VOLVO PENTA

SERVICE AND MAINTENANCE 13L INDUSTRY

Table of Content

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.

P0024482

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.

P0024470

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.

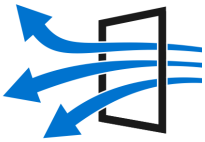
Oil-soaked rags can spontaneously ignite under certain circumstances.

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.

Ventilation when running the engine



P0024481

⚠ 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.

P0024808

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.

P0024483

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.

P0024688

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.

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.

P0024488

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).

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

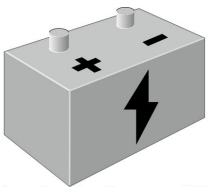
IMPORTANT:
Take great care to keep the fuel system components clean. Even minimal amounts of dirt can cause engine breakdown.

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.



P0024468

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.

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 75*.

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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.

Lifting the engine

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

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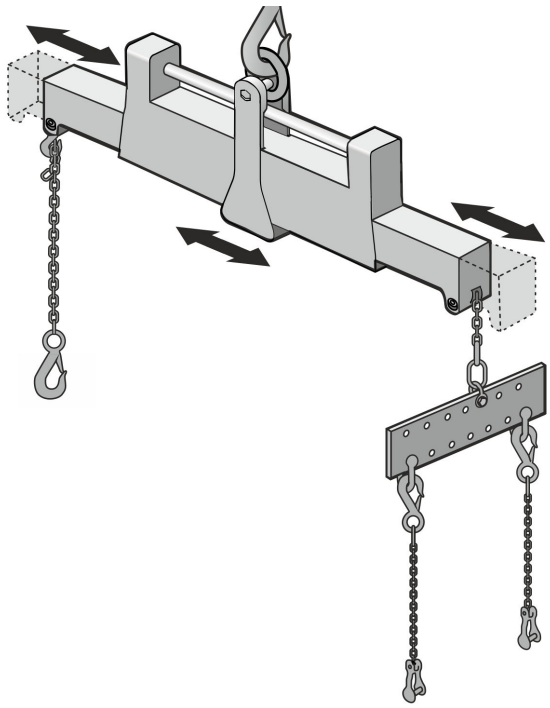
IMPORTANT:
When using a lifting device, two people are usually required to do the work – one to take care of the lifting device – and the other to ensure that components are lifted clear and not damaged during the lifting operations.



P0024689

Example of an adjustable lifting yoke and a lifting tool.

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.

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)

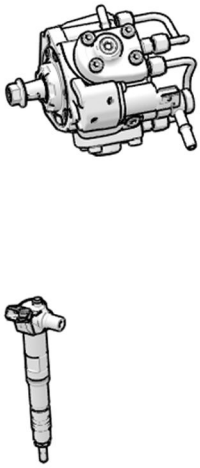
Service Protocol

To maintain the functionality of the product Service Protocol shall be followed. The owner or other persons with sufficient technical competence may carry out some measures in accordance with Service Protocol. Contact an authorized Volvo Penta dealer in the case of uncertainty as to how service work must be performed.

Service Protocol contains the necessary maintenance points for your engine in a single document. See more on Volvo Penta‘s website: *vppn.volvo.com and Product Center for online service protocol*.

Preventive repair

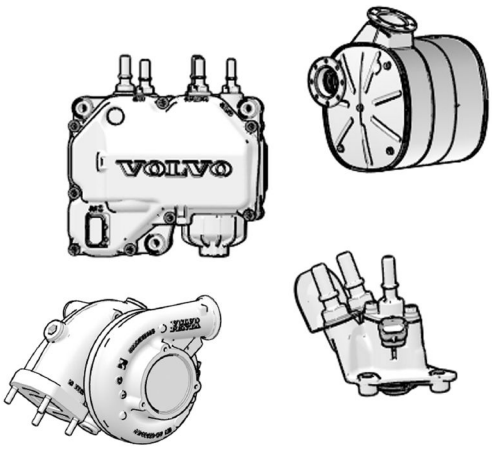
Here is an overview of the components that may be included in preventive maintenance. May vary depending on the engine's design and construction.
These components form the basis for calculating service contracts and the costs in the service calculator in Product Center.



P0026295

Fuel system

Fuel pump
Unit injectors



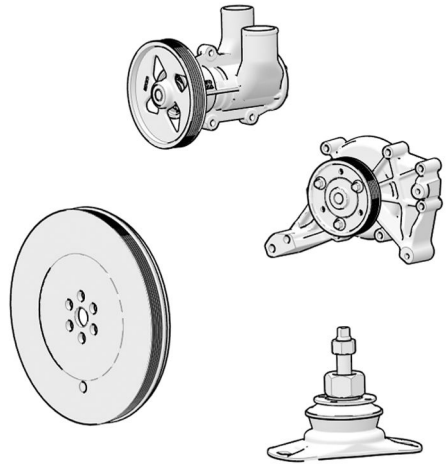
P0026296

Exhaust system

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

After-treatment system

Pump unit
Dosage valve



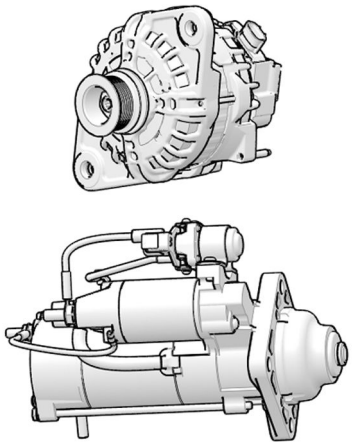
P0026297

Cooling system

Coolant pump

Engine

Vibration dampers



P0026298

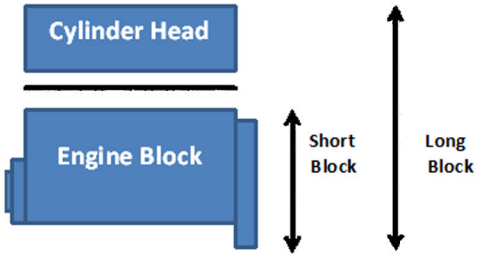
Electrical system

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 once, after which the engine will be regarded as spent and will be replaced by a “long block” or a new engine.



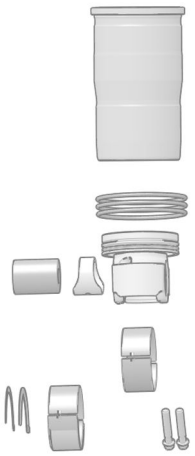
P0026299

Overhaul

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

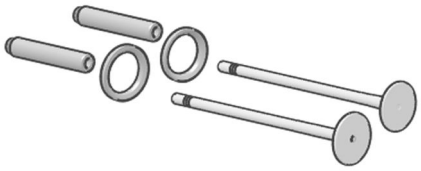
P0026300

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



P0026301

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



P0026302

Exhaust valve
Valve seat

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. Therefore 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 drivelines.

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 quality requirements. We recommend the use of the specified oil to ensure engine function and a long service life.

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.

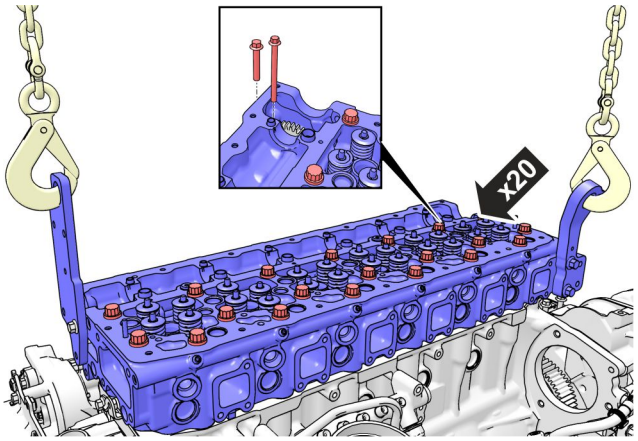
Mixing the concentrated coolant	**Protection against freeze bursting down to:**
40 %	-25 °C
46 %	-30 °C
54 %	-38 °C
60 %	-46 °C

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

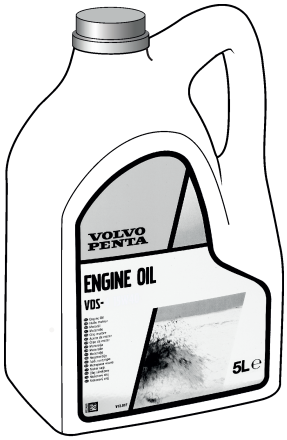
Chemical products

A **selection** of Volvo Penta recommended chemical products is shown below. Also refer under Specifications.

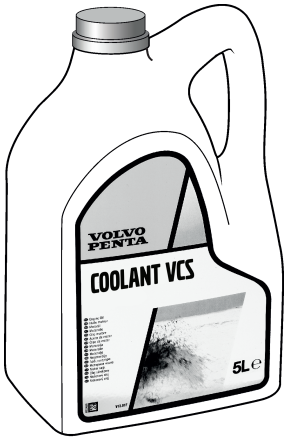
Thread locking fluid

Corrosion protection

Sealant



Engine oil



P0023031

VCS Coolant

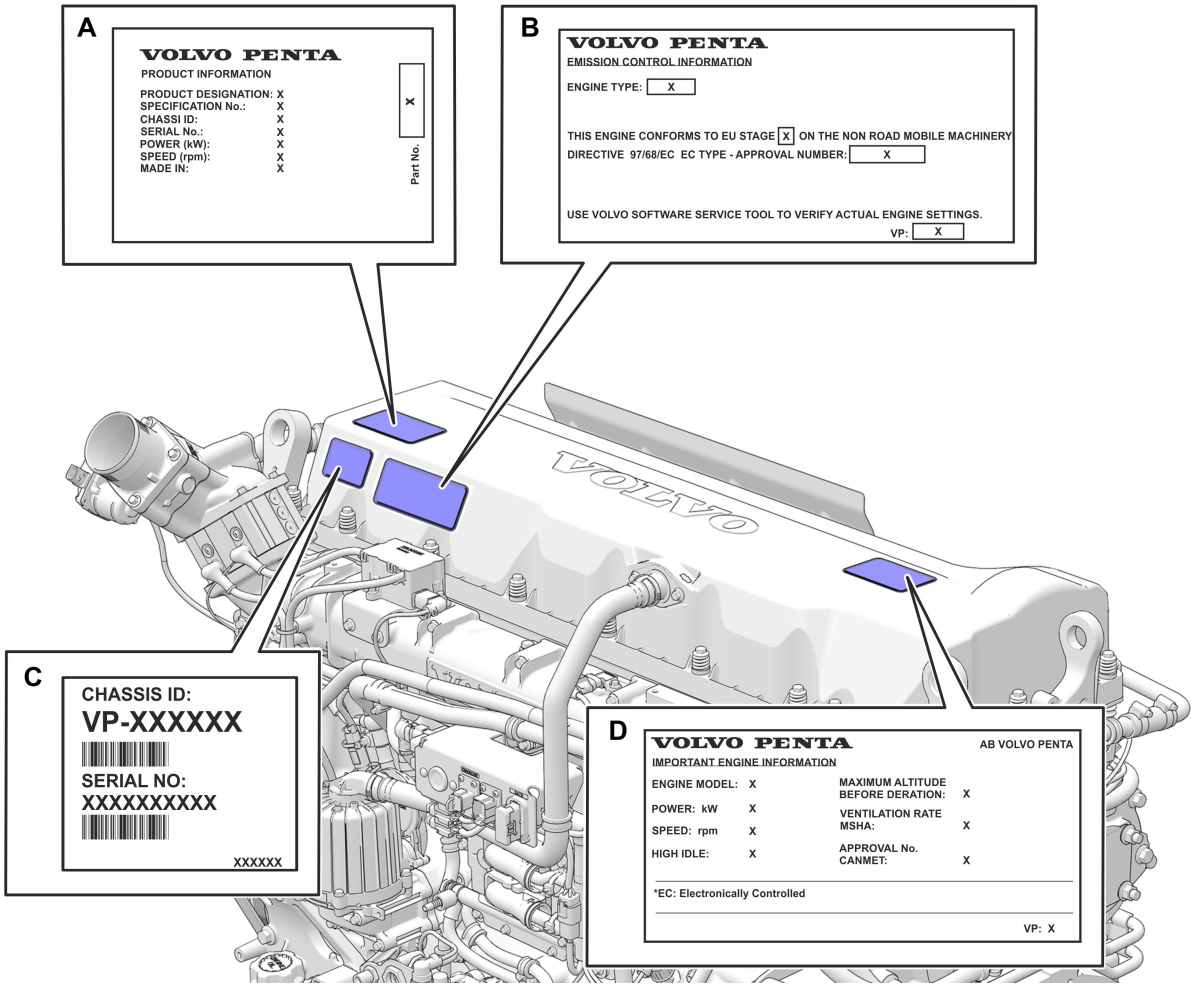
P0022805

Grease

Specifications

Engine Decals

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



P0030241

A Product information
B Emissions information
C CHASSIS ID
D Engine information

General Tightening Torques

Bolt	Nm
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

Oil quantity in engine, including filter TAD1340–1375VE/GE TAD1380–1385VE/GE	36 liters
VDS–4.5 SAE10W–30	
Part number: 23068339 Part number: 17488420 Part number: 17488431 TAD1380–85VE/GE	5 liters 20 liters 208 liters
VDS-4.5 SAE15W-40	
Part number: 23909459 Part number: 23909460 Part number: 23909461 Part number: 23909462 TAD1340–1375VE/GE	1 liter 5 liters 20 liters 208 liters
Coolant, VCS yellow, concentrated	
Part number: 22567295 Part number: 22567307	5 liters 210 liters
Coolant, VCS yellow, ready-mixed	
Part number: 22567314 Part number: 22567340	5 liters 210 liters
Volume ready-mixed VCS yellow coolant, (engine + standard radiator + hoses + expansion tank) TAD1340–1375VE/GE TAD1380–1385VE/GE	24 liters

Volumes may differ if the installation has extra coolers/ radiators connected.

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.

Volvo Penta products for North America

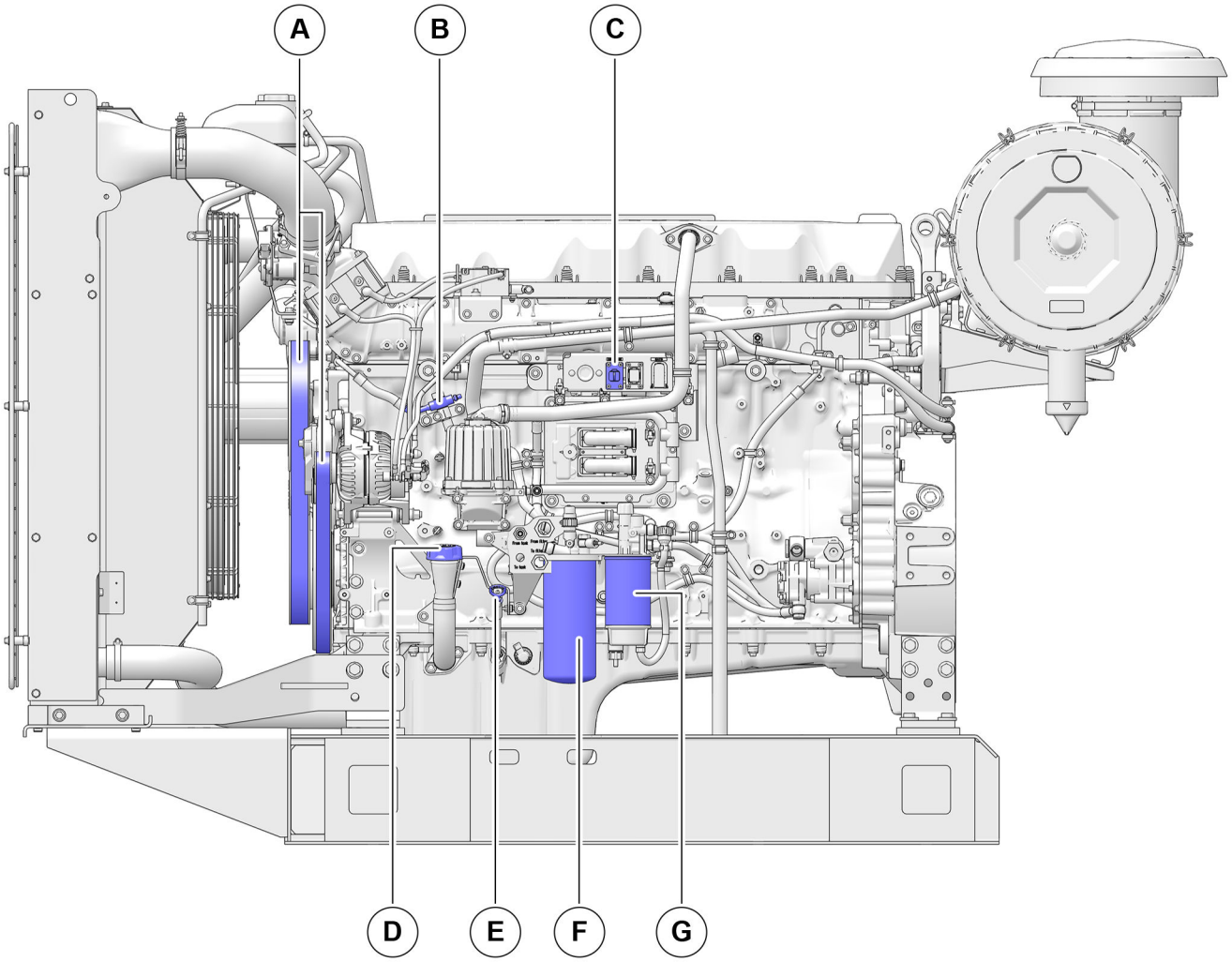
Oil quantity in engine, including filter TAD1340–1375VE/GE TAD1380–1385VE/GE	9.5 gallons
VDS–4.5 Part number: 23219282 Part number: 23219274 Part number: 23219264 Part number: 23219260 Part number: 23219246	 1 US quart 1 US gallon 5 gallons 55 gallons 330 gallons
Coolant, VCS yellow, concentrated. Part number: 21485012	1 US gallon
Coolant, VCS yellow, ready-mixed. Part number: 21485014	1 US gallon
Volume ready-mixed VCS yellow coolant, (engine + standard radiator + hoses + expansion tank) TAD1340–1375VE/GE TAD1380–1385VE/GE	6.34 US gallons

Volumes may differ if the installation has extra coolers/ radiators connected.

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.

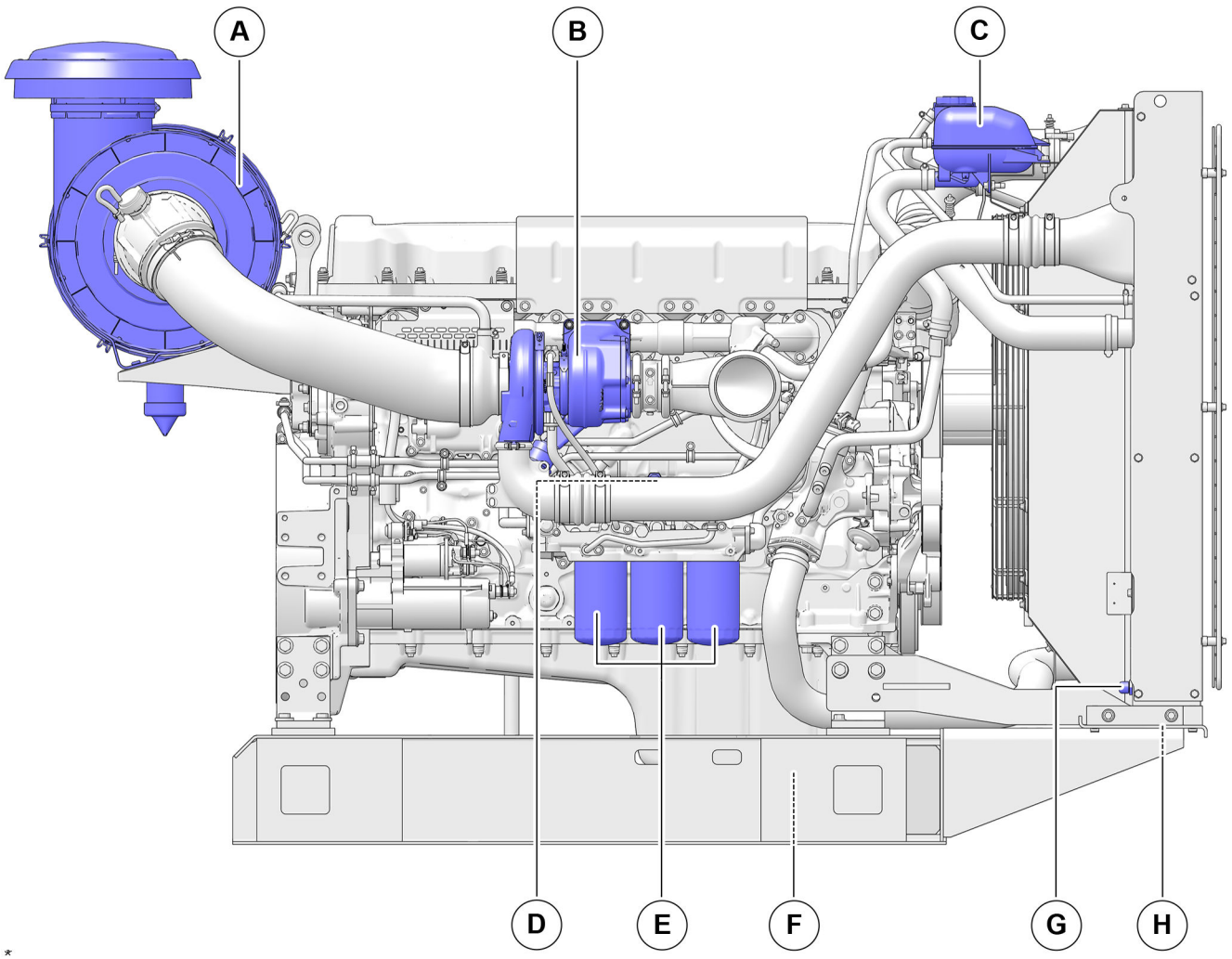
Engine

Component location



P0030230

A Drive belts
B Purging, fuel
C Diagnostic connector
D Oil filler
E Oil dipstick
F Fuel filter
G Fuel pre-filter



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P0030237

A Air filter
B Turbocharger
C Expansion tank, coolant
D Coolant drain, engine block
E Oil filter
F Bottom plug, oil drainage
G Coolant drain, HD radiator
H Coolant drain, std radiator

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**.
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 42*.
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.

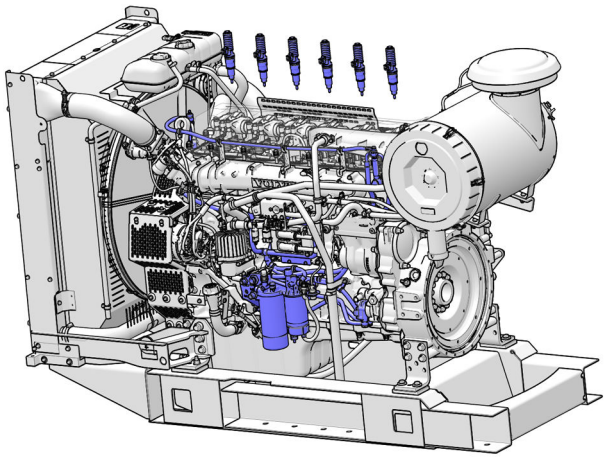
General inspection

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.

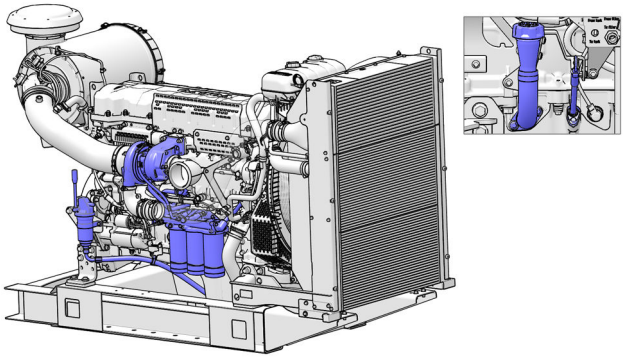
The images are generic and applicable to all engine installations. They show only a selection of components and systems.
The inspection applies to all components in the systems.



P0030234

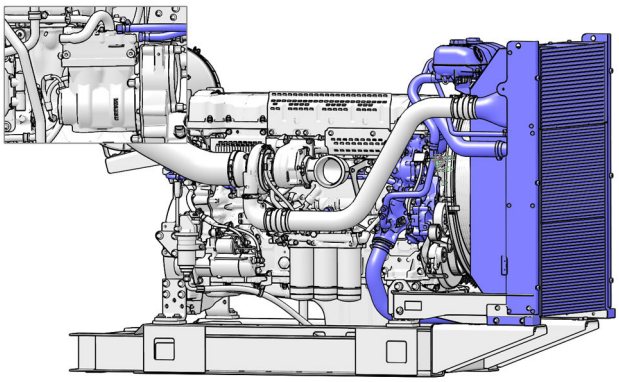
Look especially carefully for fuel leakage at:

- Injector connections
- Pressure sensor, common rail
- Check all clamped items
- Fuel filter
- Fuel pipe/hoses
- Fuel pump



P0030243

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



P0030239

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

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!

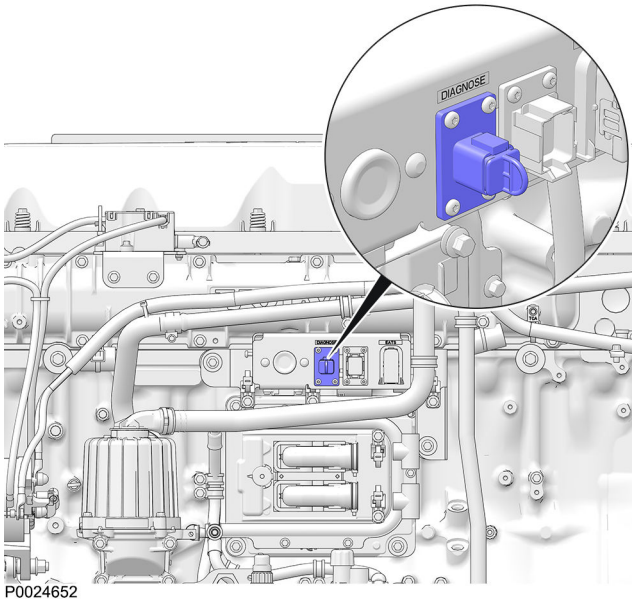
If you discover a leakage of oil, fuel or coolant, investigate the cause and fix the fault before starting the engine to avoid the risk of fire.

General advice for electronic protection

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

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

- 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 as a starting aid. 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.



P0024652

The diagnostic connector is located at the side of the engine.

P0024905

Check software status

These readings depend on the type of installation and are carried out using the VODIA diagnostics tool.

- Reading and resetting parameters.
- Reading and erasing any fault codes (DTC).
- Resetting service intervals (EVC2).

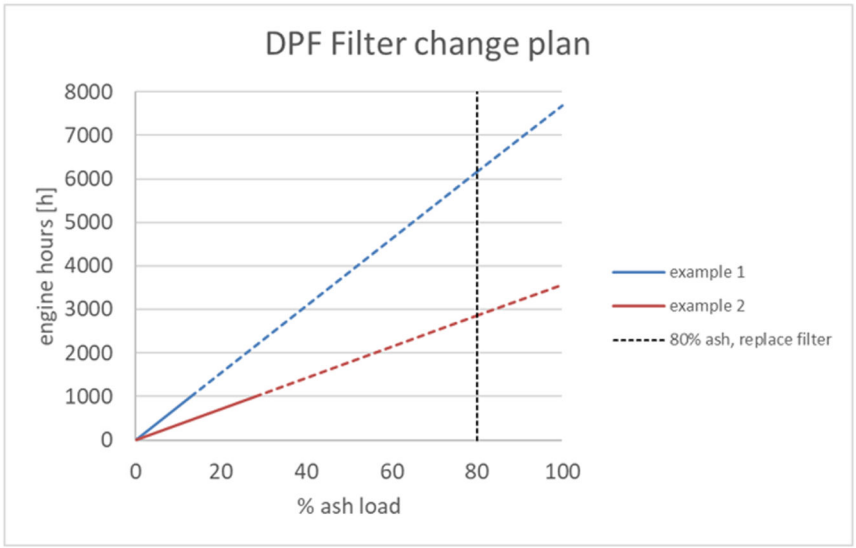
P0024905

Reading Ash Load, DPF

- This reading describes how large the ash quantity is as a percentage. Whether the filter must be replaced or if it will last until the next service.
- Current condition is calculated using hours consumed and hours remaining until the next service in relation to the ash quantity reading.
- The reading is taken using the VODIA diagnostics tool.
- The reading **must** be noted in the maintenance schedule and saved in Product Center.

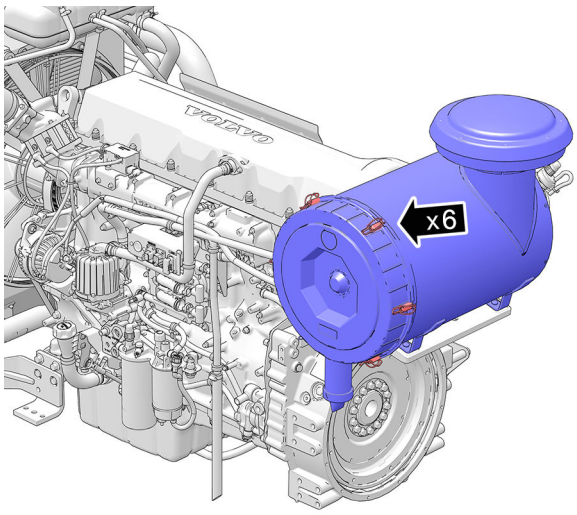
DPF filter, replacement planning

The amount of ash must be read off at the 1000 hour service and an estimation made of how many hours remain before the DPF filter must be replaced.
The filter must be changed when the amount of ash reaches 80%.



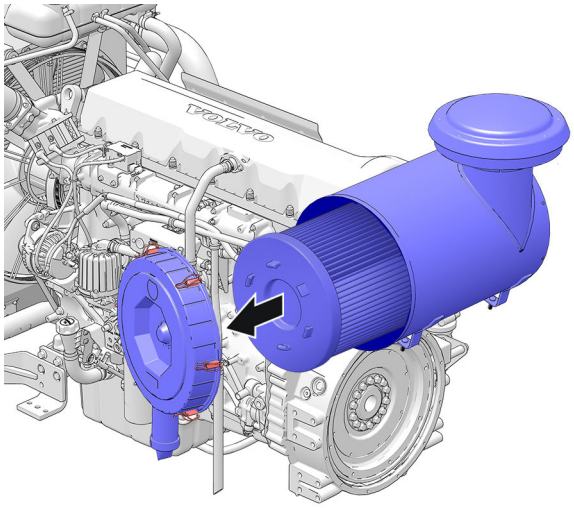
P0031617

Air Filter



P0024653

The engine air filter is connected to the turbocharger inlet pipe.



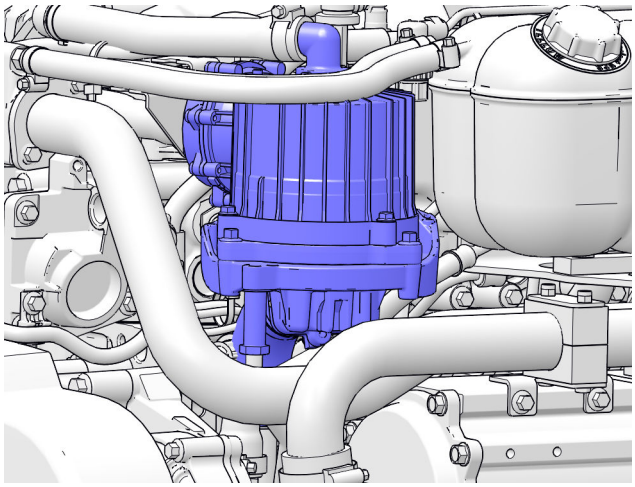
P0030240

Replacing the air filter

- Open the fasteners and remove the cover.
- Remove the filter by pulling/rocking it straight out.
- Wipe clean around the attachment point.
- Install the new filter.
- Refit the cover and close the fasteners.

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

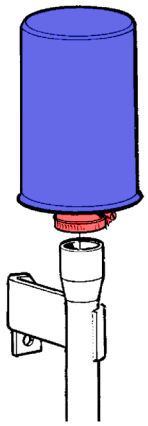
Crankcase Ventilation, Filter Change



P0026321

Crankcase separator

- Requires no service.

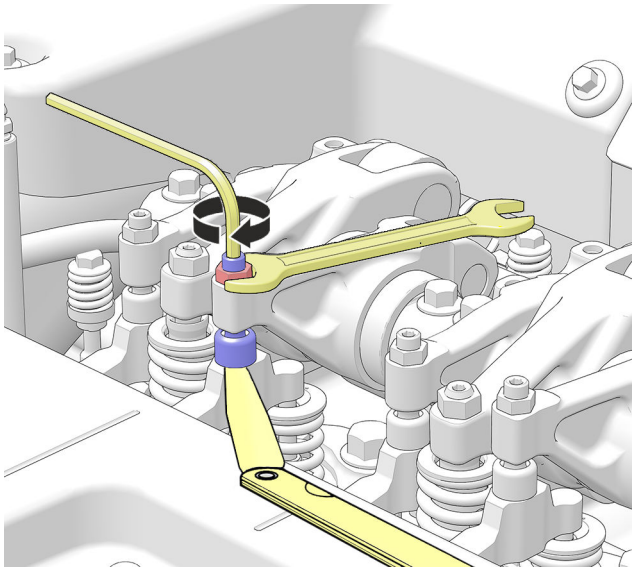


P0026927

Air filter Compressor, filter replace

NOTICE! Universal image - filter types may differ.

- Remove the hose clamp.
- Remove the air filter.
- Install a new filter.
- Tighten the hose clamp.
  Tightening torque: **5 Nm**



P0026355

Valves, Adjustment

Adjusting valve clearance is a task meant for workshop-trained personnel. Refer to the Workshop Manual.

Note the interval in the maintenance schedule for your engine.

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.

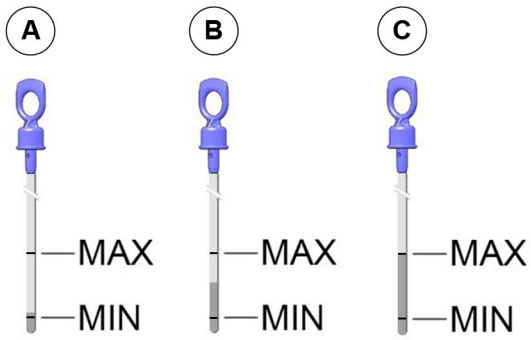
Oil level check, hot engine.

- 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.



P0028585

A Oil level on the MIN marking: add oil until the level is between min and max.

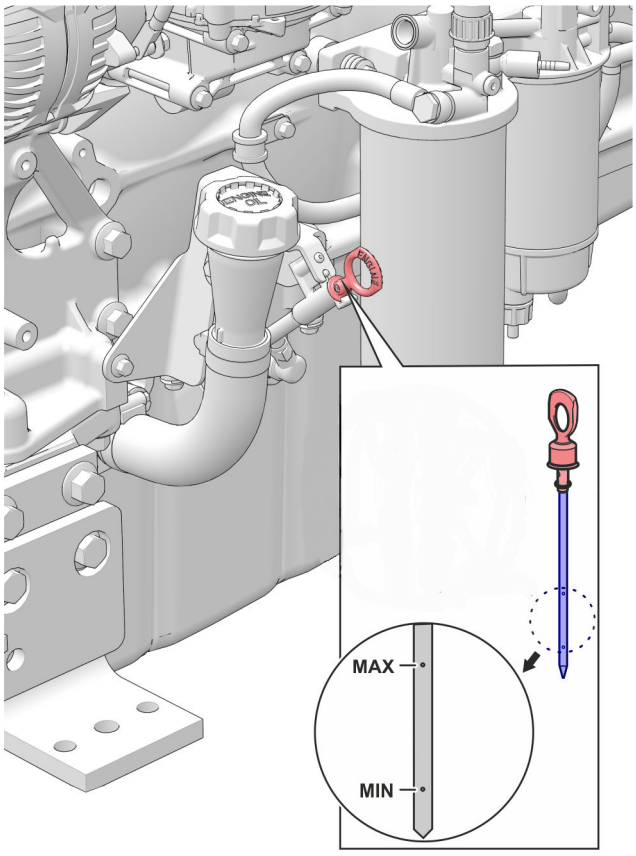
B **Optimal oil level**, do **NOT** add oil.

C Oil level at max marking; do **NOT** add oil.

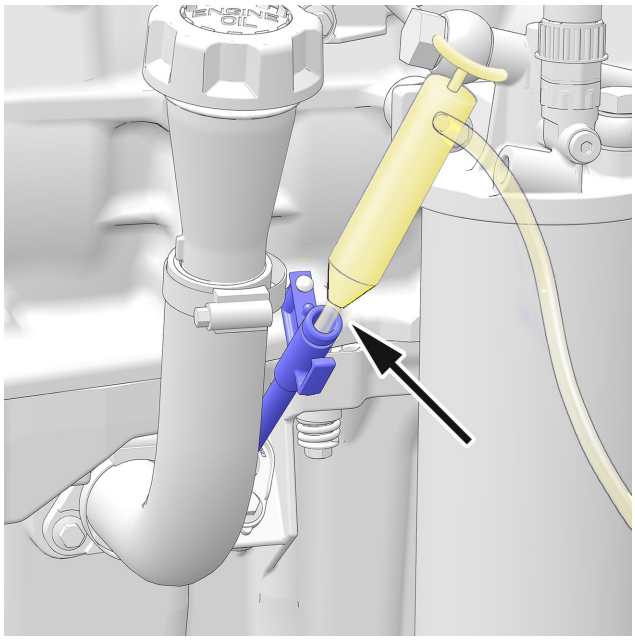
NOTICE! Never add too much engine oil.

Engine oil, Replace

Change the engine oil and filter within the recommended service intervals.

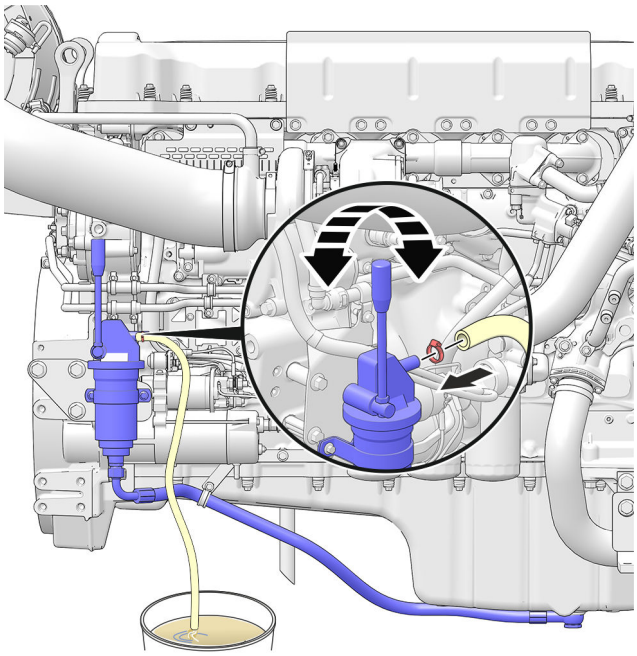


P0027025



P0026944

Drain the engine oil by connecting a pump to the oil dipstick hole and drawing out the oil.

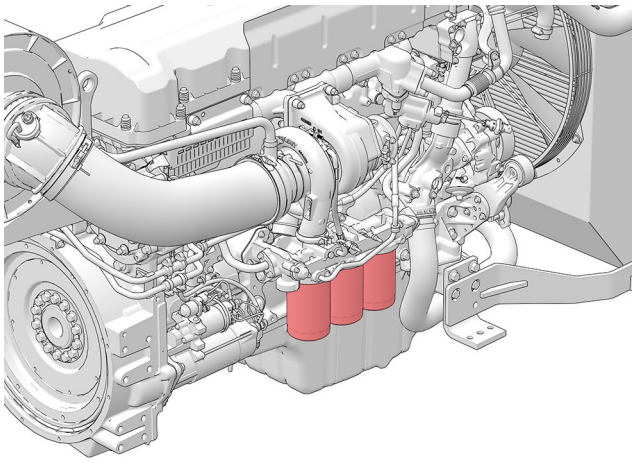


P0024664

Alternatively, permanently connect a hand pump to the bottom plug (recommended).

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

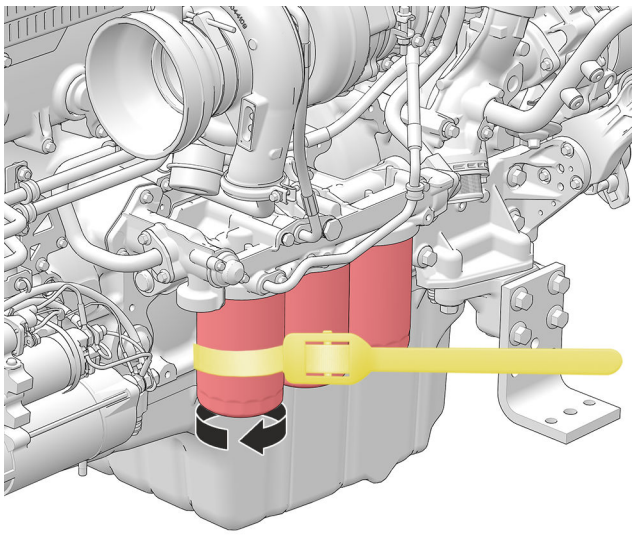
Oil filter, Replace



P0027026

We strongly recommend that only oil filters approved by Volvo Penta are used.
An incorrect type of oil filter can lead to increased wear and damage, for example to bearings and crankshaft.

Removal



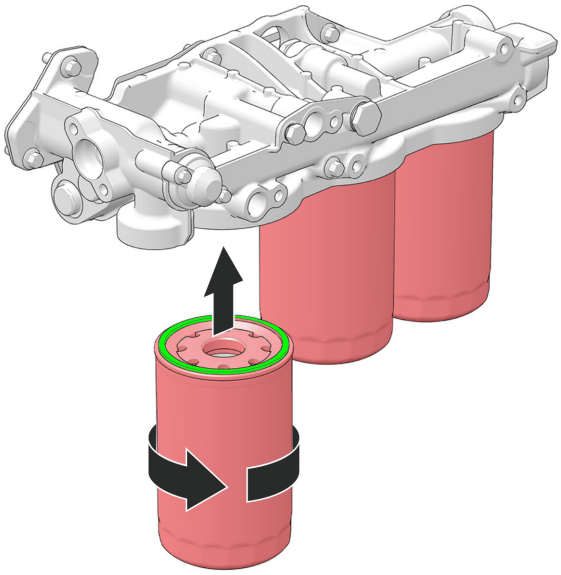
P0027027

- Remove the oil filters with a universal puller.
- Clean around the filter attachment on the filter housing.

Installation

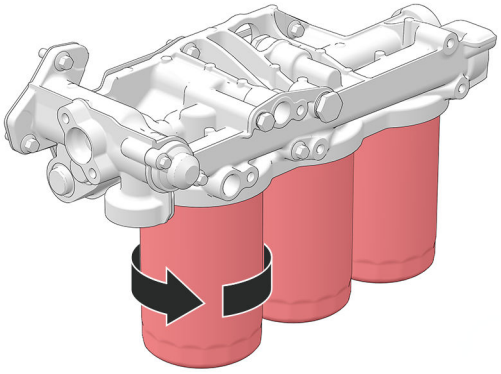
P0030090

- Lubricate the new O-ring with engine oil before installing.



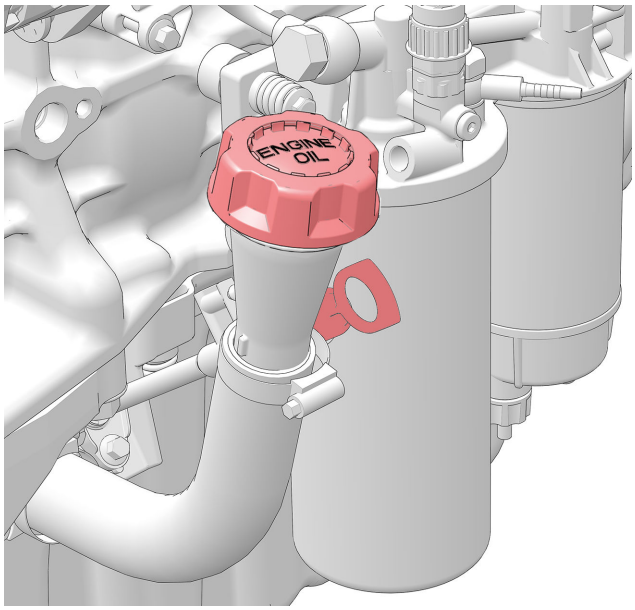
P0030242

- Fit the new filters.



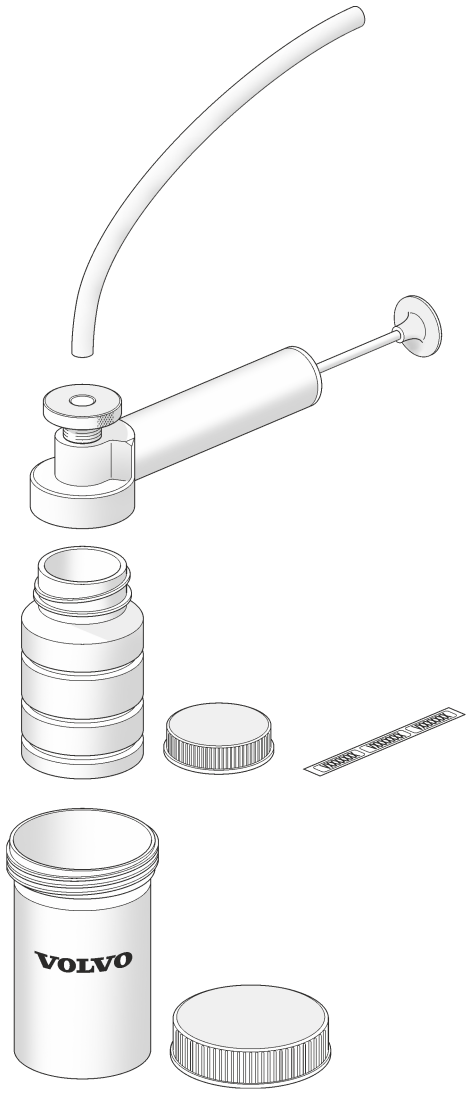
P0027029

- Tighten according to the instructions on the filters.



P0030092

- Fill with the required amount of oil; refer to *Specifications, page 23*.
- Start the engine.
- Check that no leakage occurs.
- Stop the engine and check the oil level after a few minutes.
- Top up as necessary.



P0022867

Volvo Penta oil analysis

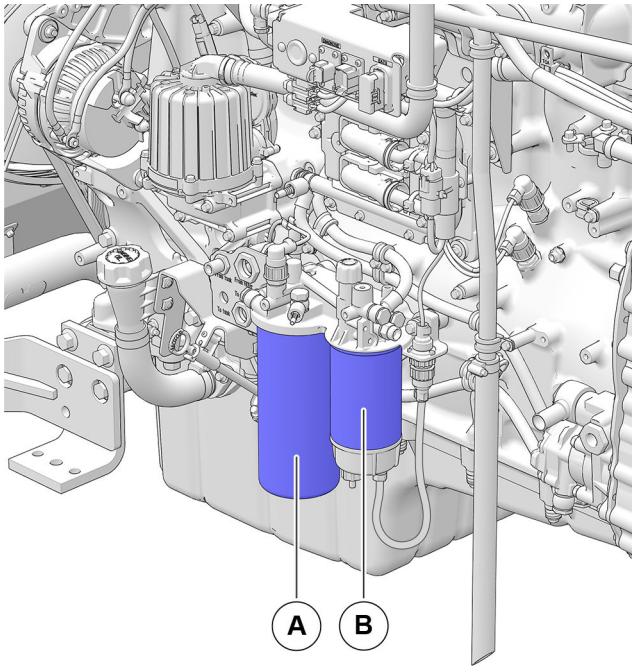
Volvo Penta oil analysis provides an extensive diagnostic check on the driveline condition. The oil analysis provides information for example on water content, fuel content, dirt and the amount of metallic particles in the oil as a result of component wear.

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.

Fuel System



P0030233

General

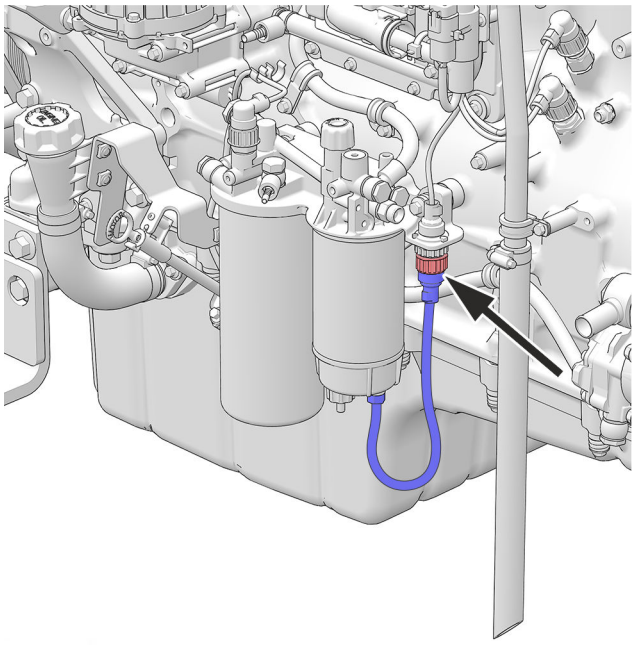
The fuel system has a fine filter (A) and a pre-filter (B).

Fuel Pre-filter, Replace

⚠ CAUTION!
Risk of skin damage.

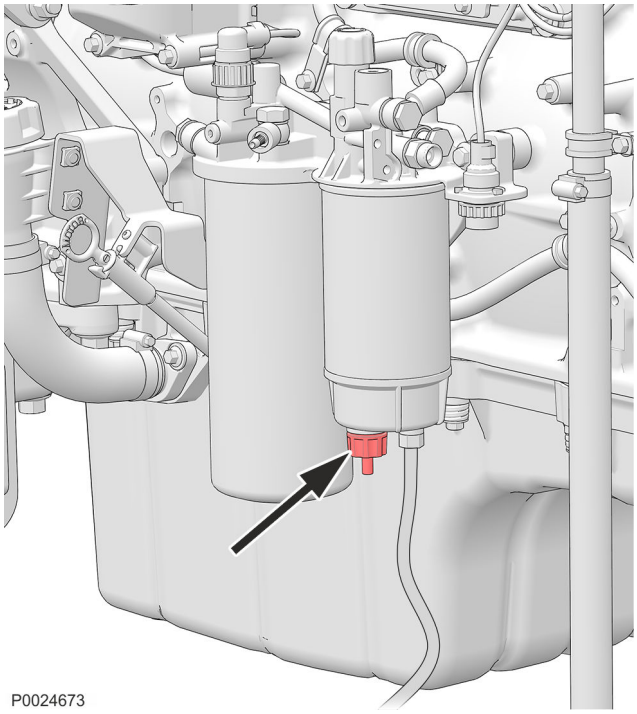
NOTICE! Be prepared to gather up fluid.

Removal



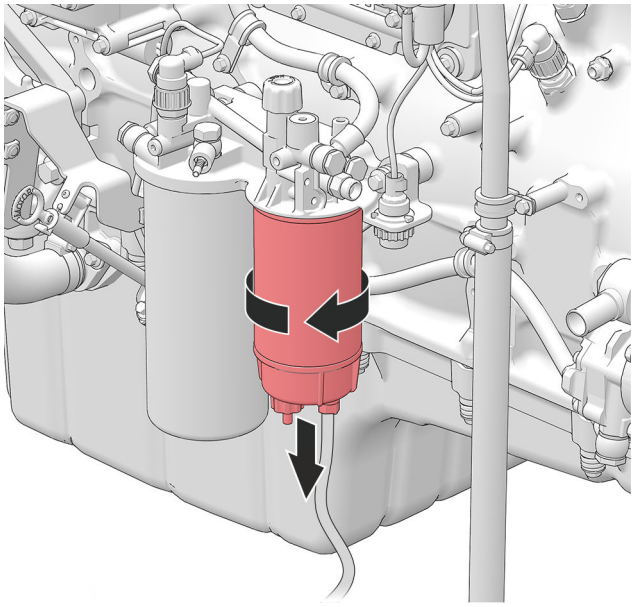
P0027034

- Remove the water separator sensor connector.



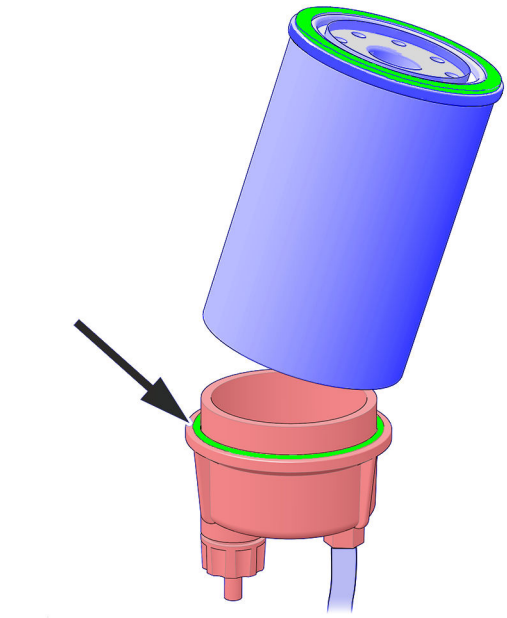
P0024673

- Loosen the drain nipple in the base of the water separator. Drain the filter.
- Reinstall the drain nipple and tighten securely.



P0027035

- Remove the pre-filter together with the lower section of the water separator. Use a universal puller for the oil filter.



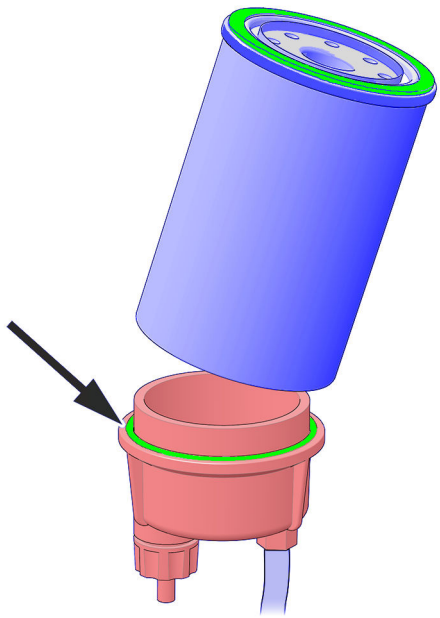
P0030094

- Remove the lower section of the water separator and O-ring from the filter.

P0025046

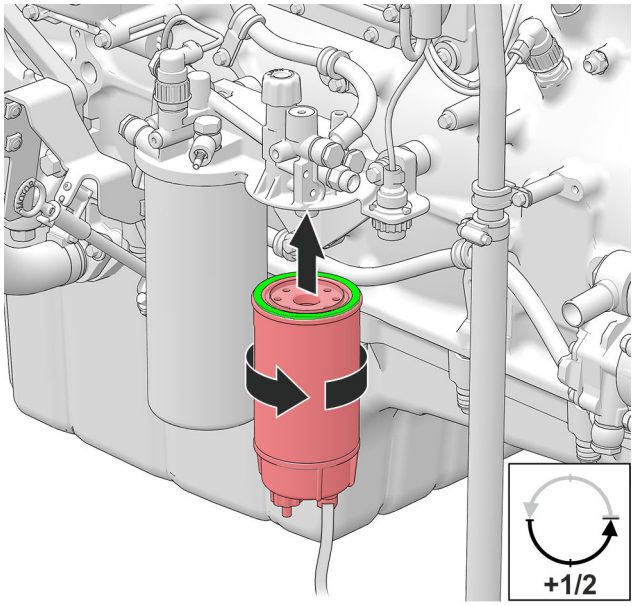
- Clean the lower section of the water separator and the contact surfaces. Check that the strainer and drain hole in the lower section are not clogged.

Installation



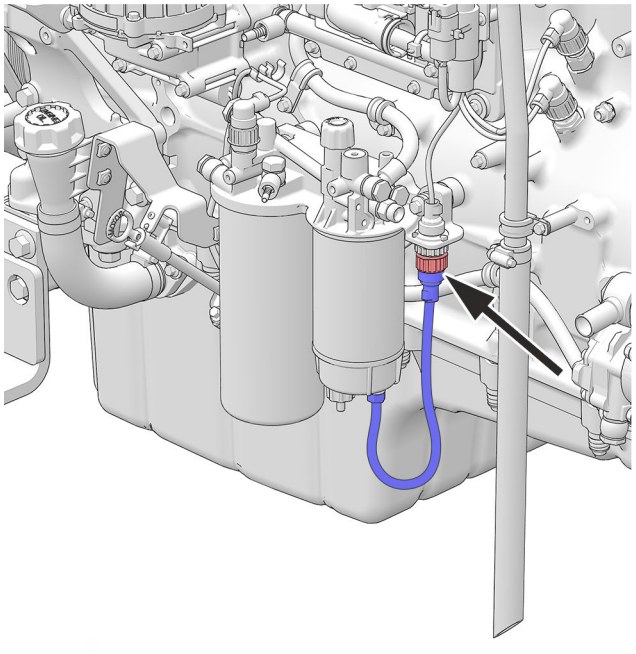
P0030094

- Install a new O-ring. Lubricate the seal with diesel.
- Install the lower part of the water separator.



P0030231

- Lubricate the sealing surface with diesel and screw the new filter onto the filter bracket by hand until the seal touches the sealing surface. Then tighten a further 1/2 turn.



P0027034

- Connect the connector.
- Open the fuel tap and vent the fuel pre-filter; refer to *Fuel system, bleeding, page 51*. Check for leakage.

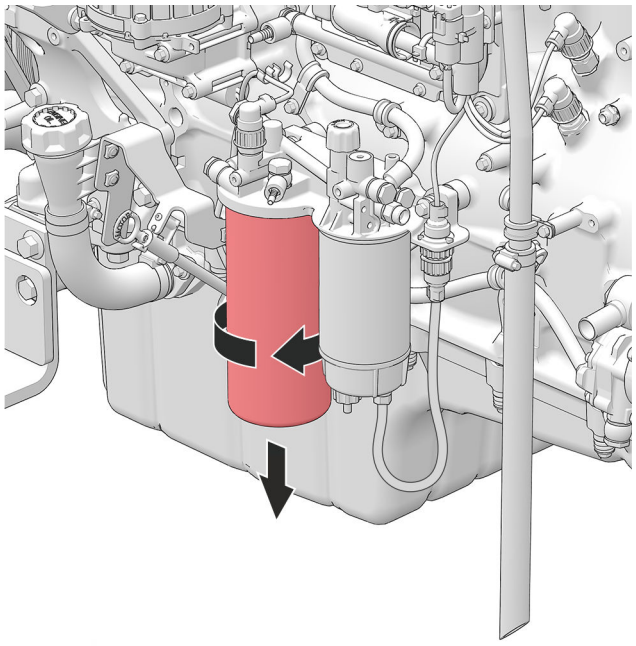
Fuel filter, Change

IMPORTANT!

Protect against dirt while work is in progress.

NOTICE! Be prepared to gather up fluid.

Removal

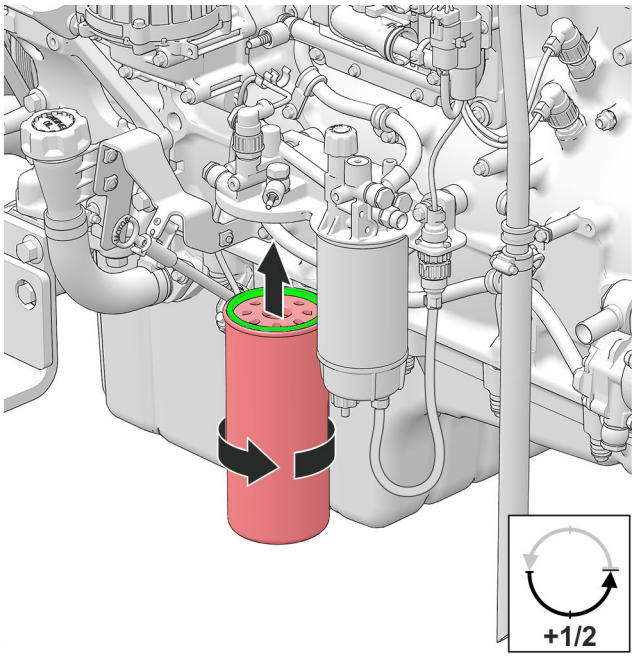


P0027041

- Remove the fuel filter with the aid of a suitable filter puller. Let the fuel drip off into a collection vessel.
- Clean around the filter housing sealing surface.

Installation

NOTICE! Do not fill the new filter with fuel before installation; there is a risk that contamination may cause malfunctions.



P0030232

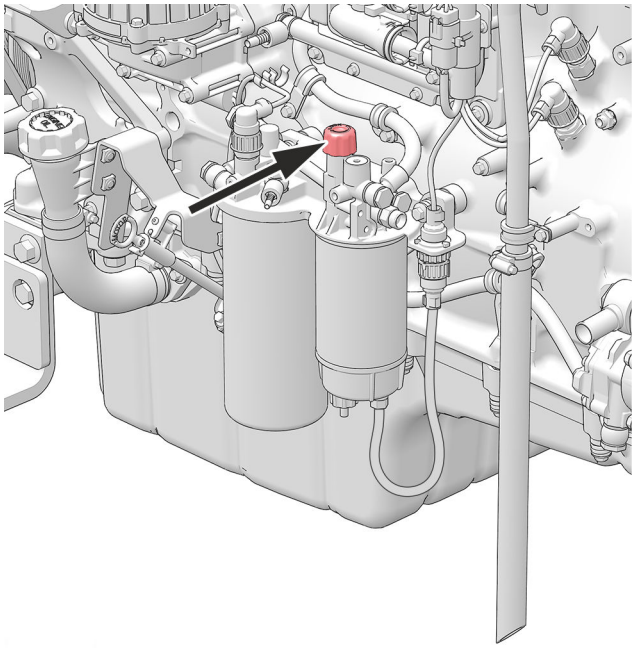
- Lubricate the sealing surface with diesel and install the new fuel filter. Tighten according to the instructions on the filter.
- Purge the fuel system; see *Fuel system, bleeding, page 51*.
- Start the engine and check for leaks.

Fuel system, bleeding

⚠ CAUTION!

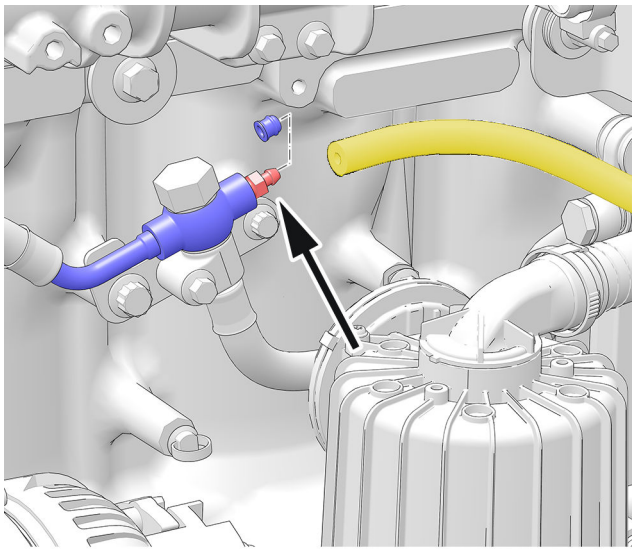
Never disconnect a fuel line or component after the fuel pump to bleed. The fuel is under very high pressure and can penetrate the skin.

NOTICE! Check that there is sufficient fuel in the tank, and that any fuel taps are open.



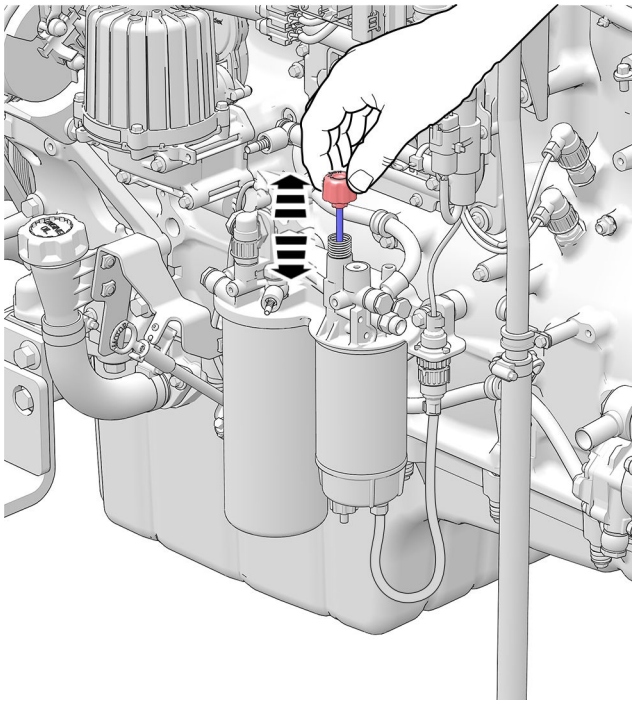
P0027043

- Free the hand pump from the fuel filter bracket.



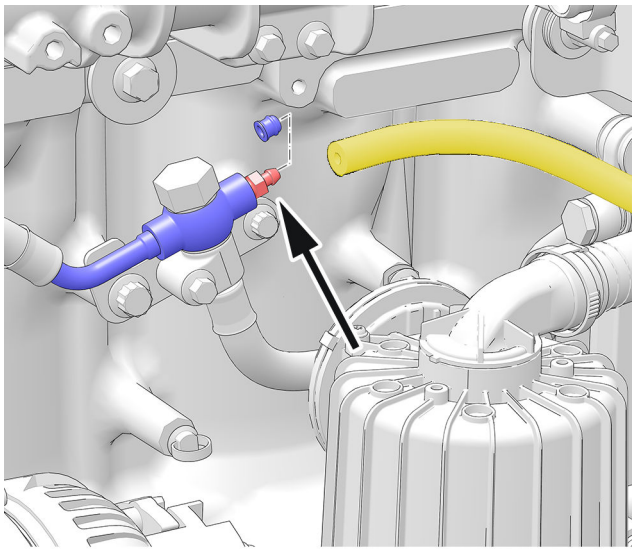
P0027044

- Open the bleed nipple on the front fuel connection next to the valve cover and fit a hose.
- Connect a hose and a bottle/receptacle to the other end of the hose to collect fuel when bleeding.



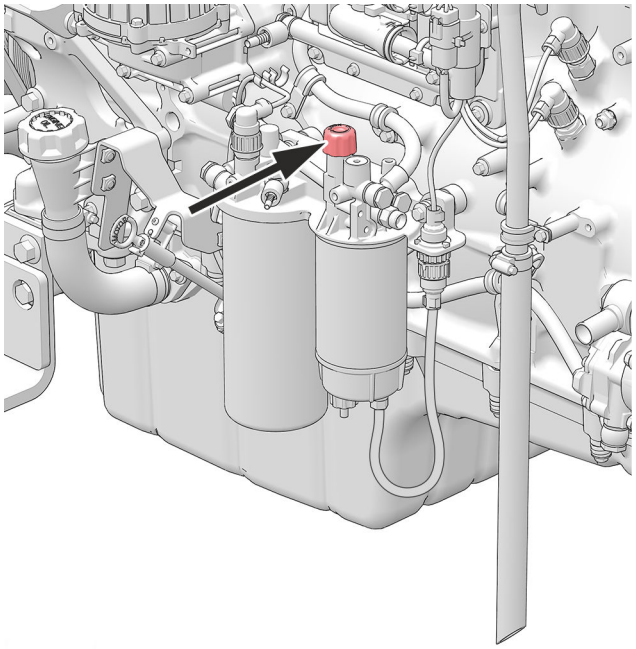
P0027045

- Purge the fuel system by pumping with the hand pump until fuel flows without air bubbles.



P0027044

- Close the nipple.
  Tightening torque: **3.5 Nm**
- Remove the hose and fit the protective rubber cover.



P0027043

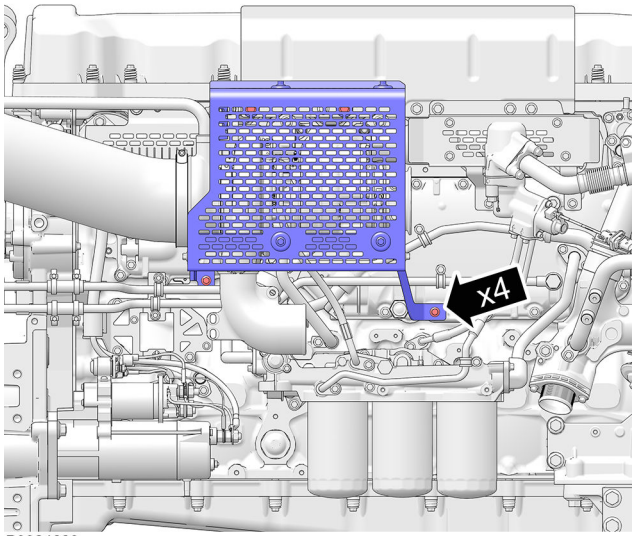
- Tighten the fuel pump handle.
- Wipe dry any spilled fuel.
- Start the engine and let it idle.
- Check that no leakage occurs.

Exhaust System

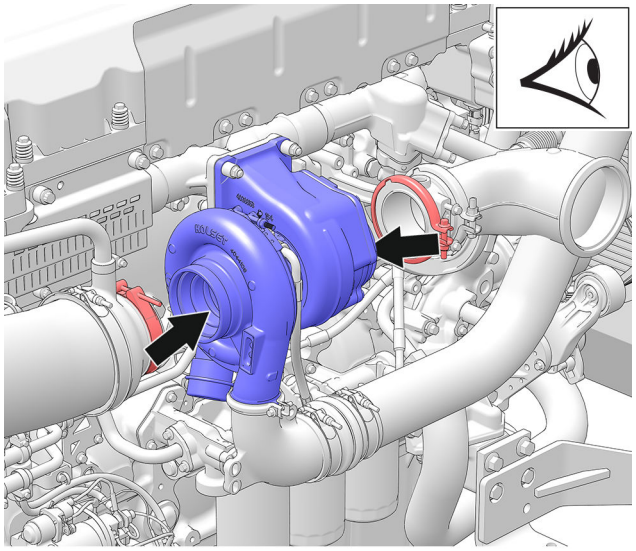
Turbocharger, Inspection

Inspecting the turbocharger and charge air pipe

- Remove the protective grille.



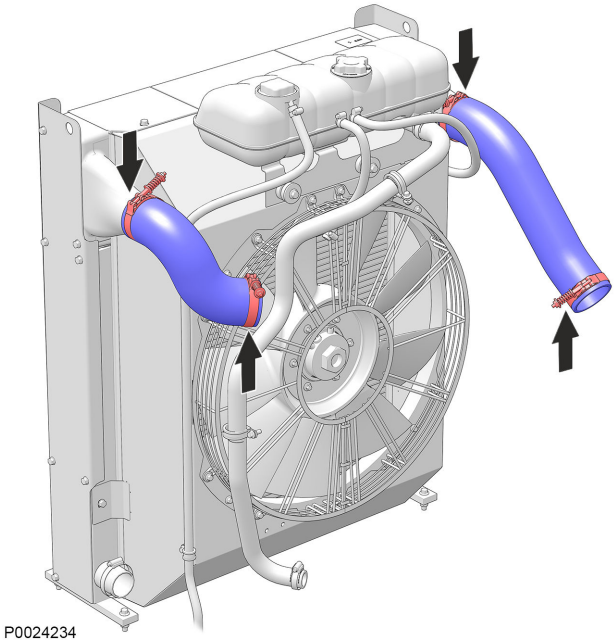
P0024680



P0030244

- Remove the inlet pipe from the turbocharger
- Remove the exhaust pipe from the turbocharger.
- Check the turbocharger with regard to damage to the compressor and turbine wheels.
- In the case of damage, replace the turbocharger in its entirety.

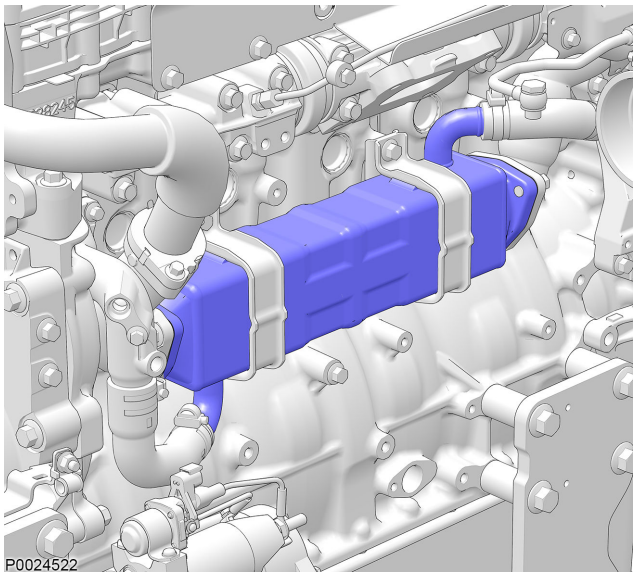
NOTICE! We recommend that turbocharger replacement be carried out by a Volvo Penta workshop.


P0024234

Charge Air Pipe, Leakage Check

Inspect the condition of the charge air hose connections and hoses for cracks, leaks and other damage. Replace as necessary.

EGR cooler



EGR cooler

Refer to the maintenance schedule for the engine cleaning or replacement of the EGR cooler.
This job should be carried out by trained workshop personnel. Refer to the workshop literature for further information regarding the engine concerned.

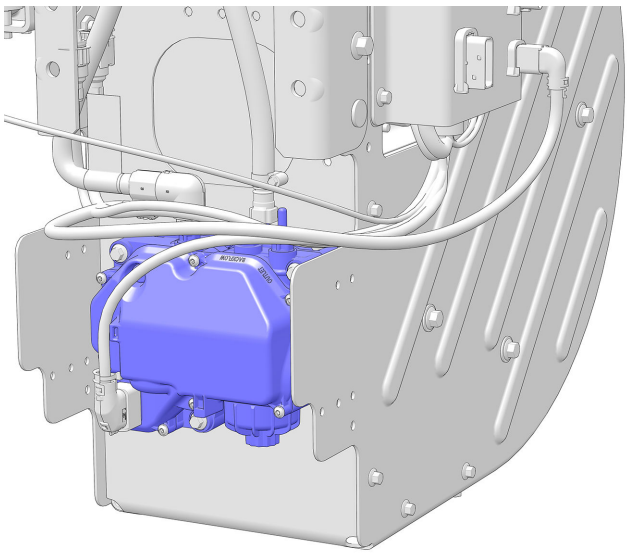
NOTICE! Not all engines have EGR coolers.

NOTICE! EGR cooler shown for illustration purposes. Design and attachment differs between different engines.

SCR System

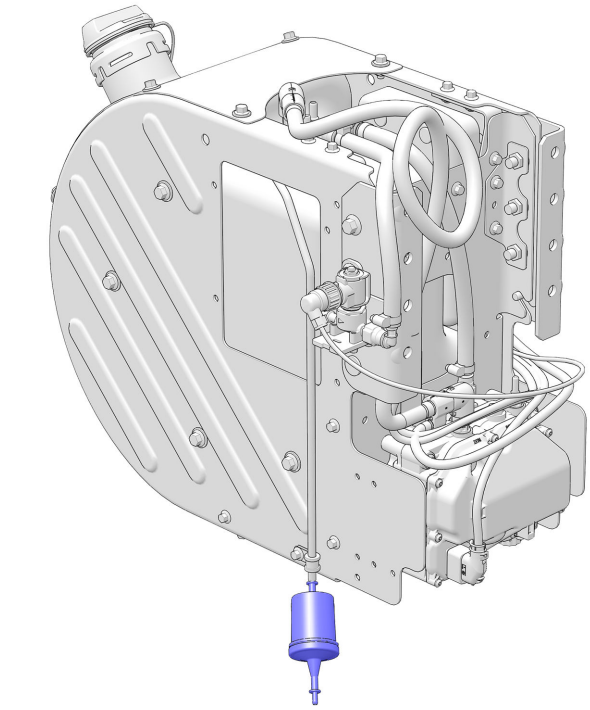
Engines with SCR have filters that must be replaced. Check the replacement intervals in the maintenance schedule for your engine.

NOTICE! Illustrative images of components. Installations can differ between different models.



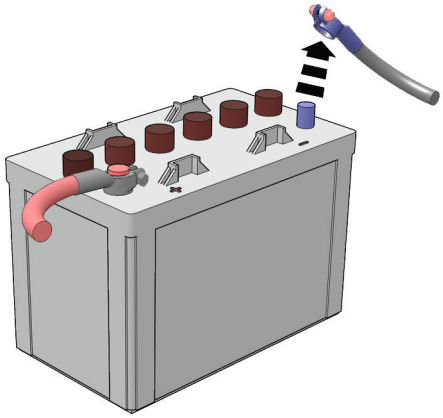
P0029170

- Pump unit filter.



P0029171

- Filter for air to the AdBlue/DEF tank.

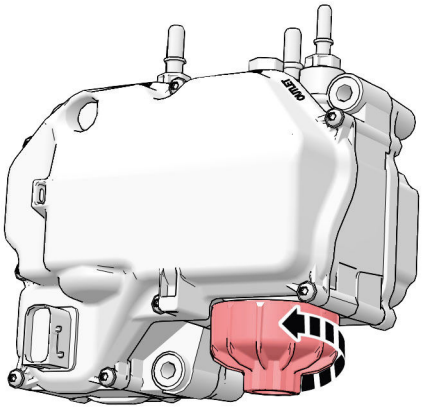


P0026516

Replacing the filter to the AdBlue/DEF pump

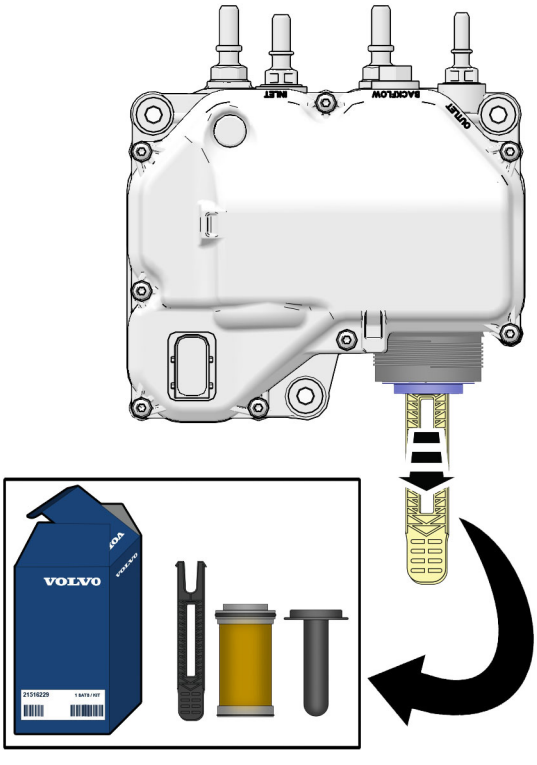
NOTICE! Maintain a high level of cleanliness when working with the SCR system. Wipe clean around covers and connections before beginning work. Make sure the filter and gaskets do not come into contact with dirty surfaces before installation.

- Switch off the engine. Wait until the pump unit has stopped as it always performs a hose emptying sequence.
- Remove the battery's minus pole.
- Place a collection vessel under the filter cover.



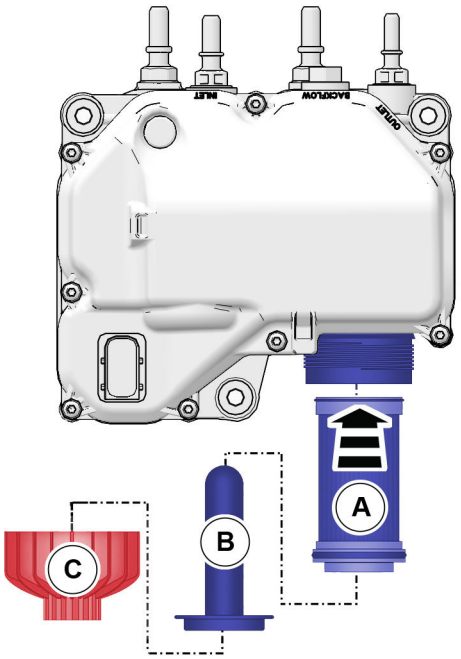
P0026517

- Undo the filter cover



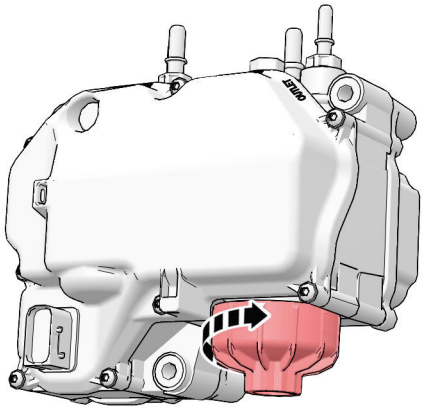
P0019390

- Use a puller (supplied with the filter kit) to pull out the filter by first pressing it into the filter hole until it clicks.
- Pull out the filter.



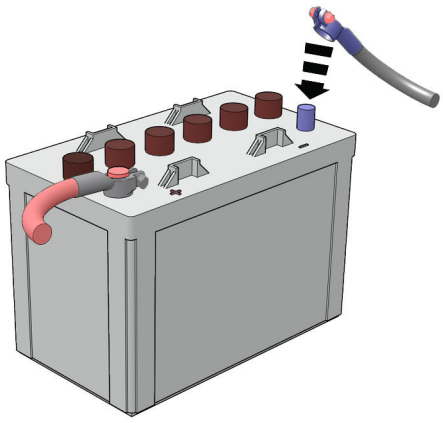
P0028678

- Install the new filter (A).
  Install the rubber gasket (B).
  Screw the filter cover (C) back on.



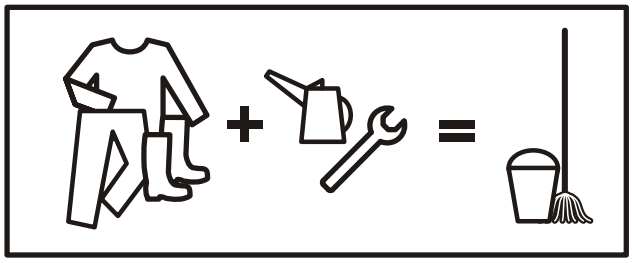
P0026519

- Tighten the cover.
  Tightening torque: **20 +5 Nm**



P0026520

- Connect to the battery negative pole.
- Start the engine. Check operation and inspect for leaks.
- Delete any fault codes.



p0013225

NOTICE! Take appropriate care of equipment and surplus AdBlue/DEF solution.

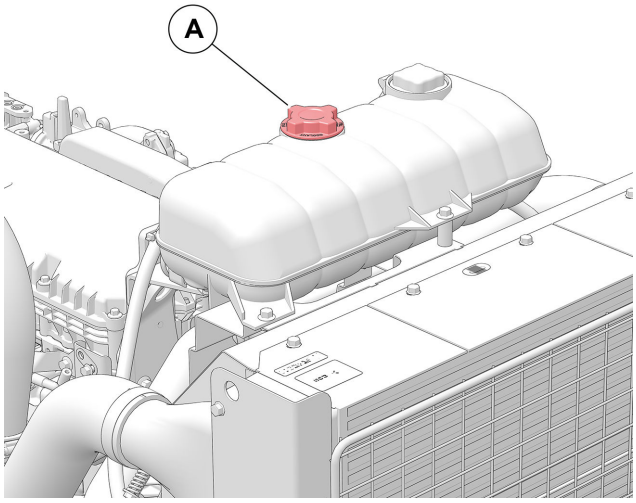
Nox-sensor Pre/Post SCR

When fault tracing or replacing components in the aftertreatment system, refer to the EATS System workshop manual.

Particulate Filter Insert, Replace

When changing components in the after-treatment system, refer to the EATS System workshop manual.

Cooling System



P0028679

Coolant Level, Checking and Topping Up

The engine's internal cooling system makes sure the engine works at the right temperature. It is a closed system that must always be filled with a mixture of concentrated coolant and water in order to protect the engine against internal corrosion, cavitation and bursting due to freezing.

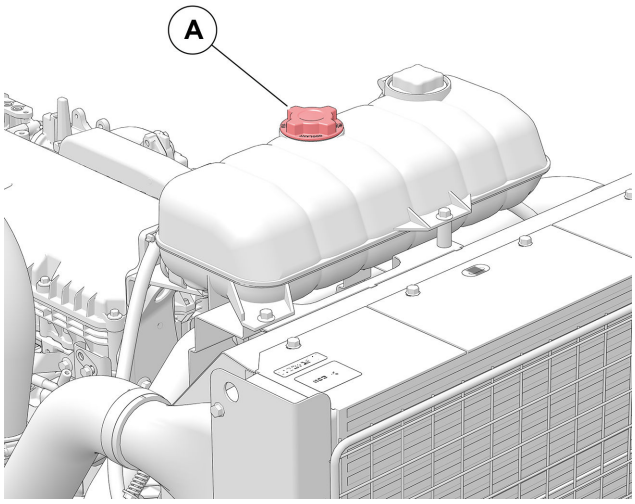
NOTICE! Different kinds of coolant may not be mixed.

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

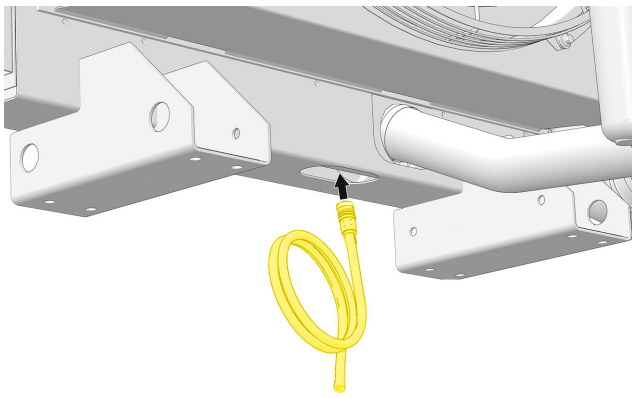
- Check the coolant level in the expansion tank.
- Top up with coolant as required (A), so that the level is between the MIN and MAX marks.

Replacing coolant

- Open the filler cap (A).

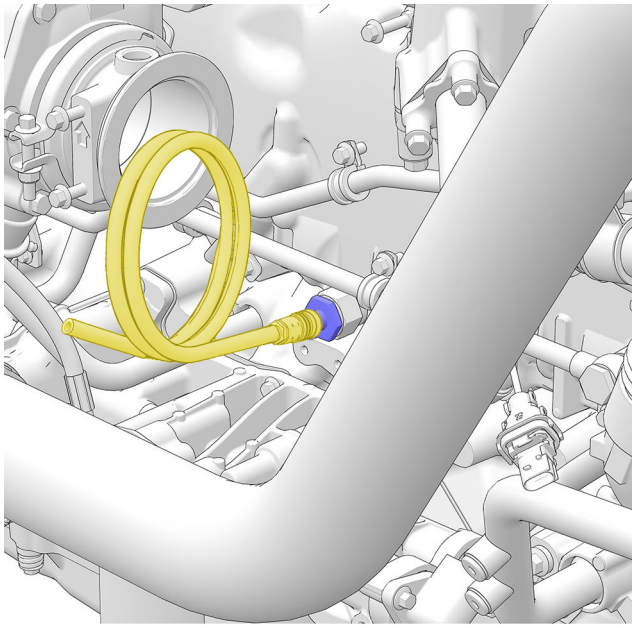


P0028679



P0026914

- Connect a drain hose and drain the coolant out of the radiator. The drain nipple is located underneath standard radiators and on the side of HD radiators.

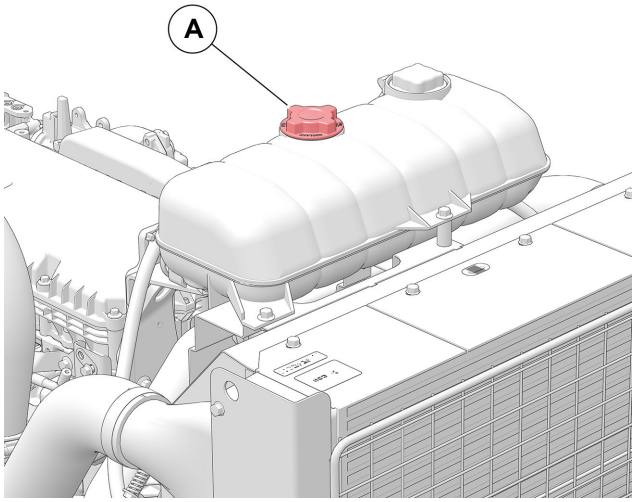


P0027047

- Connect a drain hose to the engine block and drain the coolant from the engine. Use a receptacle to collect the coolant.
- Remove the hoses and close the nipples/taps.
- Refill with new, Volvo Penta-recommended coolant.

NOTICE! Cooling performance is reduced by deposits in the radiator and cooling galleries. The cooling system should be cleaned when coolant is replaced. Cooling system cleaning is described in the Workshop literature.

NOTICE! Check anti-freeze protection every year, if the coolant is not replaced.



P0028679

Filling a completely empty system

Mix the coolant in advance, to ensure the cooling system is filled with the correct mixture, (applies to concentrated coolant).

If a heating unit is connected to the engine cooling system, its valves must be opened and the installation vented during filling.

NOTICE! The engine may not be started before the system is full.

- Check that all drain points are closed.
- Open the filler cap (A).
- Top up and check that the coolant level is between the MIN and MAX marks on the expansion tank.
- Start the engine when the cooling system has been filled and vented.
- Open any venting nipples shortly after starting the engine, to allow trapped air to escape.
- Run the engine at idle a while.
- Increase engine revolutions for a few minutes. Stop the engine and check the coolant level.
- Run the engine until the thermostat opens. Check the level again when the engine has cooled. Top up as necessary.

NOTICE! Only fill coolant when the engine is cold and stopped. Fill slowly, to allow air to flow out.

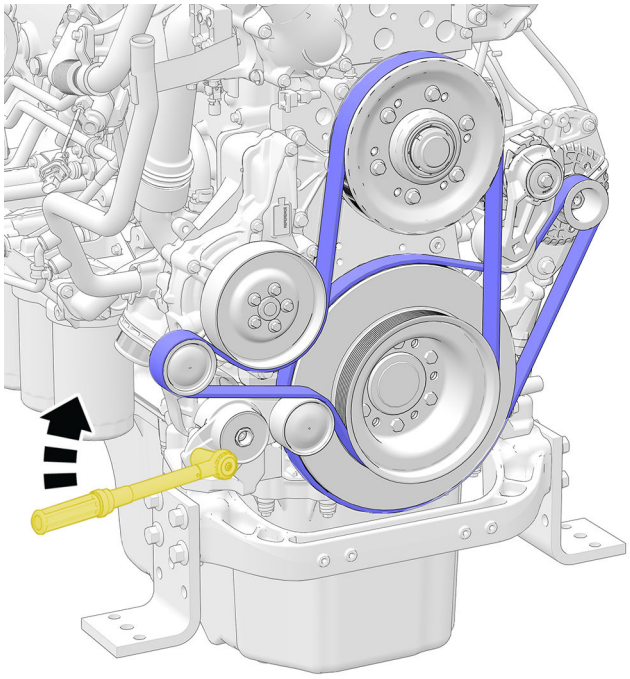
Drive Belt, Replace

Drive belt, water pump

NOTICE! Always replace belts that are greasy, worn or damaged.

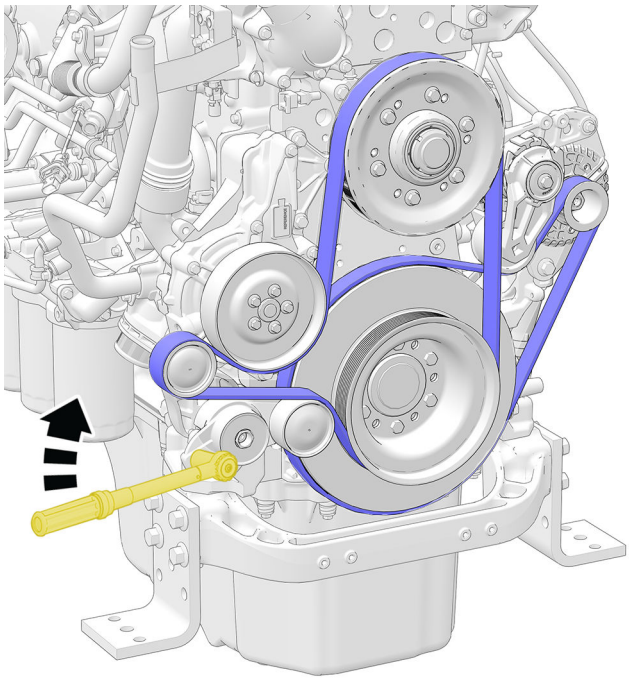
Removal

⚠ CAUTION!
Pinch hazard. Keep fingers clear.



P0030235

- Clear a space in front of the engine. Remove the engine fan guard, cooling fan and fan ring. If necessary, also remove the radiator assembly.
- Insert a tool in the belt tensioner
- Relieve the load on the belt tensioner (1) and remove the belt.
- Check the function of the belt tensioner and idler wheel bearings. Replace the idler wheel if there is play in the bearings.



P0030235

Installation

- Insert a tool in the belt tensioner
- Relieve the load on the belt tensioner and install the new belt.
- Deploy the belt tensioner and also check that the belt is correctly aligned on all pulleys.
- Install a fan guard around the cooling fan and install the radiator assembly if this has been removed.

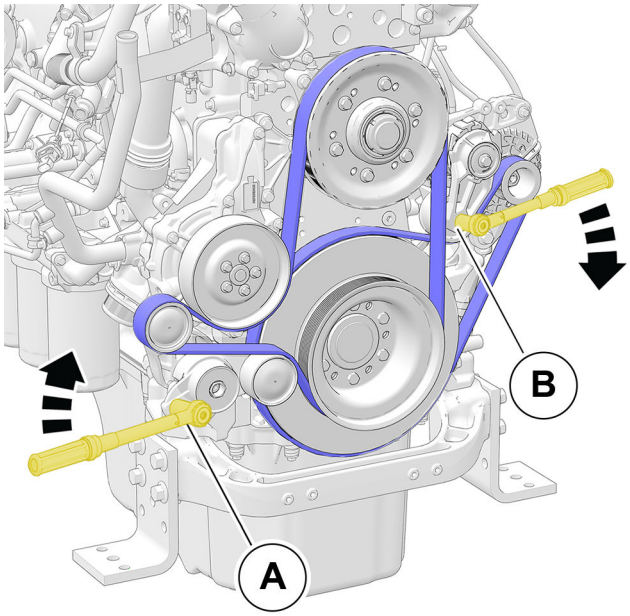
Check

The drive belt has an automatic belt tensioner and does not need to be adjusted.

Drive belt, alternator

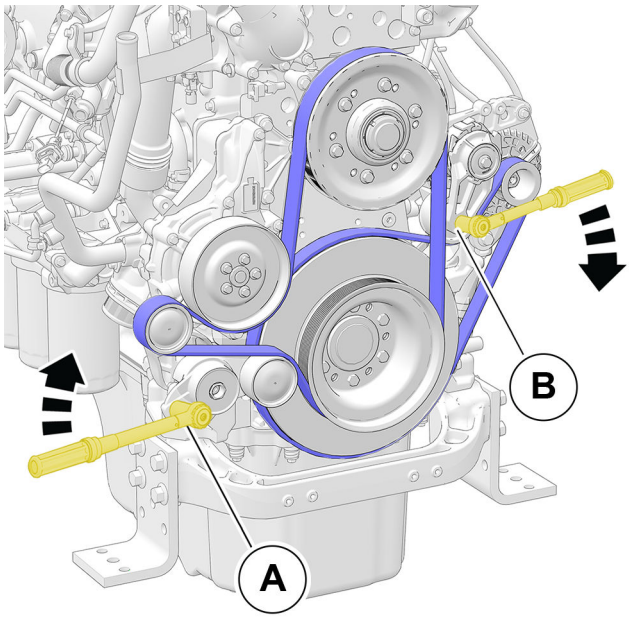
Removal

⚠ CAUTION!
Pinch hazard. Keep fingers clear.



P0030236

- Clear a space in front of the engine. Remove the engine fan guard, cooling fan and fan ring. If necessary, also remove the radiator assembly.
- Insert a tool into the belt tensioner (A).
- Relieve the load on the belt tensioner (A) and lift away the water pump drive belt.
- Insert a tool into the belt tensioner (B).
- Relieve the load on the belt tensioner (B) and lift off the generator drive belt.
- Check the function of the belt tensioner and idler wheel bearings. Replace the idler wheel if there is play in the bearings.



P0030236

Installation

- Insert a tool into the belt tensioner (B) and relieve the load on the belt tensioner.
- Install the new generator belt.
- Deploy the belt tensioner (B) and also check that the alternator belt is correctly aligned on all pulleys.
- Relieve the load on the belt tensioner (A) and fit the drive belt onto the water pump.
- Deploy the belt tensioner (A) and also check that the water pump belt is correctly aligned on all pulleys.
- Install a fan guard around the radiator fan and install the radiator assembly if this has been removed.

Check

The drive belt has an automatic belt tensioner and does not need to be adjusted.

Long-Term Storage

The engine and other equipment should be conserved to avoid damage during extended lay-ups (4-6 months or longer). Conservation protects the engine against freezing and corrosion damage.

The checklist below covers the most important points for the engine. Before taking the engine out of operation for an extended period, we recommend checks for any maintenance or repairs.

IMPORTANT:
Washing with a power washer: Never aim the water jet at radiators, charge air cooler, seals, rubber hoses or electrical components.

P0002089

For layups up to 8 months:

- The fuel system must be protected during storage to prevent internal oxidation and corrosion.
  Start and run the engine with FAME-free fuel before storage.
  Run the engine for at least 10 minutes to allow the fuel to reach all parts of the fuel injection system.
  FAME = Biodiesel
  B0 = Diesel with 0% FAME
  B10 = Diesel with 10% FAME
- 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.
- Drain water from the pre-filter to reduce the risk of bacterial growth.
  Drain water, dirt and sludge from the fuel filter and fuel tank. Fill the fuel tank completely to prevent condensation.
  Use the recommended B0 fuel. Fuels with a FAME -content greater than 10% may not be used as storage fuel.
- Change engine oil and oil filters.
- Check that the coolant has the requisite antifreeze qualities. Top up as necessary.
- Disconnect the battery cables; clean and charge the batteries. Maintenance charge the batteries while the equipment is laid up. **An insufficiently charged battery can freeze and burst.**
- Cleaning the outside of the engine, see *Cleaning engine and transmission, page 75*.
- Touch up paint damage with Volvo Penta original paint or paint of the equivalent quality.
- Attach a tag into the engine with information about the date, type of conservation and the conservation oils used.
- Cover the air filter, exhaust pipe and engine as necessary.

See also Service bulletin: 05-2-104

Recommissioning

- Replace filters before starting the engine.
  Keep extra filters available as FAME may cause microbial growth that blocks the fuel filter.
- Check the drive belts.
- Check the condition of all rubber hoses.
- Check the hose clamps.
- Check the coolant level. Top up as necessary.
- Connect the fully charged batteries.
- Remove the covers from the air filter and exhaust pipe.
- Start the engine and let it idle with no load a short while.
- Check that there are no oil, fuel or coolant leaks.

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.

Checklist, long term storage			
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 came 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.

Checklist

Suggestions for the checklist in addition to the regular service items.

Check/action

- Check for leakage: oil/fuel/water/exhaust.
- Check – Hoses and hose clamps.
- Inspection of cable connections.
- Cleaning of battery terminals; remove any oxide. Check the electrolyte level.
- Clean the engine and engine compartment.
- Inspection/cleaning the fuel tank.
- Function check of other electrical systems.
- External cleaning of the radiator/radiator assembly.

Start the engine every six months

If the engine is to be laid up for 6-8 months or more, it should be started and warmed up every six months as follows:

- Check the engine oil level.
- Check the coolant level.
- Connect the battery cables to the batteries (fully charged).
- Start the engine and run it for 2-3 minutes.
- Switch off the engine.
- Detach the battery cables.
- Check the engine compartment for any condensation.
- Ensure good ventilation.

P0002107

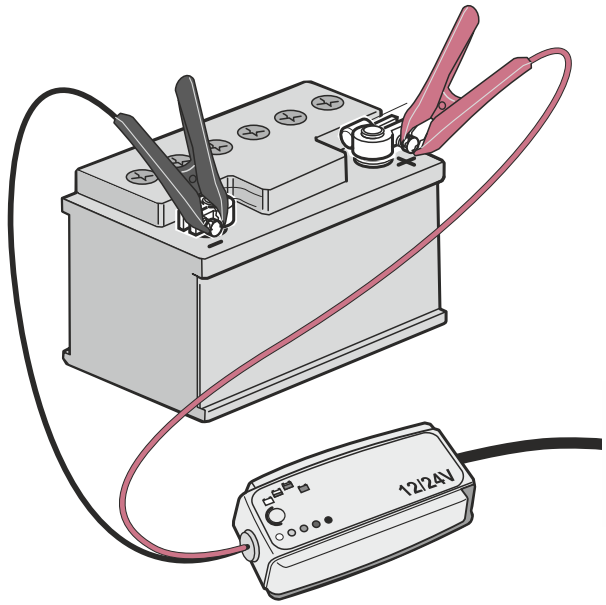
Battery, Maintenance

⚠ 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.

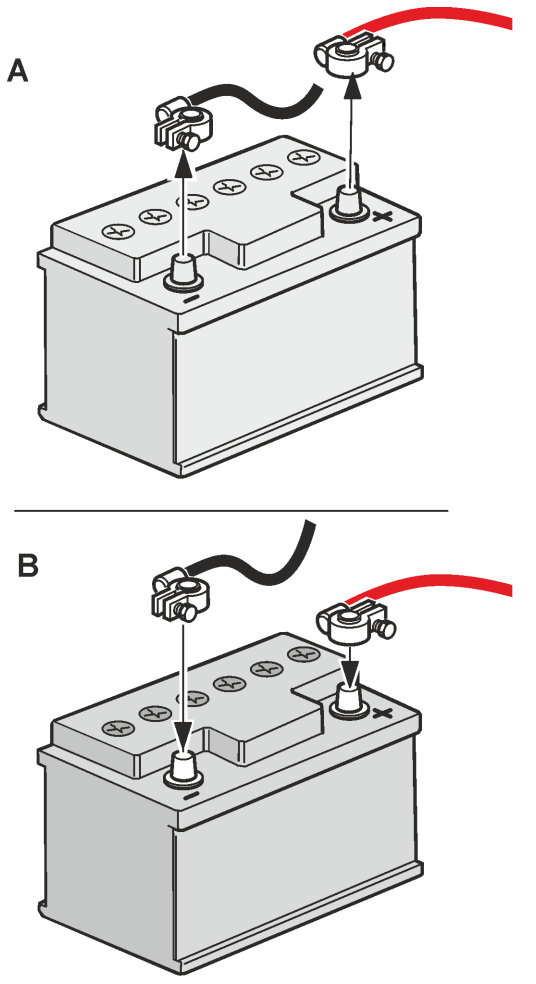


P0022892

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.



P0028239

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.

Index

VOLVO PENTA

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47709849 English