the screws (E).
- Pull out the spindles (A).
- Grease the folding propeller spindles (A) (propeller blade attachment)
- Remove the center bolt (D).
- Remove (B) and (C).
- Pull off the entire propeller unit.
- Grease the propeller shaft splines with water resistant grease.
- Install in reverse order.  
For tightening torque; refer to **General Tightening Torques, page 27**.



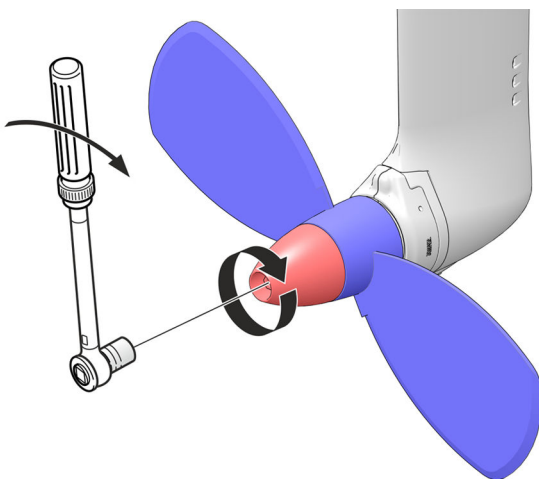
P0031801  
Early model

### Propeller, S-drive

- Put the control lever in the Ahead position.
- Fold down the lock tab on the lock washer (B).
- Remove the lock screw (C), the lock washer (B) and the propeller cone (A).
- Remove the propeller and the spacer sleeve.
- Clean and apply grease part # 828250 on the propeller shaft.

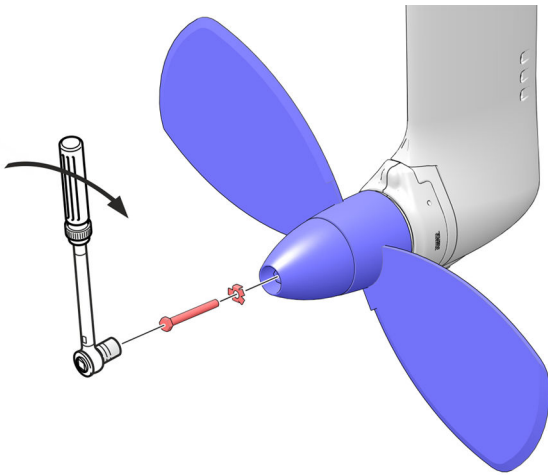


P0031088  
Late model



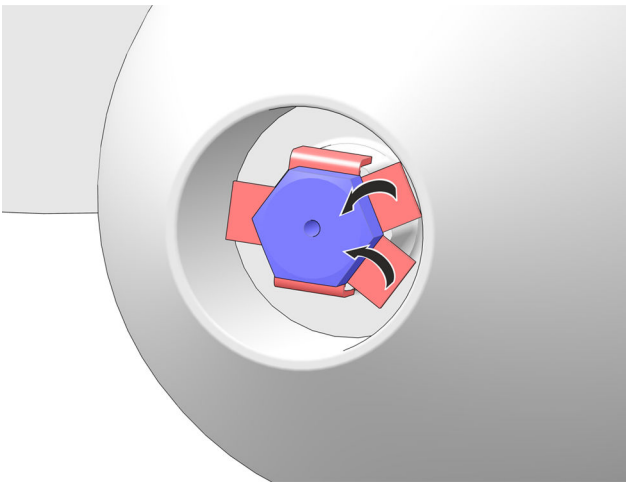
P0031089

- Install the spacer sleeve and the propeller on the propeller shaft.
- Tighten the propeller cone (A) to **70 Nm**.



P0031090

- Install the lock washer (B) and the new bolt (C).
- Tighten the bolt to **20 Nm**.



P0031091

- Fold up at least 2 of the 3 lock tabs to secure the bolt.

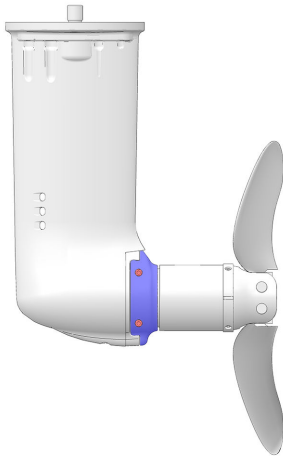
## Checking Protective Anodes

Check the anodes on the drive every time the boat is out of the water. Replace anodes when 50% of the anode has been consumed.

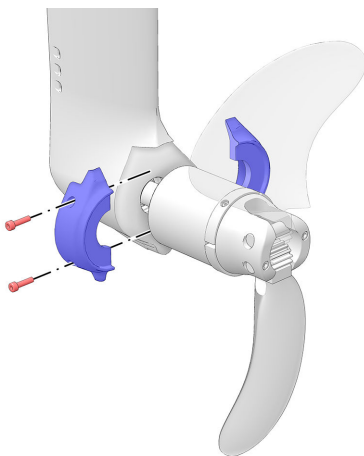
When the boat is out of the water, corrosion protection deteriorates due to anode oxidization. Even new anodes may have some surface oxidation. Therefore always clean and polish them with an emery cloth before launching.

### Replacement of anodes

- Clean the contact surfaces on the new anode.
- Install and tighten the halves so that they make good contact with the surface of the drive/each other.



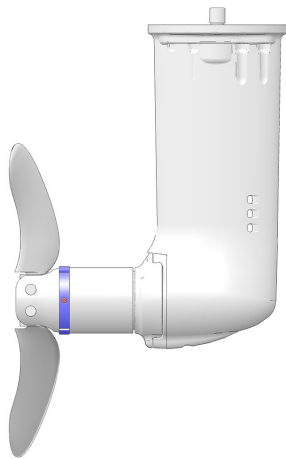
P0023890



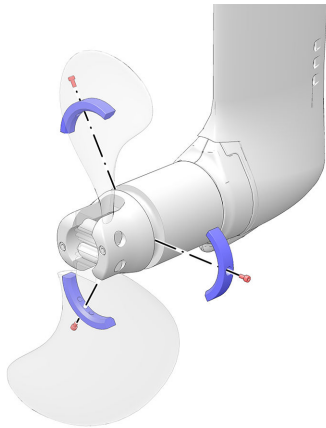
P0023891

**NOTICE!** Do not use a wire brush or grinding abrasive with metallic ingredients for cleaning the anode. This will impair the galvanic function of the anode.

**NOTICE!** If the boat is mostly used in salt water, the anodes must be of zinc or aluminum. If the boat is mostly used in fresh water, the anodes must be of magnesium.



P0023888



P0023889

## Painting the Drive

### **⚠ WARNING!**

Read and carefully follow the instructions and warnings on the packaging.

Remove all loose paint and corrosion residue by blasting or with sandpaper.

If blasting is used, the blasting agent should be aluminum oxide with a particle size of between 0.2 and 0.7 mm.

If sandpaper is used, it must be coated with aluminum oxide.

Sand the painted surfaces and the damaged/corroded raw aluminum surfaces to be touched up.

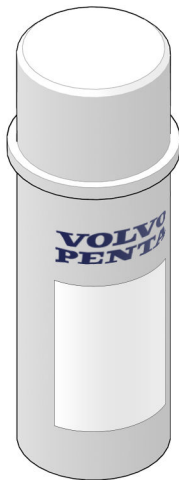
Then clean using clean water.

### **⚠ WARNING!**

Do not use steel wool. Small pieces of steel will become embedded in the aluminum and will cause severe corrosion damage.

### **⚠ WARNING!**

Do not use emery cloth. Small pieces of iron oxide which are used in the emery cloth will become embedded in the aluminum and will cause severe corrosion damage.



When the primer coating is thin or the surface is unpainted, it must first be coated with primer, part # 1141562.

Drying time 8-12 hours.

Then apply a final coat.

The spare parts catalog and the “Volvo Penta accessories” catalog specify the part numbers for surface treatment products.

Also apply anti-fouling.

**NOTICE!** Use a locally recommended anti-fouling paint on the drive gear.

P0029743

## S-drive

### Changing oil in S Drives

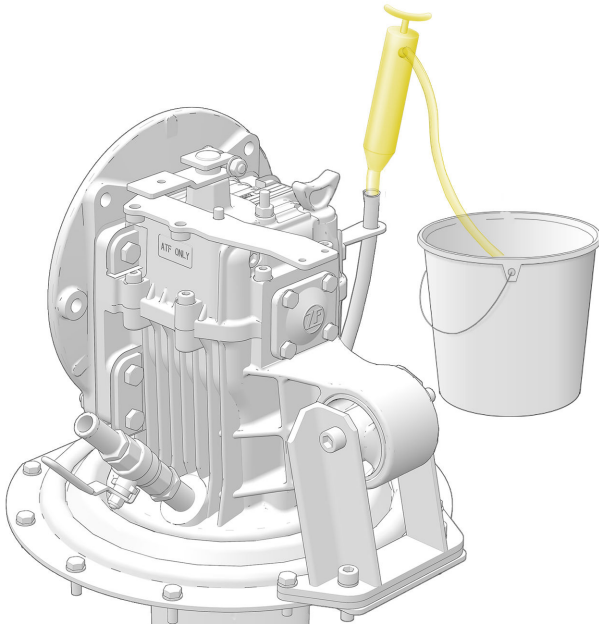
The oil can be changed from within the boat by drawing it up through the pipe on the side of the S Drive or draining from below when the boat is out of the water. The advantage of changing the oil with the boat out of the water is the removal of all oil when draining from below. When changing oil inboard around 3 dl will remain in the drive.

Another advantage when draining oil from below is that the magnetic plug in the oil drain can be cleaned.



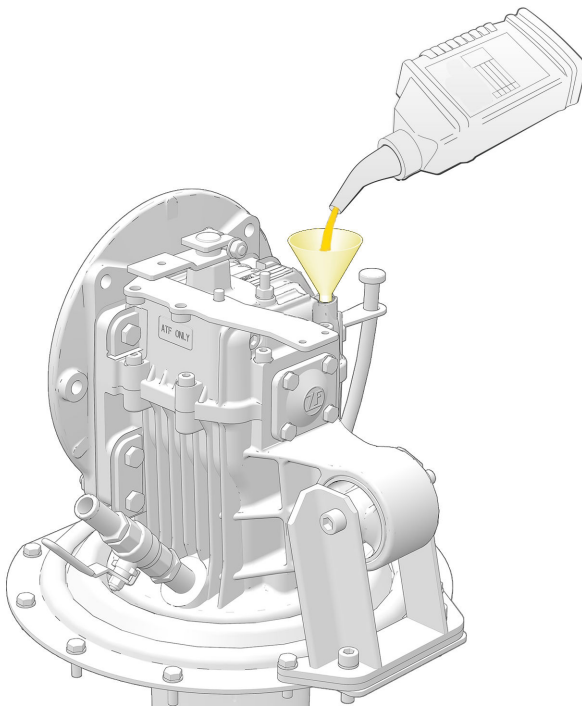
**Changing oil with the boat in the water**

- Draw the oil through the pipe on the side of the drive using a vacuum pump.



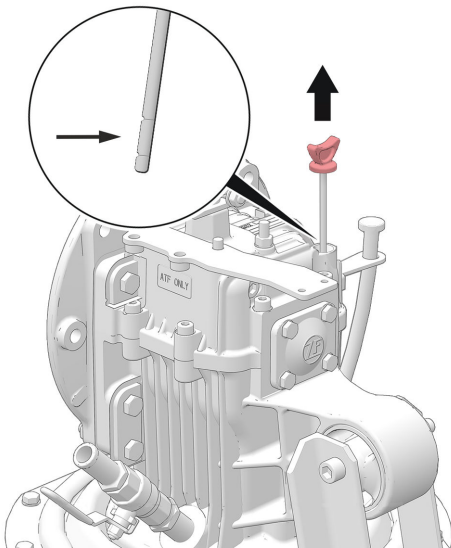
P0026767

- Fill with new oil.

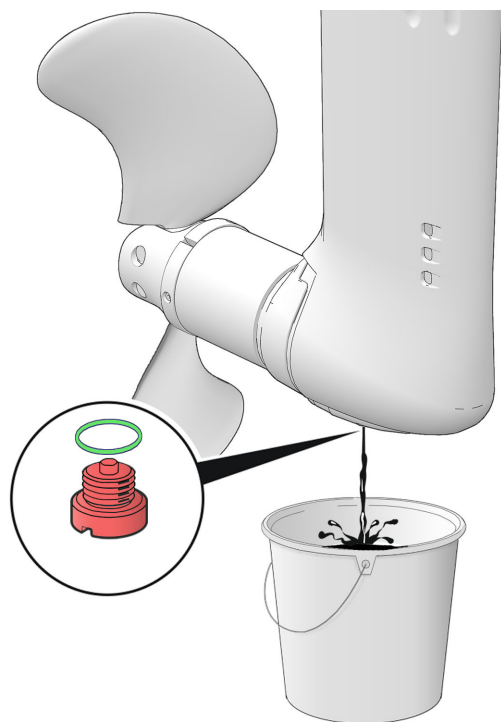


P0026768

- Check the level using the dipstick in the filler hole. The level must be between the markings on the dipstick; top up as necessary.



P0026769

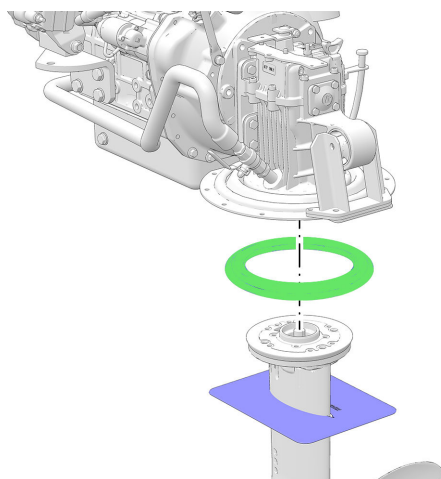


P0030920

### Changing oil with the boat out of the water

- Place a container under the drive for collecting the oil.
- Unscrew the oil drain plug in the bottom of the drive and drain the oil.
- Clean the magnet on the oil drain plug.
- Install the plug together with a gasket. Tightening torque: **10 Nm**
- Top up oil through the dipstick hole.
- Check the level and top up as necessary.

**NOTICE!** Hand the old oil in to a re-cycling station.



P0030922

### Replacing the rubber bellows

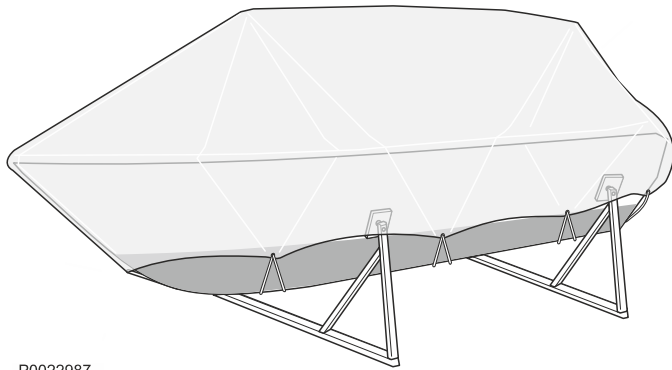
Check and replace the rubber bellows for the S Drive according to the intervals in the maintenance schedule. When replacing, refer to the installation instructions in the rubber bellows packaging.

# Long-Term Storage

If the boat is not going to be used for two months or more, it is important to reduce the risk of damage to the engine and other equipment. The suggestions below include measures to prevent freeze-bursting and reduce the formation of condensation, mold and corrosion.

## IMPORTANT:

When cleaning with a high pressure washer, make sure to never aim the water jet at seals, rubber hoses or electrical components.



P0022987

**NOTICE!** Attach a note on the engine/filters with the date and type of oil that has been used so it is easier to remember what has been carried out when it is time to launch.

## Before storage

- The fuel system must be protected during storage to prevent internal oxidation and corrosion.
- Start and run the engine with FAME-free fuel. Run the engine for at least 10 minutes to allow the fuel to reach all parts of the injection system. The fuel may be fed from a separate tank if preferred.
- If B0 fuel is not available, fuel additives with anti-corrosion and anti-oxidation properties may be mixed in the fuel to protect the fuel system during storage.
- Engines that use diesel fuel with a FAME content greater than 10%, (even if additives are used) must not be placed in long-term storage.  
FAME = Biodiesel  
B0 = Diesel with 0% FAME  
B10 = Diesel with 10% FAME
- Drain water from the pre-filter to reduce the risk of bacterial growth.
- Drain and clean the fuel tank.
- Fill the fuel tank with fuel to avoid condensation during storage. Use the recommended B0 fuel.
- Check that the coolant offers adequate protection against freezing. Check the level and top up as necessary.

- Drain all the remaining seawater from the cooling system, (heat exchanger, charge air cooler, impeller pump, hoses containing sea water).
- Remove the impeller from the seawater pump. Store the impeller in a sealed plastic bag and keep it cool.
- Disconnect the battery cables; clean and charge the batteries.  
An insufficiently charged battery can freeze and burst if stored at freezing temperatures.
- For cleaning the engine and transmission, see the next section.
- Touch up any paint damage with Volvo Penta original paint or paint of the same quality.
- If necessary, cover the engine, air intake and exhaust pipe.
- Always ensure good ventilation in the engine compartment in order to prevent the formation of mold and corrosion (if possible, leave hatches open).

**After storage**

- Replace filters before starting the engine. Keep extra filters available as FAME may cause microbial growth that blocks the fuel filter.

## **Storage instruction for long-term storage of new engine**

### **Applies to installed and non-installed engines**

The engines must be laid up in a warm, temperature-controlled store.

The temperature should be between +5°C and +30°C.

Storage outdoors is strictly prohibited.

Humidity should be below 40%.

We recommend that you:

- Unpack the engine, remove the plastic wrap.
- Use the plastic bag as dust protection; leave it loose for good ventilation.
- Do not use wax as protection in case the engine must be started during storage.

### **If the engine must be stored for more than 8 months**

#### **Before storage**

Make sure the engine cooling system is filled with glycol.

Make sure the engine lubrication system is filled with oil.

Pump the coolant through the seawater cooling system. (Marine engines only)

Seal all open connections.

Remove the battery cables from the battery.

Empty the AdBlue®/DEF tank if it is filled and clean it.

Attach a tag into the engine with information about the date, the product's part number, type of oil used and sign it.

#### **During storage**

The engine must be cranked 2.5 turns every 8th month.

If the engine can be started, run it until warm.

Check that humidity is below 40%.

Check that the temperature in the storage area is between +5°C and +30°C.

**Before the engine enters service.**

Uncover the engine or vacuum the system until dry. This is in order to prevent remaining glycol mixture from contaminating the environment. Hand the glycol mixture to a waste management facility as hazardous waste.

Clean the engine as necessary.

Check:

- Drive belts
- Hoses
- Clamps

Check the oil level in the engine and top off as necessary.

Make sure the coolant has adequate antifreeze properties; top off as necessary.

**Should be replaced:**

- Fuel filter
- Air filter
- AdBlue®/DEF filter
- Air filter AdBlue®/DEF tank
- Fill the AdBlue®/DEF tank
- Seawater pump impeller (Marine engines only)
- Anodes for the seawater system. (Marine engines only)

Start the engine and let it idle a while without a load.

Check that there are no oil, fuel or coolant leaks.

Run the engine until warm.

Change the engine oil and oil filter.

<b>Checklist, long term storage</b>			
Date	Product part number	Type of conservation	Signature and date of checks
Month		Checks during storage	
8,			
16,			
24,			
32,			
40,			

## Cleaning engine and transmission

### Including the engine encapsulation and all hatches

- A clean engine compartment minimizes the risk of overheating and wear damage.
- Prior to every engine compartment wash, a visual inspection must be carried out to identify any fluid or exhaust leakages.
- Following each wash, all hoses and bellows must be inspected visually to identify any leakages, cracks or chafing.
- Following each wash, electrical harnesses must be visually inspected to identify any damage to insulation, cable jackets or clamping.
- Battery, alternator, power steering unit and starter motor cables must be inspected extra carefully.
- Any damage to hoses, bellows, grommets or electrical harnesses must be reported immediately.

### Important!

- When cleaning, always use mild detergents/solvents.
- When cleaning the engine and engine compartment, the alternator, idler pulley, belt tensioner, power steering unit and all electrical components must be covered with plastic or similar so that detergent/solvents do not get into the parts
- Where fitted, the AC compressor must also be protected with plastic or similar.
- When cleaning air coolers, they should be vacuum cleaned first before flushing with warm water from the inside out.
- Do not use a power washer on the air cooler.
- Clean the outside with a sponge/brush.
- Then flush with lukewarm water.
- When pressure washing and steam cleaning, water pressure may not exceed 80-100 bar at the nozzle. Maintain a distance of 100-150 mm; use a fan spray nozzle.
- It is not permitted to come jets of water from the pressure washer directly onto the alternator. The electrical regulator, rectifiers, power steering units, bellows and mechanical parts (bearings) may be damaged and lead to serious consequential damage.

**NOTICE!** If the generator is exposed to water, it must be dried; see drying.



- Wash using a flat fan nozzle when cleaning sound absorbent.
- To maintain the fire prevention and sound dampening qualities of the absorbent as per the sound certificate, no damage to the absorbent may be repaired with the aid of patches or the puzzle principal i.e. by covering any damage with new absorbent (patch). Accordingly, in the case of major damage or where fluid has seeped into the absorbent (deep tears, tears wider than the width of tape; holes or cracked edges), the entire damaged unit must be replaced.
- Tears that can be covered widthwise by tape, must be repaired using approved aluminum tape.
- After the wash, check that no small rocks or other debris has adhered to the belts and are able to penetrate them when the engine is started.

### **Drying the alternator**

- Blow the water away from the alternator using compressed air.
- Check that the alternator charges.

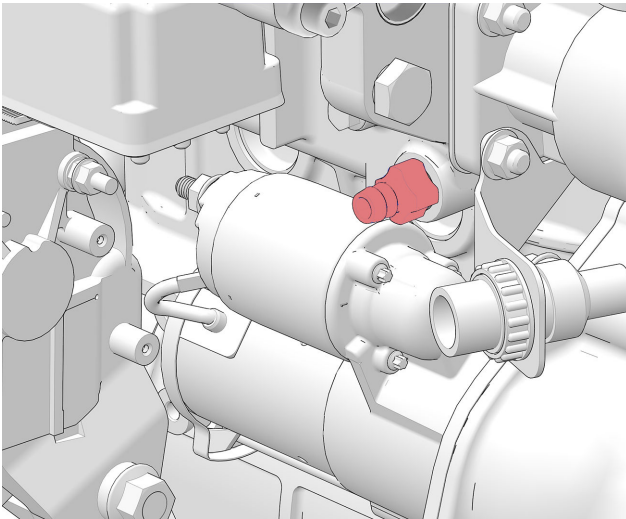
## Cold Weather Precautions

### **IMPORTANT:**

Coolant of a suitable chemical composition must be used all year round to protect the engine against internal corrosion, cavitation and freeze bursting. This even applies when there is no risk for freeze damage, to make sure the engine always has a complete corrosion protection.

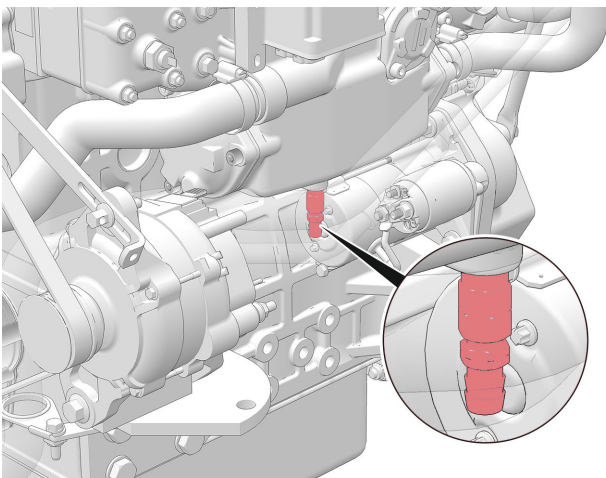
- Drain sea water from the heat exchanger and loosen the impeller pump cover.
- Check that all water drains out otherwise residual water may cause freeze bursting.

The risk of freeze bursting can be reduced by running the engine when on land with a mixture of 40% coolant and 60% fresh water through the sea water system before the engine is switched off. Connect a garden hose to the impeller pump (the sea water hose from the intakes) and put the other end into a bucket of the glycol mixture. Start the engine and let it idle. Be ready to stop as soon as the bucket is empty. Use a container to collect the coolant from the exhaust outlet and hand it in to a recycling station.



**D1-13/20/30 - D2-40**  
Heat exchanger drain

P0030919



**D2-50/55/60/75**  
Heat exchanger drain

P0030931

## Checklist

Suggestions for the checklist in addition to the regular service points:

### Checks/actions when taking the boat out of the water

- Check for leakage: fuel/water/exhaust.
- Check hose clamps and bellows.
- Check cable connections.
- Inspect through-hull fittings/cocks.
- Check the cooling water cock: opening/closing. Replace if stuck.
- Clean off fouling growth (drive/hull/propellers).
- Clean the battery terminals; remove oxide. Check the electrolyte level.
- Clean the engine and engine compartment.
- Clean the fuel tank.
- Drain/replace the fuel pre-filter.
- Functional check of other electrical systems.
- Check the rudder, drive and propeller(s).

### Start the engine every six months

If the boat will be out of the water for 6-8 months or more, the engine must be started and warmed up every six months as follows:

- Check the engine oil level.
- Check the oil level in the drive or reverse gear.
- Check the coolant level.
- Connect the battery cables to the batteries (fully charged).
- Take the impeller out of the seawater pump, or connect cooling water via a hose to the intake.
- Start the engine and run it for 2-3 minutes with the gearshift in the neutral position.
- Switch off the engine.
- Rotate the stern drive or reverser output shafts by hand for 2-3 turns.
- Detach the battery cables.
- Check the engine compartment for any condensation.
- Ensure good ventilation.



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## Battery, Maintenance

### ⚠ WARNING!

Risk of fire and explosion. Never allow an open flame or electric sparks near the batteries.

### ⚠ WARNING!

Battery electrolyte is a corrosive acid and should be handled with care. If you spill or splash electrolyte on any part of the body, immediately flush the exposed area with liberal amounts of water and seek medical attention as soon as possible.

### ⚠ WARNING!

Ventilate the engine compartment before working on batteries or battery connections.

### IMPORTANT:

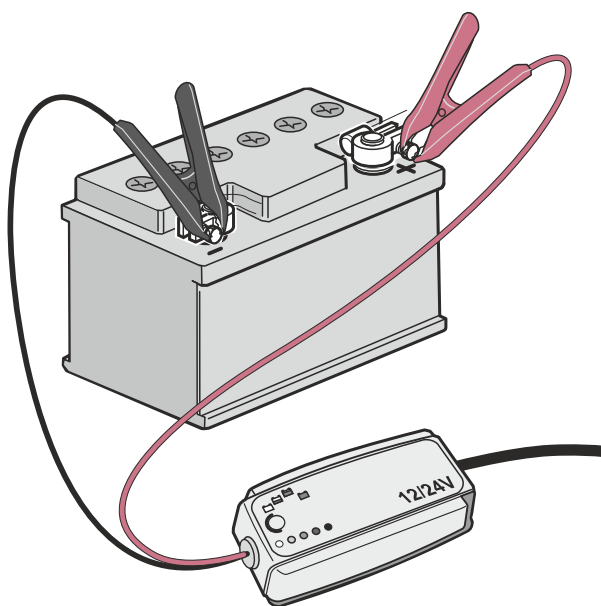
Batteries can be damaged if they are left discharged, and can also freeze and burst easier in cold weather. If the engine is not going to be used for a longer period of time, the batteries should be fully charged, trickle charged if possible.

## Care

It is important always to follow the battery manufacturer's recommendations and instructions when replacing and charging batteries. Instructions for maintenance and charging may vary depending on battery type.

Modern batteries are usually maintenance free, but there are some recommended measures to avoid accidents and increase battery service life:

- Keep the batteries clean and dry. Contamination and oxide on the batteries and battery terminals can cause stray currents, voltage drop and discharge, especially in damp weather.
- Remove oxidation from the battery poles and terminals using a brass brush.
- Tighten the terminals securely and grease them with terminal grease or petroleum jelly. Loose battery connections can cause damage to the engine electrical system.
- Charge the batteries regularly. Batteries kept at full charge enjoy maximum service life. The easiest way to check whether a battery needs charging is to use a volt meter.



P0022892

## Battery replacement

### IMPORTANT:

Make sure that the new battery fulfills the specifications in *Technical Data*. Read the information supplied with the battery before you begin the installation.

### IMPORTANT:

Do not disconnect the batteries with the engine running.

Sensitive electrical components can be immediately damaged.

### ⚠ WARNING!

Never confuse the positive and negative poles on the batteries. Risk of arcing and explosion.

### Disconnection (A)

- Remove the negative (-) cable (black).
- Remove the positive (+) cable (red).

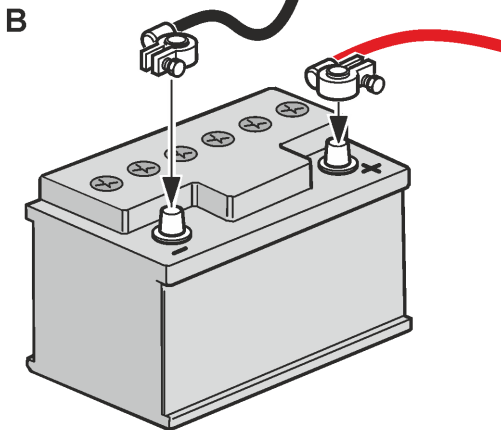
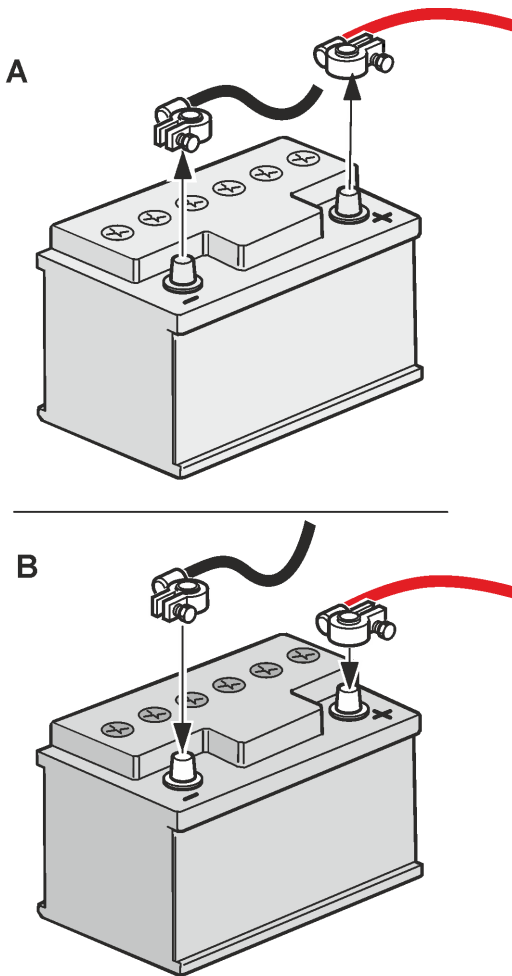
Remove the battery.

### Connection (B)

Put the new battery in place.

- Attach the positive cable (red) to the battery's positive terminal. Tightening torque: **6 Nm**.
- Attach the negative cable (black) to the battery's negative terminal. Tightening torque: **6 Nm**.

**NOTICE!** Hand in the old battery to a waste management facility.



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# **VOLVO PENTA**

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