

Operator's Manual

Maintenance and Engine

VHD



VOLVO

Foreword

This manual contains information concerning the safe operation of your vehicle. It is extremely important that this information is read and understood before the vehicle is operated. This manual also contains a considerable amount of information concerning the vehicle, such as vehicle identification, Preventive Maintenance recommendations and a log for your service records. Please keep this in the vehicle at all times. Information from other component manufacturers is supplied in separate manuals in the Owner's Package.

NOTE! It is important that this manual stays with the vehicle when it is sold. Important safety information must be passed on to the new customer. The service information contained in this manual gives the owner important information about maintaining the vehicle but is not intended as a substitute for the Preventive Maintenance Service Manual and must not be regarded as such.

The National Highway Traffic Safety Administration (NHTSA) and Volvo Trucks North America, Inc. should be informed immediately if you believe that the vehicle has a defect that could cause a crash, injury or death.

Contact NHTSA by calling the Auto Safety Hotline at 1 (800) 424-9393 (or 366-0123 in the Washington, DC area) or by writing to: NHTSA, U.S. Department of Transportation, Washington, DC 20590.

Volvo Trucks North America, Inc.
Greensboro, NC USA

Order number: PV776-TSP20 154789

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Warning Label Information

IMPORTANT

Before driving this vehicle, be certain that you have read and that you fully understand each and every step of the driving and handling information in this Operator's Manual. Be certain that you fully understand and follow all safety warnings.

IT IS IMPORTANT THAT THE FOLLOWING INFORMATION CONCERNING LABELS IS READ, UNDERSTOOD AND ALWAYS FOLLOWED.

The following types of labels are used throughout this manual:

NOTE! A note defines an operating procedure, practice, condition, etc., which is essential to the proper operation of the vehicle.



A caution label directs the operator's attention to unsafe practices where personal injury is not likely but property damage could occur. The caution label is in **black** type on a **white** background with a **black** border.



A warning label directs the operator's attention to unsafe practices which could result in personal injury or severe damage to the vehicle. The warning label is in **black** type on a **gray** background with a **black** border.



A danger label directs the operator's attention to unsafe practices which could result in serious personal injury or death. The danger label is in **white** type on a **black** background with a **black** border.

Information For the Owner

If there are questions on the maintenance and performance of your vehicle, please discuss them with your Volvo Truck dealer. Your authorized dealer is required to have trained mechanics, special tools and spare parts to fully service your vehicle. If necessary, your dealer will contact Volvo Trucks North America or other manufacturer for any assistance.

In addition to this Maintenance Manual, there may be additional instruction/operator's manuals supplied by component manufacturers. These manuals are placed in the Owner's Package and placed in the cab. Be sure to read all the manuals thoroughly before operating the vehicle.

Also, various safety labels may be placed on components by the component manufacturer. Be sure to read and follow these labels to prevent damage to the vehicle, personal injury or even death.

Information in this manual refers to Volvo components and Volvo drivetrain. Information concerning non-Volvo engines and/or drivetrains can be obtained by contacting the respective manufacturer.

Establish a Preventive Maintenance Program with the help of your local Volvo Truck dealer. A Preventive Maintenance Program makes it possible to maximize the amount of time your vehicle is up and running, resulting in longer component life. This makes for a safer vehicle by reducing any mechanical failures due to poor maintenance practices.

NOTE! Federal law requires manufacturers to notify owners of its products in the event of a Federal Motor Vehicle Safety Standard or if a safety related defect is discovered. If you are not the original owner of this vehicle, please notify us about the change in ownership at the address below or through an authorized Volvo Truck dealer. This is the only way we will be able to contact you if necessary.

Volvo Trucks North America, Inc.

P. O. Box 26115

Greensboro, NC 27402-6115

United States of America

2 General Information

Do Not Remove this manual from the vehicle. It contains important operational and safety information that is needed by all drivers and owners of this vehicle.

This Maintenance Manual covers all Volvo vehicles manufactured by Volvo Trucks North America, Inc., including the whole chassis and all Volvo manufactured components. Specific maintenance information on vendor components, manufactured by, for example: Cummins, Detroit Diesel, Fuller, Meritor, etc., see the respective manufacturer's service and maintenance literature.

This manual, together with manuals for specific components, for example, Volvo engine, Cummins engine, Eaton transmission, etc., contain important information to be able to operate this vehicle safely. They contain advice and instructions which will enable you to get the operating economy and performance that you expect from this quality vehicle.

All information, illustrations and specifications contained in this manual are based upon the latest product information available at the time of publication. If any questions arise concerning the current status of Federal or state laws, the appropriate Federal or state agency should be contacted.

Volvo Trucks North America, Inc. reserves the right to make changes at any time or to change specifications or design without notice and without incurring obligation.

Proper Maintenance Procedure

During Maintenance

Whenever performing maintenance or repair, attach a DO NOT OPERATE or similar warning label or sign to the ignition key or prominently displayed on the instrument panel.

Do not allow unauthorized personnel on, around or in the vehicle when maintenance or repair is being performed.



WARNING

Do not attempt to repair or service this vehicle without having sufficient training, correct service literature and the proper tools. Failure to follow this could lead to personal injury or making your vehicle unsafe.



WARNING

Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects and other reproductive harm.

- When operating the engine in an enclosed area, vent the exhaust to the outside.



DANGER

Exhaust gases contain carbon monoxide. Always run the engine outdoors or use a properly vented exhaust hose. Prolonged or excessive exposure may cause serious illness or death.

- Before servicing your vehicle, apply the parking brakes and adequately chock the wheels in order to prevent unintended vehicle movement. If the service procedure requires the parking brakes to be released — recheck to ensure that the wheels are adequately chocked to prevent all forward and/or rearward movement.
- Do not use combustible substances in or around the engine either during repair or maintenance or when running the engine.



DANGER

Never operate the engine in an area where hydrocarbon vapors (gasoline, for example) are present or are suspected to be present. Hydrocarbon vapors can enter the air intake and overspeed the engine, causing severe engine damage and/or an explosion and fire. Serious personal injury or death could occur.

- Do not wear loose clothing or jewelry that can catch or get snagged by parts or moving components on the engine. Also wear all protective equipment required by the job conditions, such as protective glasses, hearing protection, etc.
- Make certain that all protective covers and guards are in place and secured.
- Never put maintenance fluids into glass containers since glass containers can break.

4 Safety Information

- Report all problems in a timely manner before they threaten the safety of operating the vehicle.
- Do not work on the engine while it is running.
- Tag the vehicle with the DO NOT OPERATE sign. Make sure other protective locks and covers are in their proper place.
- Disconnect the batteries whenever performing any repairs or before servicing the electrical system.
- DO NOT use high amperage electronic starting devices for jump-starting the engine. Rely on conventional battery charging for charging the batteries or jump-start with the help of a start battery.
- DO NOT attempt repairs you do not understand or have the proper tools for.
- When starting an engine after repairs have been made to the fuel or injection system, prepare equipment for shutting off the engine intake air and/or fuel supply (to stop the engine), in case there is an overspeed on start-up.
- Start the engine only from the driver seat. Never operate the starter motor across the starter terminals or the batteries as this could by-pass the engine neutral-start system as well as causing damage to the electrical or electronic systems.



DANGER

Never try to operate or work on this vehicle while under the influence of alcohol. Your reflexes can be affected by even a small amount of alcohol. Drinking and operating this vehicle can lead to an accident, causing serious personal injury or death.

Compressed Air and Water



DANGER

Compressed air can cause personal injury. When using compressed air for cleaning, wear a protective face shield, protective clothing and protective shoes. Pressurized water could cause particles and/or hot water to be sprayed in your direction and cause personal injury. The maximum air pressure must be below 30 psi (200 kPa) for cleaning purposes.

Asbestos Information

NOTE! The Volvo engine and replacement parts for it shipped from the factory are asbestos free. Volvo recommends the use of only genuine Volvo spare parts.

Never use any parts that contain or are thought to contain asbestos. Exposure to asbestos fibers can create serious health risks, including death.

Fluid Penetration



DANGER

Always use a piece of paper or cardboard when checking for a leak. Escaping fluid under high pressure, even a pin-hole sized leak, can penetrate body tissue, causing serious injury or death. If fluid is injected into your skin, immediate treatment must be administered by a doctor familiar with this type of injury.

6 Safety Information

Injury Prevention

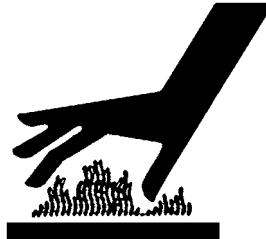
Burn Prevention

Engine Parts



WARNING

Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine and/or fluid can cause serious burns.



W0001525

Do not touch any part of the engine while it is hot. Allow the engine to cool before any repair or maintenance is performed on the engine.



WARNING

Do not raise the engine hood or cab if you see or hear steam or coolant escaping from the engine compartment. Wait until steam or coolant cannot be seen or heard any longer before raising the hood or cab.

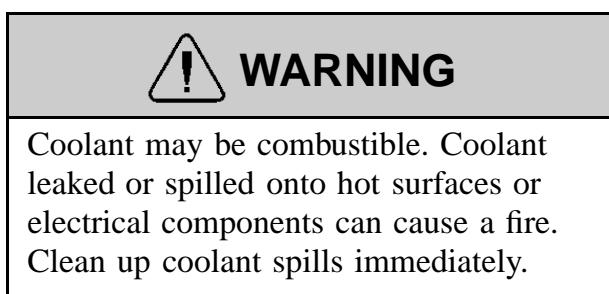
Do not remove the coolant fill cap if the coolant in the surge tank is boiling.

Also, do not remove the cap while the engine and radiator are still hot. Scalding fluid and steam may be blown out under pressure if the cap is taken off too soon.

Relieve all pressure in air, oil, fuel or cooling systems before any lines, fittings or related items are disconnected or removed.

Coolant

To prevent personal injury, do not climb up on the engine to remove the filler cap. Use a suitable, properly positioned ladder to reach up to the cap. At normal operating temperature, the engine coolant is very hot and under pressure. If pressure is relieved rapidly in a hot cooling system, the hot coolant can turn into steam. Any contact with hot coolant or steam can cause severe burns. The radiator and all heating system and radiator lines and hoses contain hot coolant.



Verify coolant level only by the markings on the expansion tank. Open the filler cap only after the engine has been stopped and cooled down. Remove the filler cap slowly to relieve pressure.



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8 Safety Information

Oils



WARNING

Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine and/or fluid can cause serious burns.

Hot oil can cause severe burns. Do not allow hot oil to contact the skin. When changing oil, wear protective gloves.

Batteries



WARNING

Always wear eye protection when working around batteries to prevent the risk of injury due to contact with sulfuric acid or an explosion.



WARNING

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

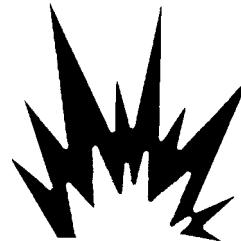
Battery electrolyte contains acid and can cause injury. Avoid contact with the skin and eyes. Wash hands after touching batteries and connectors. Use of gloves is recommended. Always wear protective glasses when working with batteries.

Fire or Explosion Prevention



DANGER

The diesel engine will operate on any fuel which enters the cylinder, whether it is from the injectors or from the air intake system. Therefore, if any solvent is used to flush out the air cleaner element, the engine may overspeed during start-up. Engine damage and severe injury and/or death from burns or explosion can occur.



W0001526

The engine should not be operated in an area where combustible gases are suspected to be in the air. These could be drawn into the engine through the engine air intake system and could cause the engine to overspeed with possible serious damage to the engine and bodily injury or property damage.



DANGER

Excessive heat may cause the pressurized components of the air conditioned system to explode. Never weld, solder, steam clean or use a gas torch near any part of the air conditioning system. Severe injury or death may occur from an explosion.

Do not pressure or leak test R134a refrigerant for air conditioning or servicing equipment using compressed air. Some mixtures of air and R134a refrigerant have been shown to be combustible at elevated pressures. These mixtures, if ignited, can cause injury or property damage. Consult the R134a Material Safety Data Sheet (MSDS) for additional information.

10 Safety Information



DANGER

Do not service any part of the fuel system while smoking or in the presence of flames, sparks or hot surfaces. Failure to follow these precautions can result in fire, which can cause serious injury or death.



W0001527

All fuels, most lubricants and some coolant mixtures are flammable. Diesel fuel is flammable. Gasoline is flammable. The mixture of diesel and gasoline fumes is extremely explosive. Do not smoke while refueling or when in a refueling area.



WARNING

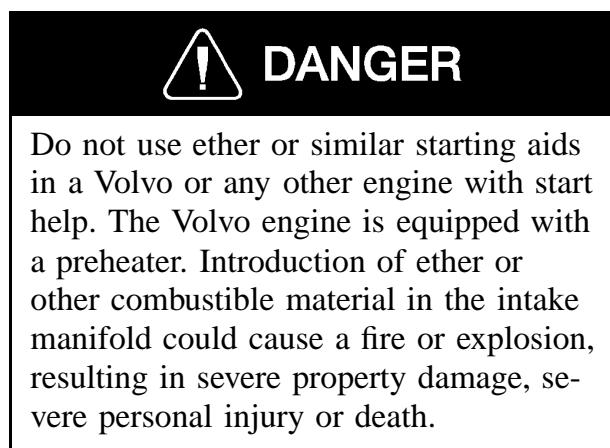
Do not store fuel containers in the vehicle. They may leak, explode and cause or feed a fire. Empty or full, they present a hazard that may lead to burns in the event of a fire.

Keep all fuels and lubricants stored in properly marked containers and away from all unauthorized personnel. Store oily rags or other flammable material in a protective container, in a safe place. Remove all flammable material such as fuel, oil and other substances before they accumulate on the engine. Do not expose the engine to flames, driving over burning ground, etc., if at all possible. Do not weld or flame cut on or around pipes or tubes that contain flammable fluids.

Exhaust heat shields may be installed to protect oil or fuel carrying lines and pipes from hot exhaust parts. To protect from pipe or seal failure, install heat shields correctly.

Provide adequate and proper waste oil disposal. Always dispose of waste liquids according to Federal and local regulations. Oil and fuel filters should be properly installed and housing covers tightened to the proper torque when being changed.

Starting Aids



W0001484

DO NOT use **ether** or other combustible starting aids on engines that have a heater element or other heating devices installed in the intake manifold for heating intake air at cold-starts.

Fire Extinguisher

Anytime work is being done to the fuel system or any other area where flammable substances are being used, have a fire extinguisher available and know how to use it. Inspect and have it serviced as recommended on its instruction label.

12 Safety Information

Respiratory Hazard Prevention



DANGER

Exhaust gases contain carbon monoxide. Always run the engine outdoors or use a properly vented exhaust hose. Prolonged or excessive exposure may cause serious illness or death.



W0001523



WARNING

Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects and other reproductive harm.

Always work in a well ventilated space if the engine needs to be running and use a hose to route the exhaust to the outside.

Poisonous Substances



DANGER

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

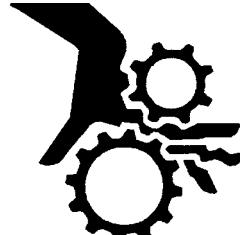
Cooling system supplemental additive contains alkali. To prevent personal injury, avoid contact with the skin and eyes. DO NOT drink coolant of any concentration.

Crushing or Cutting Prevention



DANGER

Before working on a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.



W0001524



DANGER

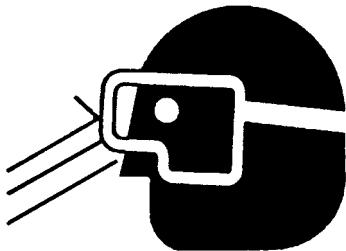
Do not work near the fan with the engine running or the ignition in the ON position. The engine fan can engage at any time without warning. Anyone near the fan when it turns on could be seriously injured.

Support equipment and components properly when working beneath them. Never attempt adjustments while the engine is running unless otherwise specified for the service procedure. To help prevent an accident caused by moving parts, work carefully around them. Guards, covers and shields should be in place whenever maintenance is not being performed. Keep objects away from moving fan blades. They will throw or cut any object or tool that falls or is pushed into them.

Inspect the fan blade assembly before service for cracks or loose mounting before starting the engine. *Never* stand along side a rotating fan assembly, particularly at high fan speeds.

14 Safety Information

Wear protective glasses when striking objects to avoid injury to your eyes. Chips or other debris can fly off objects that are struck. Make sure no one can be injured by flying debris before striking any object.



W0001528

Climbing Up and Down



DANGER

Always have three limbs (one foot and two hands or two feet and one hand) in contact with the vehicle at all times when entering or exiting the cab or the area behind the cab. Failure to follow this warning can result in serious personal injury or death.

DO NOT climb up on or jump off from the engine or stand on components that cannot support your weight. Use an adequate ladder or scaffolding, suitably situated. Do not use top of engine or cowling ledge as foothold when reaching on top of cab. Clean steps, handholds and areas of the vehicle you will be working on or around. Refer to the Operator's Manual for proper entry and exit procedures.

Always use a three-point stance (two hands — one foot or one hand — two feet) whenever climbing up or down.

Engine Damage Prevention

Before Starting the Engine



DANGER

Before working on a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Inspect engine for potential hazards. Make sure all protective guards and covers are properly installed if an engine needs to be started to make adjustments or checks. To help prevent an accident by moving parts, work carefully around them.

DO NOT disable or bypass automatic alarm/shutoff circuits. They are provided to prevent personal injury and engine damage.



DANGER

The diesel engine will operate on any fuel which enters the cylinder, whether it is from the injectors or from the air intake system. Therefore, if any solvent is used to flush out the air cleaner element, the engine may overspeed during start-up. Engine damage and severe injury and/or death from burns or explosion can occur.

Make provisions for shutting off the engine intake air or fuel supply to stop the engine if there is an overspeed on start-up after performing repair or maintenance on it.

Always consult the proper Volvo Service Manual before any repair is attempted.

16 Safety Information

Engine Starting

DO NOT start the engine or move any of the controls or disengage the parking brake if the warning tag “DO NOT OPERATE” is attached to the ignition key or located on the dash. Check with the person who attached the tag before starting.

Make sure no one is working on or close to the engine or components driven by the engine before starting it. Always make an inspection of the engine before and after starting.

Diesel engine exhaust contains products of combustion which may be harmful to your health. Always start and operate the engine in a well-ventilated area, and if in an enclosed area, vent the exhaust to the outside.

Start the engine only from the driver seat in the cab. Never start the engine by shorting across the starter motor terminals or batteries to start the engine as this could bypass the engine neutral-start system as well as damage the electrical and electronic system. Always start the engine according to the required engine starting procedure described in this operator’s manual to prevent major engine component damage and personal injury.

Starting Aids

DO NOT use ether or other combustible starting aids on engines that have a heater element or other heating devices installed in the intake manifold for heating intake air at cold-starts. Introduction of ether or similar starting aids could cause a fire or explosion resulting in severe property damage, serious personal injury or death.



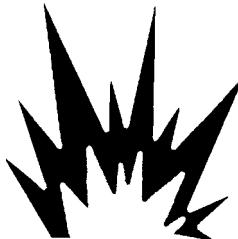
W0001484

Electric System Damage Prevention

Electric and Electronic Systems

Never disconnect any charging unit circuit or battery circuit cable from the battery when the charging unit is operating. A spark can cause the flammable vapor mixture of hydrogen and oxygen to explode.

To prevent potential sparks from igniting combustible gases produced by some batteries, attach the negative (-) terminal last when hooking up and remove the negative terminal first after the engine has started. Check regularly around the engine and engine compartment for loose or frayed wires. Have all loose or frayed electrical wires tightened, repaired or replaced before operating the vehicle.



W0001526



WARNING

Always wear eye protection when working around batteries to prevent the risk of injury due to contact with sulfuric acid or an explosion.

Grounding Practices

Proper grounding for vehicle and engine electrical and electronic systems is necessary for proper vehicle and engine performance and reliability. Improper grounding will result in uncontrolled and unreliable electrical paths.

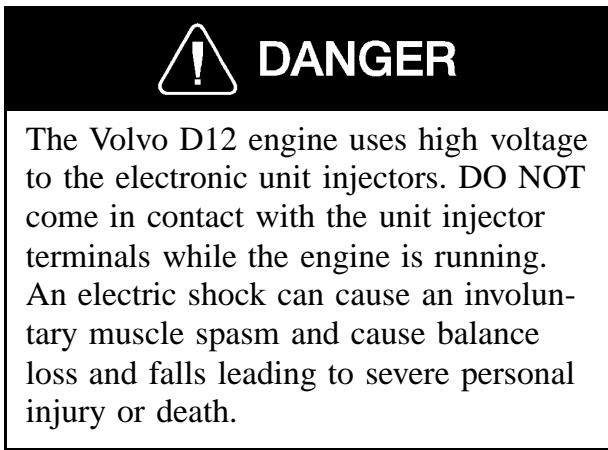
Uncontrolled engine electrical circuit paths can result in damage to main bearings, crankshaft journals surfaces and aluminum components. Uncontrolled electrical circuit paths can also cause electrical noise which may degrade vehicle and radio performance.

Operating engines without the engine-to-frame ground strap installed can cause damage to the engine. To prevent electrical discharge damage, check to make sure the engine's electrical system has an engine-to-frame ground strap. All ground connections should be tight and free of corrosion.

18 Safety Information

Electronic Engine Control System

Tampering with the electronic system installation can be dangerous and could result in personal injury or death and/or engine damage. It is very important to take the proper precautions with the electrical and electronic system when charging the batteries, jump-starting or performing electric welding on the vehicle. See the vehicle Operator's Manual for correct procedures.



W0001522

This engine is equipped with monitoring features that may cause reduced power or shutdown under certain conditions. The power output, monitoring and idling features can only be programmed and/or changed with electronic service tools and passwords.

Certain features, such as low oil pressure, high coolant temperature or low coolant level could cause the engine power and/or vehicle speed to be limited and the engine may also shut down. The shutdown will take approximately 30 seconds from the time the warning feature is activated. See the vehicle Operator's Manual for more information.

Reporting Safety Defects

USA

The National Highway Traffic Safety Administration (NHTSA) and Volvo Trucks North America should be informed immediately if you believe that the vehicle has a defect that could cause a crash, injury or death.

Contact NHTSA by calling the Auto Safety Hotline at 1 (800) 424-9393 (or 366-0123 in the Washington, DC area) or by writing to: NHTSA, U. S. Department of Transport, Washington, DC 20590.

1 (800) 424-9393

Canada

Refer consumer complaints to Volvo Trucks Canada, Inc. or to the Transport Canada — Department of Public Complaints, Recalls and Investigations.

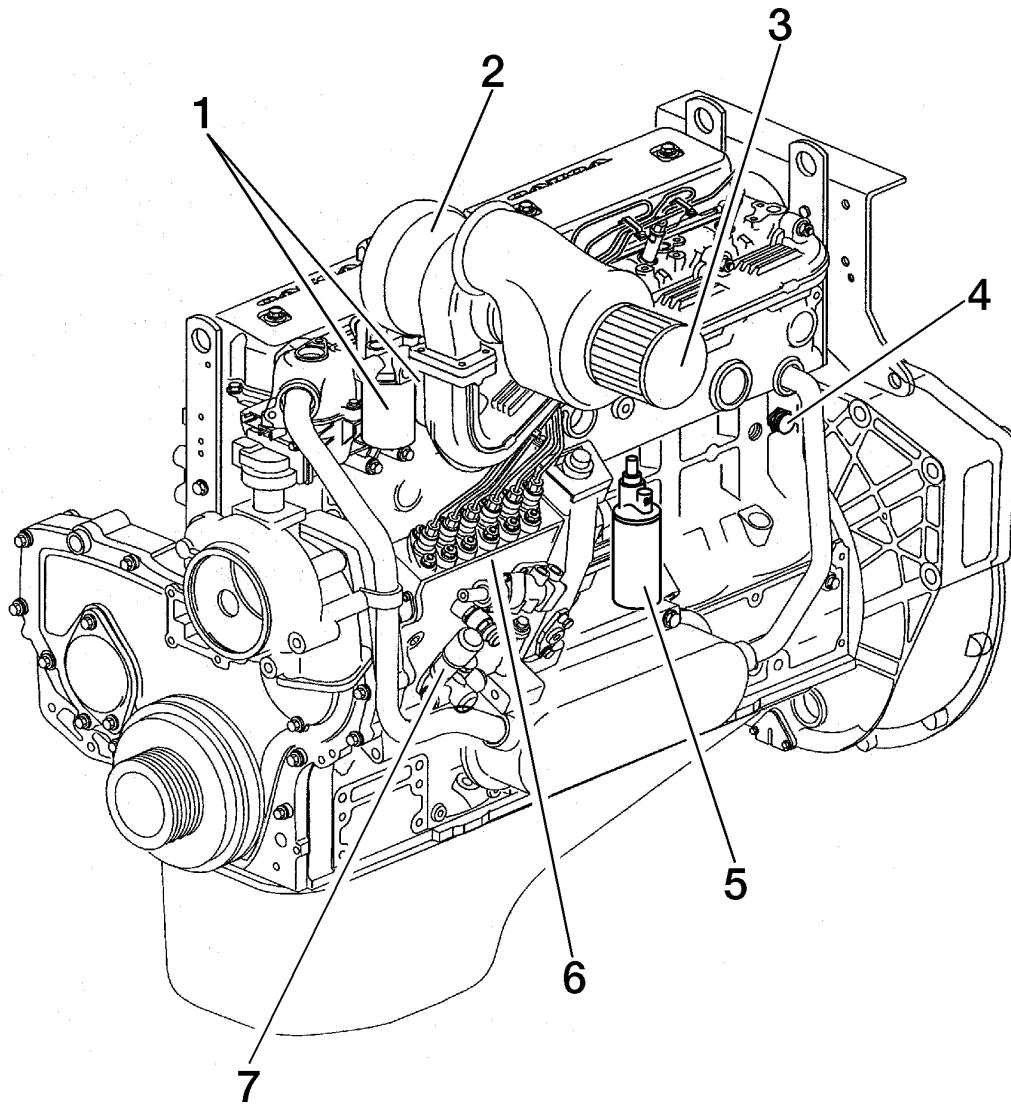
1 (905) 795-1555

Mexico

Volvo Trucks of Mexico, S.A. de C.V. should be informed immediately if you believe the vehicle has a defect that could cause a crash, injury or death. Contact Volvo Trucks de Mexico by calling 91 (5) 259-3011 or by writing to: Volvo Trucks de Mexico, S.A. de C.V., Prol. Paseo de la Reforma 600, 1er. Piso — 121, Col. Santa Fe Peña Blanca, C.P. 01210, México, D.F.

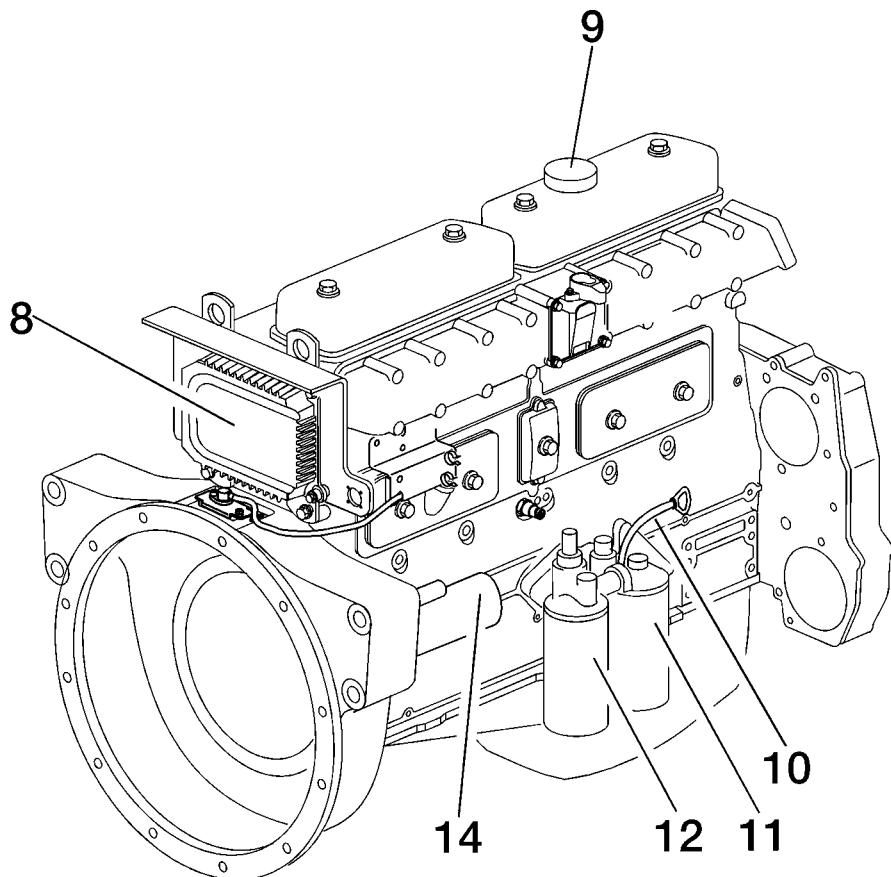
01 (800) 90 94 900

Engine Overview D7



W2002703

- | | |
|------------------------------------|------------------------------|
| 1. Fuel filters (secondary) | 5. Coolant filter |
| 2. Turbocharger | 6. Electronic injection pump |
| 3. Exhaust pressure governor (EPG) | 7. Hand fuel primer pump |
| 4. Coolant drain connection | |

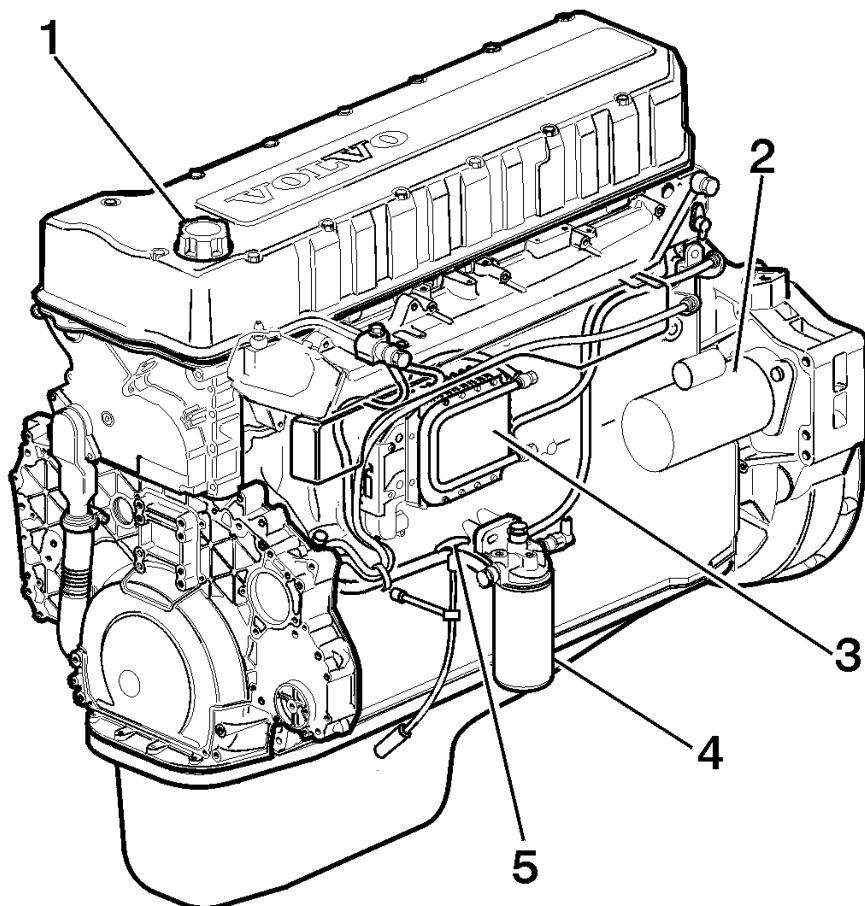


W2002702

- 8. Engine electronic control unit (EECU)
- 9. Oil fill cap
- 10. Oil dipstick
- 11. By-pass oil filter
- 12. Full-flow oil filter
- 14. Starter motor

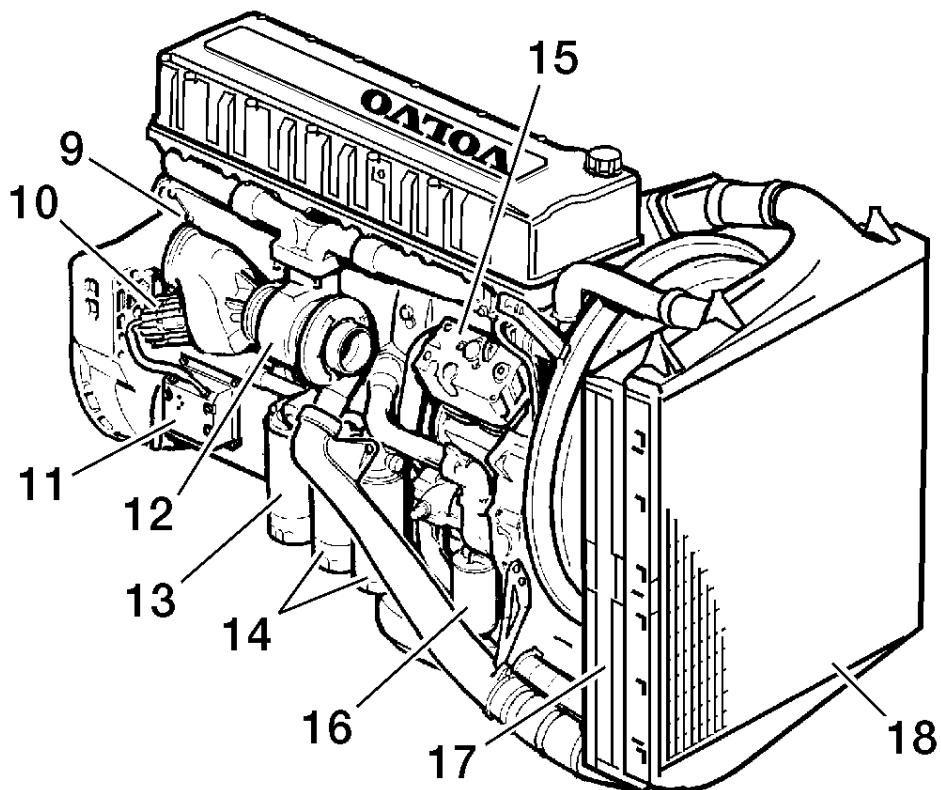
22 General Engine Design Information

Engine Overview, D12



W0001846

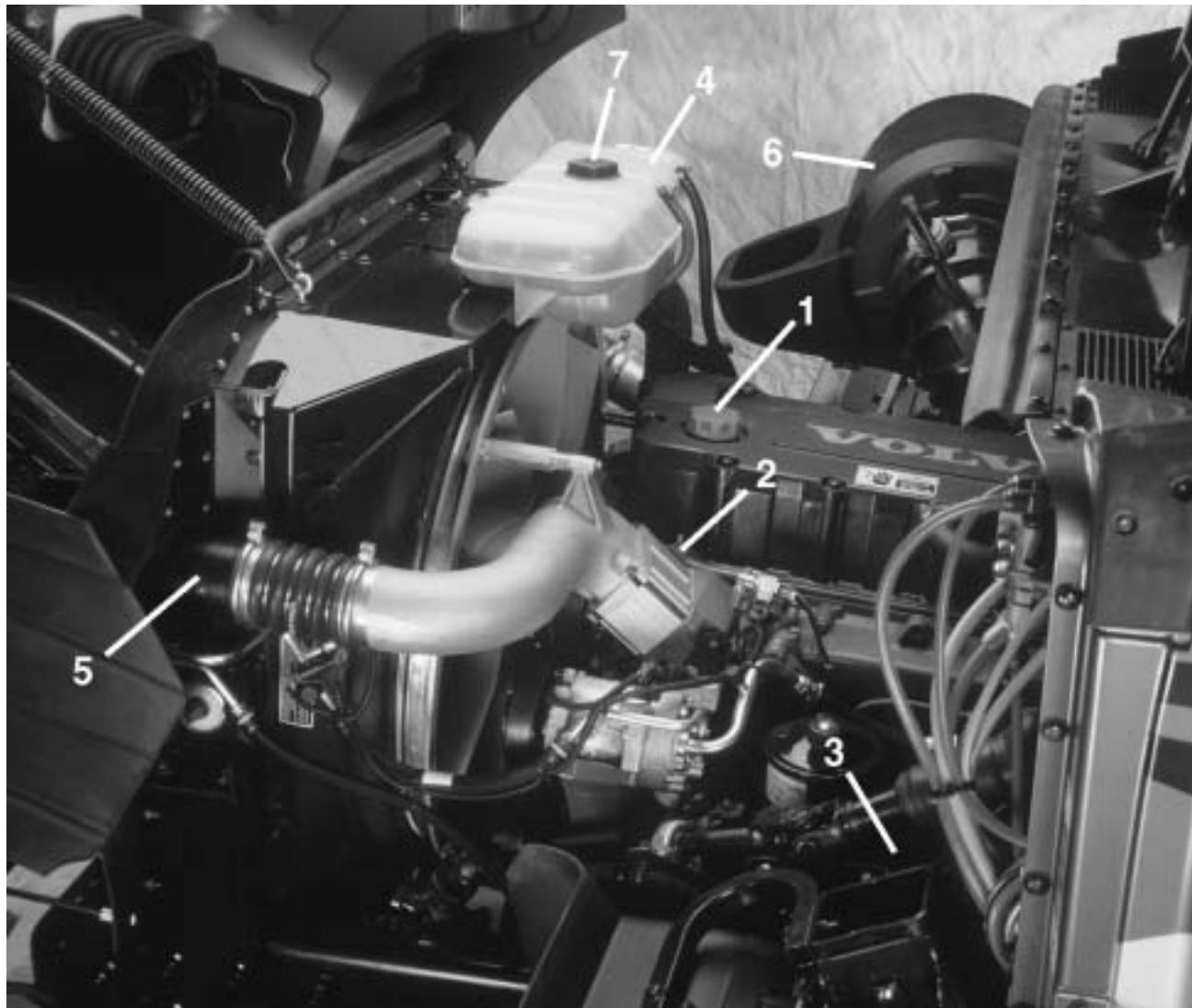
- 1. Oil Fill Cap
- 2. Starter Motor
- 3. Engine Electronic Control Unit (EECU)
- 4. Fuel Filter (secondary)
- 5. Oil Dipstick



W0001847

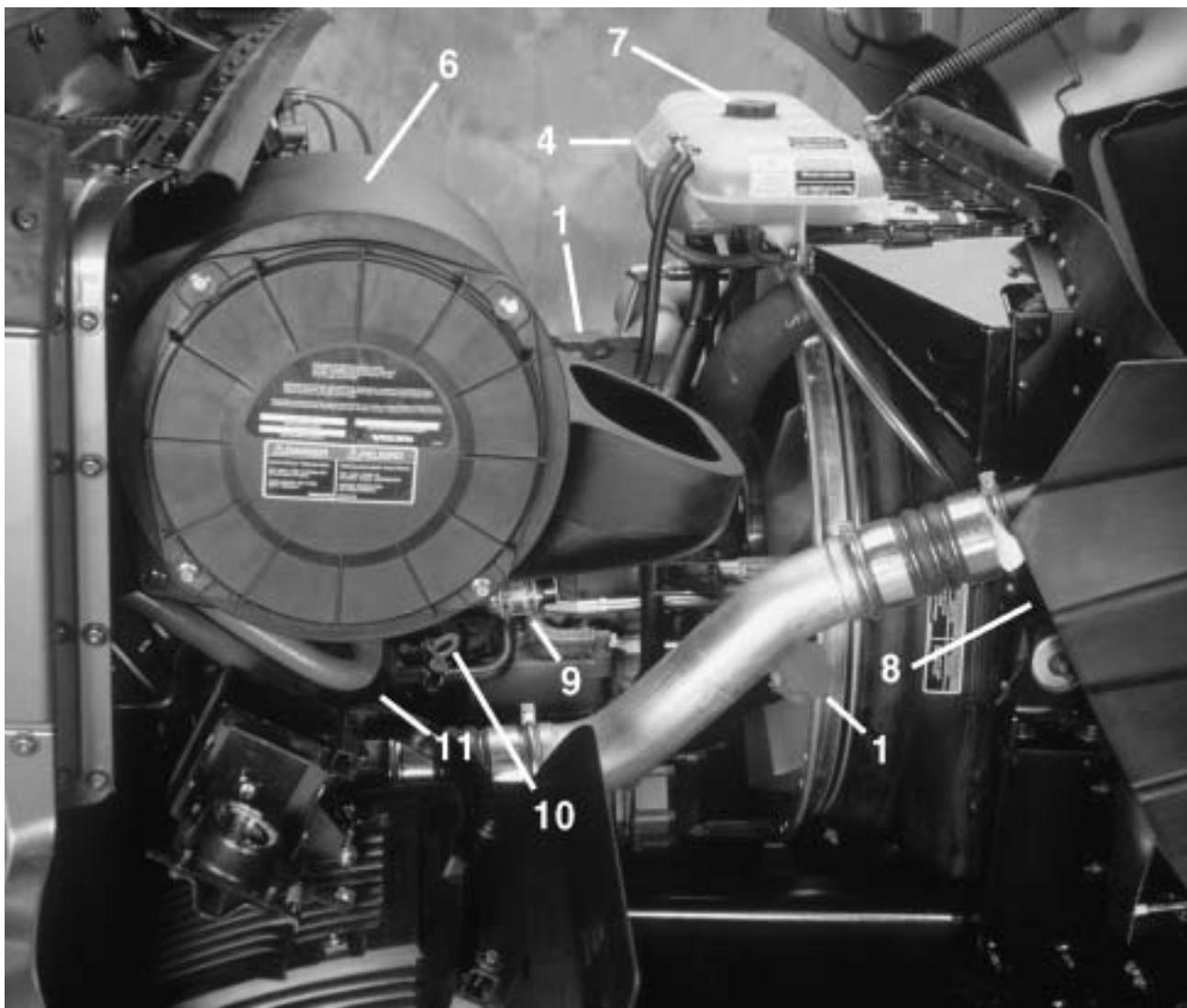
- | | |
|-------------------------------------|---------------------------|
| 9. Coolant Drain Connection | 14. Full-Flow Oil Filters |
| 10. Exhaust Pressure Governor (EPG) | 15. Air Compressor |
| 11. VEB Control Unit | 16. Coolant Filter |
| 12. Turbocharger | 17. Coolant Radiator |
| 13. By-Pass Oil Filter | 18. Charge Air Cooler |

Typical Engine Compartment Overview



W2003478

- 1. Oil fill cap
- 2. Intake air heater
- 3. Engine Electronic Control Unit (EECU)
- 4. Coolant surge tank
- 5. Output from charge air cooler



W2003479

- 6. Engine air filter
- 7. Coolant fill cap
- 8. Radiator
- 9. Airfilter restriction gauge
- 10. Oil dipstick
- 11. Turbocharger

Engine Features

Feature	Benefit
<ul style="list-style-type: none"> • VECTRO II - Volvo Engine Electronics System 	<ul style="list-style-type: none"> • Engine Brake Control (D12) • Differentiated Speed Control • Road Speed Limiter • PTO Speed Setting • Cruise Control • Idle Speed Setting • Idle Timeout
<ul style="list-style-type: none"> • VECTRO II Diagnostics • Air-to-Air Charge Air Cooler 	<ul style="list-style-type: none"> • Ease of Troubleshooting • Superior Fuel Economy • Peak Performance • Low Process Temperature
<ul style="list-style-type: none"> • Two-Piece Piston and Optimized Compression Ratio (D12) 	<ul style="list-style-type: none"> • Minimum White Smoke • Low Internal Friction
<ul style="list-style-type: none"> • Standard Exhaust Brake 	<ul style="list-style-type: none"> • Efficient Braking on Grades • Superior Temperature Control at Idle • Quick Warm-Up
<ul style="list-style-type: none"> • Optional Volvo Engine Brake (VEB) (D12 only) 	<ul style="list-style-type: none"> • Exceptional Engine Braking Even at Low Engine Speed
<ul style="list-style-type: none"> • Optional Pre-Heater Element 	<ul style="list-style-type: none"> • Excellent Startability down to as Low as -15°F (-25°C) • Minimum Smoke and Odor After Start • No Fuel Dilution of Oil in Cylinder Due to Complete Combustion • Less Engine Wear
<ul style="list-style-type: none"> • Cylinder Liners with Plateau Honing 	<ul style="list-style-type: none"> • Optimized Oil Consumption
<ul style="list-style-type: none"> • Engine-Mounted Fan Ring 	<ul style="list-style-type: none"> • Efficient Cooling with Low Parasitic Losses
<ul style="list-style-type: none"> • Electronically Controlled Fuel Injection 	<ul style="list-style-type: none"> • Precise Control of Combustion • Centrally Located Vertical Unit Injectors • Maximum Fuel Efficiency
<ul style="list-style-type: none"> • Engine-Driven Power Take-Off 	<ul style="list-style-type: none"> • Clutch-Independent PTO

VECTRO II Parameter Values, D7

Parameter		Default Value	Minimum Value	Maximum Value
PTO:				
• Maximum engine speed, r/min	2500	Low Idle	High Idle	
• Resume speed	800	Low Idle	High Idle	
Road Speed Limit (RSL):				
• Value RSL (technical), mph (km/h)	87 (140)	30 (48)	87 (140)	
Cruise Control (CC):				
• CC enable (yes/no)	Yes	-	-	
• Maximum Vehicle Speed, mph (km/h)	87 (140)	30 (48)	RSL	
• Minimum Vehicle Speed, mph (km/h)	30 (48)	30 (48)	RSL	
Differentiated Speed Limiter:				
• Yes/No	No	-	-	
• Transmission With Overdrive (yes/no)	No	-	-	
Idle Timeout:				
• Yes/No	No	-	-	
• Time Before Shutdown (if yes), minutes	5	1	40	
External Engine Protection:				
• Yes/No	Yes	-	-	
Standstill Maximum Engine Speed:				
• Maximum Engine Speed, r/min	High Idle	2500	High Idle	
Idle Adjustment:				
• Engine Idle Speed, r/min	600	550	800	

NOTE! This parameter listing is not complete. Contact your Volvo Truck dealer for a complete listing.

Parameters can be changed with a Pro-Link tool or with a VCADS Pro tool. These are available at your Volvo Truck dealer.

VECTRO II Parameter Values, D12

Parameter	Default Value	Minimum Value	Maximum Value
PTO:			
• Maximum engine speed, r/min	1200	Low Idle	High Idle
• Resume speed	800	Low Idle	High Idle
Road Speed Limit (RSL):			
• Value RSL (technical), mph (km/h)	87 (140)	30 (48)	87 (140)
Cruise Control (CC):			
• CC enable (yes/no)	Yes	-	-
• Maximum Vehicle Speed, mph (km/h)	87 (140)	30 (48)	RSL
• Minimum Vehicle Speed, mph (km/h)	30 (48)	30 (48)	RSL
Differentiated Speed Limiter:			
• Yes/No	No	-	-
• Transmission with Overdrive (yes/no)	No	-	-
Idle Timeout:			
• Yes/No	No	-	-
• Time Before Shutdown (if yes), minutes	5	1	40
External Engine Protection:			
• Yes/No	Yes	-	-
Standstill Maximum Engine Speed:			
• Maximum Engine Speed, r/min	High Idle	1200	High Idle
Idle Adjustment:			
• Engine Idle Speed, r/min	600	500	650

NOTE! This parameter listing is not complete. Contact your Volvo Truck dealer for a complete listing.

Parameters can be changed with a Pro-Link tool or with a VCADS Pro tool. These are available at your Volvo Truck dealer.

Engine Variants, D7

Power Output Options		
	D7C-275	D7C-300
Output, net ¹ , @ 2,200 r/min	275 hp (205 kW)	300 hp (224 kW)
Torque, net ¹ , @ 1,400 r/min	800 lb-ft (1,085 Nm)	950 lb-ft (1,288 Nm)
Governed speed	2,200 r/min	2,200 r/min

¹ Net output according to ISO 1585 and SAE J1349.

Engine Standard Equipment

- Air-to-air charge air cooler
- Primary fuel filter and Volvo spin-on secondary fuel filters
- Exhaust pressure governor (EPG)
- Electronically controlled fuel injection
- One Volvo full-flow and one Volvo bypass oil filters
- Electronic engine diagnostics system
- Intake air preheater element
- Thermostatically controlled fan
- 100 Ampere alternator
- Base Warranty: 2 years or 250,000 miles; parts and labor (For covered components, see the warranty certificate)

Engine Optional Equipment

- Engine block heater for coolant
- Engine oil pan heater
- Side-mounted oil fill tube
- Alternators from 85 to 145 Ampere

30 General Engine Design Information

Engine Variants, D12

Power Output Options				
	D12C-345	D12C-385	D12C-425	D12C-465
Output, net ¹ , @ 1,700 r/min	345 hp (250 kW)	385 hp (279 kW)	425 hp (309 kW)	465 hp (338 kW)
Torque, net ¹ , @ 1,200 r/min	1,255 lb-ft (1,700 Nm)	1,365 lb-ft (1,850 Nm)	1,475 lb-ft (2,000 Nm)	1,625 lb-ft (2,200 Nm)
Governed speed	2,000 r/min	2,000r/min	2,000r/min	2,000r/min

¹ Net output according to ISO 1585 and SAE J1349.

Engine Standard Equipment

- Air-to-air charge air cooler
- Primary fuel filter and Volvo spin-on secondary fuel filter
- Exhaust pressure governor (EPG)
- Electronically controlled fuel injection
- Double Volvo full-flow and one Volvo by-pass oil filters
- Thermostatically controlled oil cooler
- Electronically controlled unit injectors
- Overhead camshaft
- Electronic engine diagnostics system
- On/off fan clutch
- 110 Ampere alternator
- Base Warranty: 2 years or 250,000 miles; parts and labor (For covered components, see the warranty certificate)

Engine Optional Equipment

- Volvo Engine Brake — 350 hp braking power @ 2,300 r/min.
- Engine direct-mounted PTO — output up to 60 hp or 300 lb-ft
- Intake air preheater element
- Engine block heater for coolant
- Engine oil pan heater
- Side-mounted oil fill tube
- 85 or 135 Ampere alternator
- Thermostatically controlled fan

Engine Data

Fill in the blanks for future reference:

Vehicle Identification Number (VIN) [.....]

Engine Model [.....]

Engine Serial Number [.....]

Engine Power Output [.....]

Engine Low Idle Speed [.....]

Engine Full Load Speed [.....]

Engine Full Torque [.....]

Primary Fuel Filter P/N [.....]

Secondary Fuel Filter P/N [.....]

Oil Filter P/N, Full Flow [.....]

Oil Filter P/N, By-pass [.....]

Air Cleaner Element P/N [.....]

Coolant Filter P/N [.....]

Fan Drive Belt Set P/N [.....]

Alternator Belt P/N [.....]

Engine Storage

If the vehicle needs to be parked for a period (more than 30 days), make sure to protect it as follows:

- 1 Drain the engine of its used oil.
- 2 Fill up to the proper level with oil of the recommended quality and viscosity.
- 3 Fill up the fuel tanks with the recommended grade of fuel.
- 4 Run the engine for two minutes around 1000 r/min. Shut the engine down. Do not drain the oil after this run.
- 5 Check the engine air filter and, if necessary, change it.
- 6 Check the coolant for proper levels of antifreeze and inhibitor (SCA) protection. Service as necessary.
- 7 Clean the exterior of the engine.
- 8 Seal all engine openings using a waterproof, vaporproof and strong tape.

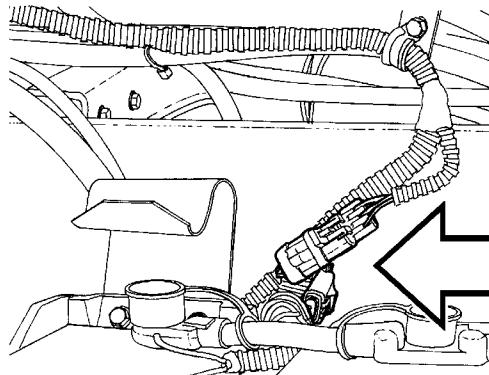
To return an engine preserved in this manner can be done in a short time by removing the seals and checking all engine fluids: coolant, fuel, crankcase oil. Also check all other component fluid levels on the vehicle.

Starting Engine After an Extended Shutdown



DANGER

Before working on a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.



W3002417

If an engine has been sitting unused for more than a week or if an oil change has been performed, it is recommended that the oil pressure is established before starting the engine. This can be done by cranking the engine without fuel delivered to the cylinders. Let an experienced technician carry out the following:

- 1 Separate the in-line fuse feeding the engine electronic control unit. The fuse is located in the battery box.
- 2 Use the starter to turn the engine over until the oil pressure registers on the oil gauge.



CAUTION

Do not crank the engine for more than 30 seconds at a time; wait two minutes after each try to allow the starter to cool. Failure to follow these instructions could cause starter damage.

- 3 Re-connect the fuse.
- 4 Start the engine.

NOTE! This procedure will load a fault in the diagnostic message display but will not interfere with running the engine.

General Coolant Information

General

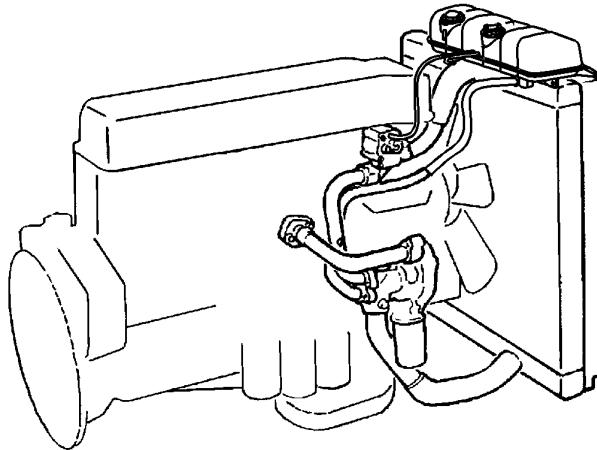


WARNING

Do not raise the engine hood or cab if you see or hear steam or coolant escaping from the engine compartment. Wait until steam or coolant cannot be seen or heard before raising the hood or cab.

Do not remove the coolant fill cap if the coolant in the surge tank is boiling.

Also, do not remove the cap while the engine and radiator are still hot. Scalding fluid and steam may be blown out under pressure if the cap is taken off too soon.



W2002056

Many engine failures can be traced back to a problem in the cooling system. Always make sure that the coolant level is above the min. mark on the surge tank. If the coolant level is allowed to go below the bottom of the tank, there is the risk of the engine shutting down. See the Operator's Manual for more information on the warning functions. See page 122 or page 124 for information on how to change the coolant.



DANGER

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.



W2003475

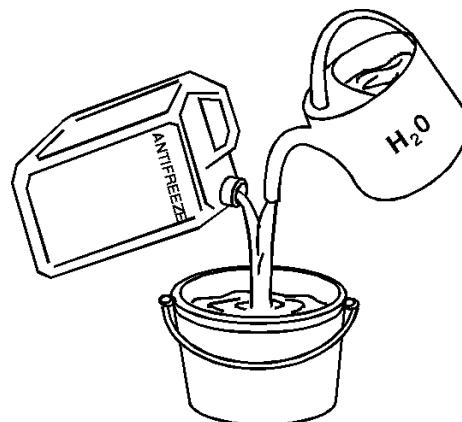
NOTE! Always dispose of coolant according to Federal or local regulations. Take all used coolant to a recycling or waste collection center.

Recommended coolant consists of a 50/50 mixture of antifreeze and clean water. Never run the engine with only water. Regardless of the season, the coolant should always contain at least 40 to 60 percent ethylene glycol (antifreeze). The antifreeze also contains anti-corrosion agents that the cooling system needs to stay functional.

NOTE! Do not use a winterfront for the cooling system. See the Operator's Manual, Engine Start and Operation, for more information.

NOTE! Do not mix regular antifreeze into coolant mixed with extended life antifreeze. The extended life properties can not be maintained, with much reduced service interval as a result.

Engine design requires the thermostat in the engine during summer and winter. Correct engine temperature should be a minimum of 165°F (75°C) with a properly functioning thermostat.



W2003082



WARNING

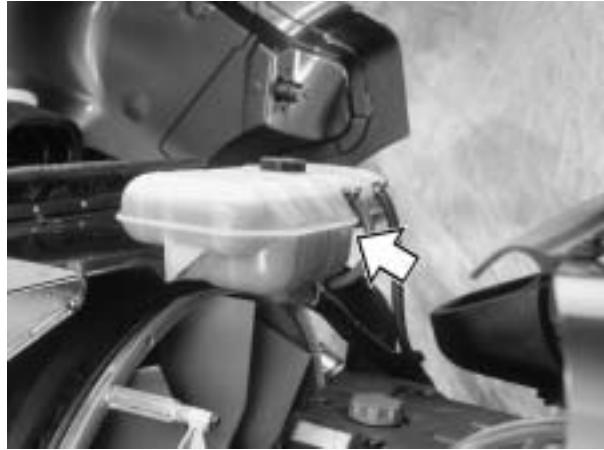
Coolant may be combustible. Coolant leaked or spilled onto hot surfaces or electrical components can cause a fire. Clean up coolant spills immediately.

Do not add cold coolant to an overheated engine because a cracked cylinder head and/or block may result.

36 Cooling System

Keep the radiator (including charge air cooler) and the frontal area free from bugs, dirt, leaves, etc. (see page 127 for cleaning information). Always keep the coolant level above the min. mark on the coolant expansion tank.

Inspection of the whole cooling system is important. Check for swollen or deteriorated heater and radiator hoses, loose hose clamps and connections, and radiator leaks.

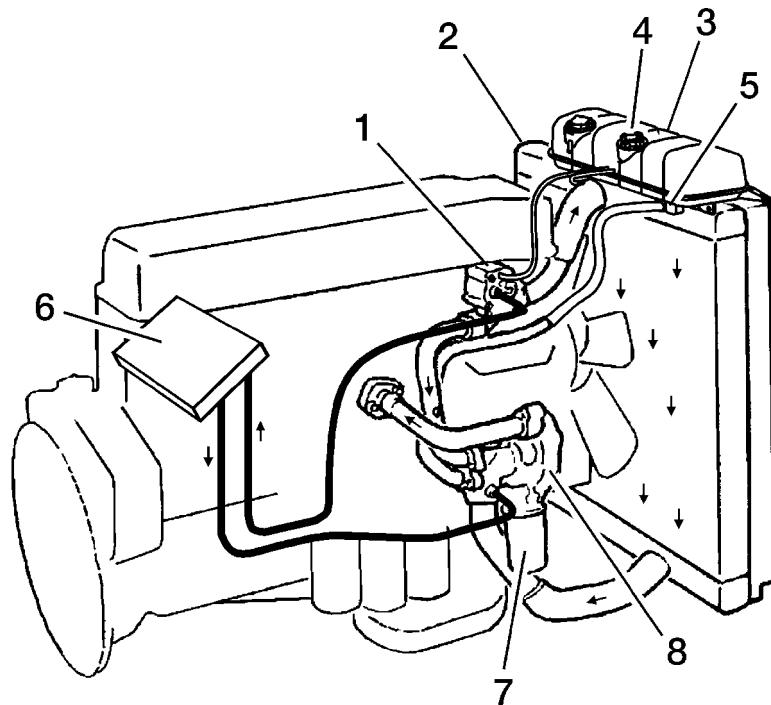


W2003475



DANGER

Do not work near the fan with the engine running. The engine fan can engage at any time without warning. Anyone near the fan when it turns on could be seriously injured. Before turning on the ignition, be sure that no one is near the fan.



W2002697

- | | |
|-----------------------|-------------------|
| 1. Thermostat Housing | 5. Level Sensor |
| 2. Radiator | 6. Heater Element |
| 3. Surge Tank | 7. Coolant Filter |
| 4. Coolant Cap | 8. Coolant Pump |

A well functioning and maintained cooling system is as important to the engine as performing regular oil changes or using good fuel. To get the best result it is very important to use quality products and to service the system at the right intervals. Please read this section carefully.

The cooling system consists of a liquid that is pumped by a gear driven coolant pump that keeps the flow through the engine to the radiator. The radiator gives off heat to the air as it passes through and air flow is helped by the engine fan. For a quick warm-up of the engine, a thermostat regulates the flow of coolant.

DANGER

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

CAUTION

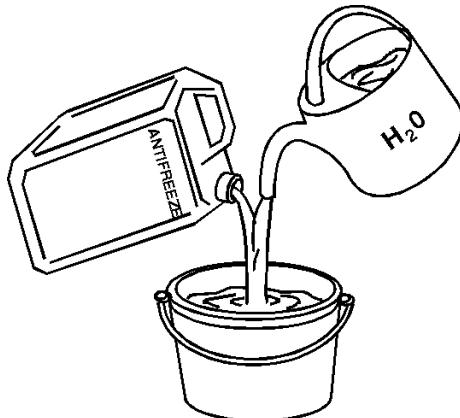
Never add coolant to a hot or overheated engine. Engine damage can result. Allow the engine to cool first.

38 Cooling System

Coolant consists of clean water and antifreeze. This mixture should never be less than 40% antifreeze and 60% clean water or more than 60% antifreeze and 40% clean water. Mix the antifreeze and water to the required concentration before adding to the cooling system.

NOTE! Do not mix different products, such as regular antifreeze and extended life antifreeze.

NOTE! Volvo Trucks North America, Inc. does not recommend the use of antifreeze based on propylene glycol.



W2003082

Coolant, consisting of an antifreeze solution in water, should be used year-round to provide freeze and boil-over protection as well as providing a stable environment for seals and hoses. The solution needs to be tested for proper additive levels at regular intervals (see page 45 for testing SCA levels), unless extended life antifreeze is used. Adjust additive concentration if not at the proper levels.

NOTE! Do not use antifreeze formulated for automobile gasoline engines. These have a very high silicate content that will clog the radiator and leave unwanted deposits in the engine.

The main purpose of coolant is to transport heat from the hot parts of the engine to the radiator and to protect the cooling system from corrosion.

In addition to this, the coolant must:

- Protect against pitting and cavitation erosion damage of the water pump and cylinder liners.
- Protect against freezing and boiling.
- Prevent formation of scale, sludge deposits and clogging.
- Be harmless to polymer materials and seals in the coolant system.
- Maintain its liquid properties in cold climates.

Coolant should consist of these three components:

- Clean water.
- Additives.
- Antifreeze (Glycol).

See the following pages for proper handling, mixtures and specifications.

40 Cooling System

Water Specification



CAUTION

Volvo Trucks North America, Inc. does not recommend using plain water in the cooling system. Water alone is corrosive at engine operating temperatures and does not provide adequate boiling protection. The engine may develop corrosion and cavitation problems in engine and radiator, and the boiling point of the coolant is lowered compared with a proper antifreeze/water mixture. The warranty is not valid when using only water in the cooling system.

Use clean water in the coolant mixture. DO NOT use hard tap water or salt softened tap water in the cooling system. If clean water is not available, using distilled water is ideal. Water specification should be:

	Parts per Million	Grains per Gallon	pH Value
Chlorides, maximum	40	2.34	
Sulfates, maximum	100	5.8	
Silica, maximum	20	1.17	
Iron, maximum	0.10	0.0058	
Manganese, maximum	0.05	0.0029	
Total dissolved solids, maximum	340	20	
Total hardness, maximum	170	10	
Water base/acid level			5.5 to 9

If you are not sure of the quality of the water in your area, contact your Volvo Truck dealer, your local water department, agricultural agent or an independent laboratory to analyze the water.

Additives

Additives are part of most antifreeze and should be tested for and added to all coolant mixtures using normal antifreeze. If extended life coolant is used, the additives are in the product when mixed. Both types need to have additives added to after a time.

Additives help prevent rust, scale and mineral deposits from forming. Additives also protect metals from corrosion, prevent water pump and cylinder liner cavitation and contain anti-foaming agents. Additives are depleted during normal engine operation and need to be replaced. For normal coolant mixture, this means the addition of Supplemental Coolant Additives (SCA) at any time the additive goes below the recommended level. For extended life coolant mixture, this means an extender package added halfway through the coolant lifetime.

Nitrites or nitrite and molybdate additives protect the cylinder liner from cavitation erosion. Nitrites deplete over time, creating the need for SCA's or extender. Other coolant additives also deplete and need replacement.

A too low concentration of additives in the coolant will not provide the protection required by the cooling system. A too high concentration of additives in the coolant can cause additives to solidify and drop out of the solution, depositing inside the cooling system or form a gel in the radiator. Deposits can be in the form of sludge and scale. Deposits accumulate on hot engine surfaces, reducing the effectiveness of the cooling system or causing water pump leaks.

Antifreeze

General



DANGER

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.



CAUTION

Never add coolant to a hot or overheated engine. Engine damage can result. Allow the engine to cool first.



CAUTION

Use of recycled antifreeze or coolant by filtration is not approved by Volvo Trucks North America, Inc., and may reduce engine life. If the recycled antifreeze or coolant has been passed through a fractional distillation or similar process that has removed all hazardous and contaminating materials, including dissolved solids and acids, will produce a sufficient base antifreeze. Correctly inhibited to meet the ASTM D4985 standard, it can be regarded as a new coolant which is fully accepted.

Antifreeze additives not only protect the cooling system from freezing but also against corrosion and cylinder liner pitting. Antifreeze typically comes in one of two glycol types, ethylene or propylene. Propylene antifreeze is NOT recommended for use in a Volvo engine. There is also regular and extended life antifreeze. If the vehicle is delivered with extended life coolant, there is a label attached to the surge tank.

NOTE! Do not mix regular and extended life antifreeze. Do not use extended life antifreeze unless it is of a type approved by the engine manufacturer.

Regardless of the type and make, acceptable antifreeze or premixed coolant must meet or exceed the standards ASTM D 5345 and ASTM D 4985, and be formulated for heavy duty diesel engines.



TEXACO

- Filled with TEXACO (ELC)
- Top up with TEXACO (E.I.C) or a coolant which meets CATEC-1
- Do Not Mix conventional coolants and SCA's with TEXACO (ELC)

1 + 800-STAR-T.I.C
Volvo GM Part No. 3969338.P01

W2002144

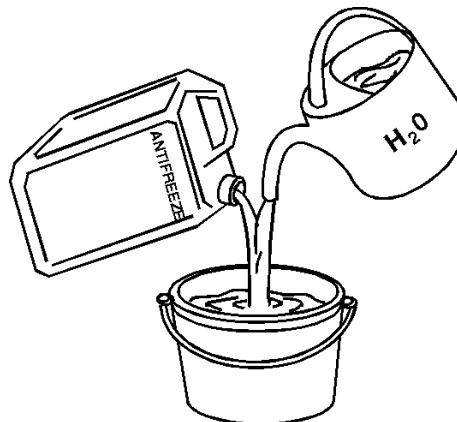
Antifreeze or premixed coolant meeting the standards ASTM D 3306 or ASTM D 4656 are primarily for automotive gasoline engines, containing high levels of silicate, and are unacceptable for heavy duty diesel engines.

Recommended antifreeze meeting the ASTM D 4985 standard is a low silicate ethylene glycol based antifreeze for heavy duty diesel engines. Standard antifreeze requires an initial charge of supplement coolant additives (SCA) when filling new coolant. Extended life antifreeze does not need an initial charge.

NOTE! ASTM D 4985 requires the use of SCA to be added to the coolant to bring it up to the recommended SCA level when the coolant is initially filled or replaced.

Water and antifreeze should generally be filled as a 50/50 mixture. The mixture should never be less than 40% antifreeze and 60% clean water or more than 60% antifreeze and 40% clean water. Mix the antifreeze/water to the required concentration before adding to the cooling system. The following table gives approximate freezing protection for certain mixtures.

Freeze Protection Down To:	Percentage of Antifreeze in Mixture
-13°F (-25°C)	40%
-22°F (-30°C)	46%
-36°F (-38°C)	54%
-51°F (-46°C)	60%



W2003082

NOTE! 60% antifreeze in the mixture gives maximal freeze protection. To increase the antifreeze content beyond that will only decrease the freeze protection.

44 Cooling System

Regular Coolant Change Interval

Replace the coolant every 250,000 miles (400,000 km), 4,000 hours or every two years, whichever comes first.

Coolant SCA level must be tested at least twice per year or whenever coolant loss occurs. For maximum coolant system efficiency, test the system every 25,000 to 30,000 miles (40,000 to 56,000 km) depending on engine oil change interval or every 1,000 hours or maximum every 6 months (whichever comes first).

The SCA level must be between 1.5 (Cummins: 1.2) and 3.0 SCA units per gallon (0.4 [Cummins: 0.3] and 0.8 SCA units per liter) of coolant.

NOTE! Always dispose of coolant according to Federal or local regulations. Take all used coolant to a recycling or waste collection center.

Coolant Filter Change Intervals

The charged coolant filter contains 8 units of SCA that are released slowly over time to maintain the recommended level during operation. Change coolant filter after the first 30 days or 6,000 miles (10,000 km). Thereafter:

Change the coolant filter at every other oil change when running 10,000 to 15 000 mile (16,000 to 24,000 km) intervals (every oil change when running 25,000 mile intervals on a D12). If the SCA level tests above 3.0, DO NOT replace the filter.

When testing indicates that the SCA level has dropped below 1.5 units per US gallon (0.4 units per liter) start changing the filter with the oil changes again.

NOTE! Test the SCA level every 6 months.



WARNING

Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine and/or fluids can cause serious burns.

Standard Antifreeze Testing

General

Coolant SCA level must be tested at least twice per year and whenever coolant loss occurs. For maximum coolant system efficiency, test the system every 25,000 to 30,000 miles (40,000 to 56,000 km), depending on the oil change interval, or every 1,000 hours or every 6 months (whichever comes first).

Use liquid SCA and pre-charged coolant filters to maintain a 1.5 to 3.0 SCA units per gallon (0.4 to 0.8 units per liter) concentration in the coolant.

Depending on the make of antifreeze or premixed coolant, SCAs are added or have to be added to the system after replacement. The SCA level will deplete over time so it is important that the SCA level is tested regularly and maintained. The Volvo pre-charged filter is designed to slowly release the SCA to help maintain the recommended level during operation.

NOTE! Only change the filter after testing shows depleted SCA in the cooling system. Do not exceed the 3.0 units per gallon (0.8 units per liter) concentration. Excessive SCA concentration can form deposits on the higher temperature surfaces of the cooling system, reducing the engine's heat transfer characteristics. Reduced heat transfer could cause cracking of the cylinder head and other high temperature components. Excessive SCA concentration can also result in radiator tube blockage, overheating and/or accelerated water pump seal wear.



W2001081



W2001082

Coolant filter

46 Cooling System

Testing Procedure

Run the engine to operating temperature. After the engine has reached operating temperature, move the heater controls (on dash and in sleeper) to full heat and run the engine for 10 more minutes.



WARNING

Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine and/or can cause serious burns.

Shut off the engine and allow it to cool. Test the coolant with the test kit. Depending on the concentration of SCA in the coolant:

- If the SCA concentration is below 1.5 units per gallon (0.4 units per liter), replace the coolant filter and calculate the required units of SCA to reach the desired SCA level. See example.
- Between 1.5 and 3.0 units per gallon (0.4 and 0.8 units per liter), replace the coolant filter, P/N 3945411.
- Above 3.0 units per gallon (0.8 units per liter). Do not replace the coolant filter until further testing at the next oil change indicates that the level has dropped below 2.3 units per gallon (0.6 units per liter).



CAUTION

SCA levels deplete during normal operation and when coolant is added because of low coolant level. SCA levels should be maintained at the middle of the recommended interval.

Unit per gallon:

1.5 LOW - 2.3 MID - 3.0 HIGH

Units per liter:

0.4 LOW - 0.6 MID - 0.8 HIGH

EXAMPLE

Step 1	Desired SCA level	2.3 units per gallon	<i>recom- mended level 1.5- 3.0 units per gallon</i>
---------------	----------------------	-------------------------	--

Subtract:

Coolant test results	1.5 units per gallon
	=

Required SCA per gallon	0.8 units per gallon
increase	

Step 2

Cooling system capacity	13 US gallons	<i>Use actual system capacity</i>
<i>Multiply by:</i>	x	

Required SCA per gallon	0.8 units per gallon
increase	

Total SCA units required	10.4 units (11 units)	<i>round up to nearest whole number</i>
	=	

**FIND-
INGS** Use one (8 unit) filter, P/N 3945411 and 3 units liquid SCA

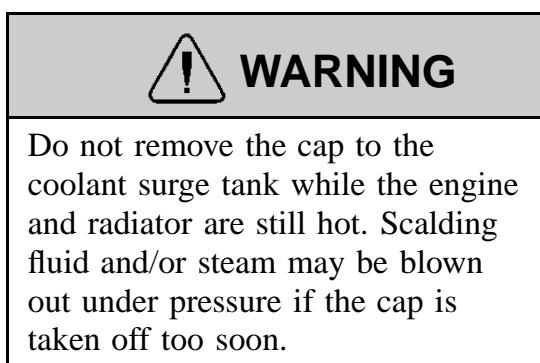
See "Cooling System Capacity*" page 167 for system quantities.

Changing from Regular to Extended Life Coolant

Drain the system of old coolant and dispose of properly. The cooling system should be flushed with clean water. If significant deposits are visible, use a reputable commercial cooling system flush designed for heavy duty diesel engines. For specific information over draining and flushing, See page 122 for D7 and page 124 for D12 engines.

NOTE! Extended Life Coolant is not recommended by all engine manufacturers. Contact other manufacturers for their current recommendations.

1



Drain the coolant into a suitable container. Make sure the heater temperature controls and valves are open.

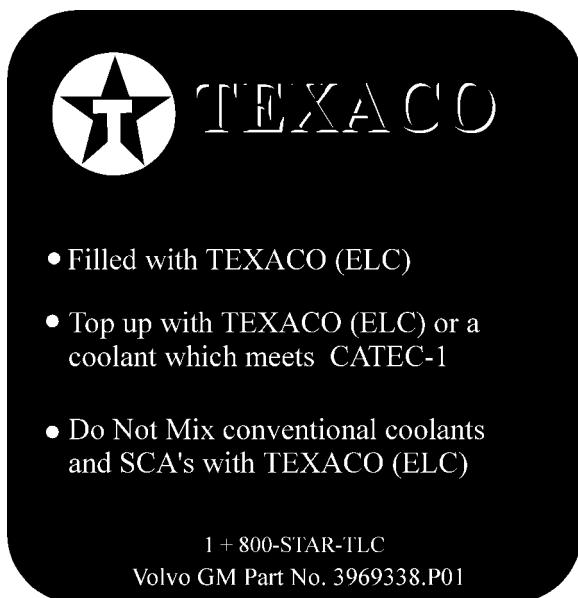
NOTE! Always dispose of coolant according to Federal or local regulations. Take all used coolant to a recycling or waste collection center.

2 Flush the system with clean water to remove any settled debris.

NOTE! Keep the water pressure low so as not to damage the tubes of the radiator.

48 Cooling System

- 3 Use a reputable cleaner to clean the cooling system. Follow the recommendations that come with the cleaner.
- 4 Drain the cleaner and flush the cooling system with clean water.
- 5 Fill the cooling system with clean water and operate the engine until the coolant temperature has reached 120° to 150°F (50° to 65°C).
- 6 Drain the water and flush the cooling system with clean water.
- 7 Again, fill the cooling system with clean water and operate the engine until the coolant temperature has reached 120° to 150°F (50° to 65°C).
- 8 Drain the water and flush the cooling system with clean water.
- 9 Fill the cooling system with pre-mixed Extended Life Coolant. Check the specifications section for refill quantity.
- 10 **Attach label P/N 3969338** to the coolant surge tank to indicate that the system is now filled with **Extended Life Coolant**. The label can be ordered from your Volvo Truck dealer spare parts department.



NOTE! When changing over from standard to extended life antifreeze, tighten all hose clamps and fasteners in the cooling system. Extended life coolant tends to leach out deposited silicate and leaks may appear.

W2002144

Extended Life Coolant Change Interval

Replace coolant every 300,000 miles (480,000 km), 6,000 hours or every four years, whichever comes first.

A one-time extender package must be added to the cooling system after 150,000 miles (240,000 km), 3,000 hours or two years, whichever comes first.

NOTE! Do not add supplement coolant additives (SCA) to extended life coolant.



CAUTION

Extended life coolant will test as out of additives (SCA), but SCA should not be added. Shortened engine life may be the result of adding SCA.

Should the system become contaminated with regular coolant exceeding 10 % of the system's total capacity or if SCA is added to the system, either drain the system and refill with new extended life coolant or maintain the system as for regular coolant. Continue treating with SCA and change the coolant at the intervals recommended for regular coolant.

Coolant Filter

Do not use a filter that contains SCA. Instead use a bypass canister or “empty” filter. Replace the “empty” filter every 125 000 miles (200 000 km) or 2500 h or 12 months, whichever comes first, to prevent external rust damage to the filter walls.



WARNING

Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine and/or fluids can cause serious burns.

Fuel Safety Reminders



DANGER

A diesel engine will operate on any fuel which enters the cylinder, whether it is from the injectors or from the air intake system. Therefore, if any solvent is used to flush out the air cleaner element, the engine may overspeed during startup. Engine damage, severe injury and/or death from burns or explosion may occur.



DANGER

Do not mix gasoline or alcohol with diesel oil fuel. This mixture can cause an explosion and result in severe personal injury or death.



WARNING

If a fuel leak is detected, stop the engine immediately. The vapors from hot fuel are highly flammable which may result in a fire.



DANGER

Do not remove the fuel tank cap near an open flame. Diesel fumes are combustible and can cause an explosion of fire resulting in severe personal injury or death.



WARNING

Do not store fuel containers in the vehicle. They may leak, explode and cause or feed a fire. Empty or full, they present a hazard that may lead to burns in the event of a fire.



WARNING

To prevent buildup of potentially volatile vapors from hot fuel, keep the engine area well ventilated during operation.

Diesel Fuel Specification

Quality

Fuel quality is an important factor in obtaining satisfactory engine performance, long engine life and acceptable exhaust emission levels. Volvo engines are designed to operate on most diesel fuels commercially available today. Volvo Trucks North America, Inc. recommends the use of diesel oil fuel which meets the specification ASTM D975 (grades No. 2-D and No. 1-D).

NOTE! The use of lighter fuels (grade No. 1-D) can reduce fuel economy.

The fuels used must be clean, completely distilled, stable and non-corrosive. Always try to keep the fuel tank full. Do not put alcohol into the fuel tank. Fill the tank after completing driving for the day.

NOTE! When draining the fuel tank, collect the waste in a fuelproof container. Take the drained fuel and water to a recycle or waste management center.

Open the drain at the bottom of the fuel tank approximately every 30,000 miles (50,000 km) or 300 hours, to drain off any water and/or sediment.

Yearly or at 120,000 miles (200,000 km), tighten all fuel tank mountings and brackets. Check all hoses, pipes and lines to and from the fuel tank. At the same time, inspect tank and connections for any signs of leakage. Make sure that hoses and lines are not resting on or touching shafts, couplings, hot surfaces or sharp areas. Since all machinery vibrates and moves to a certain extent, clamps and ties can fatigue with age. Inspect fasteners frequently and tighten or replace them as necessary.

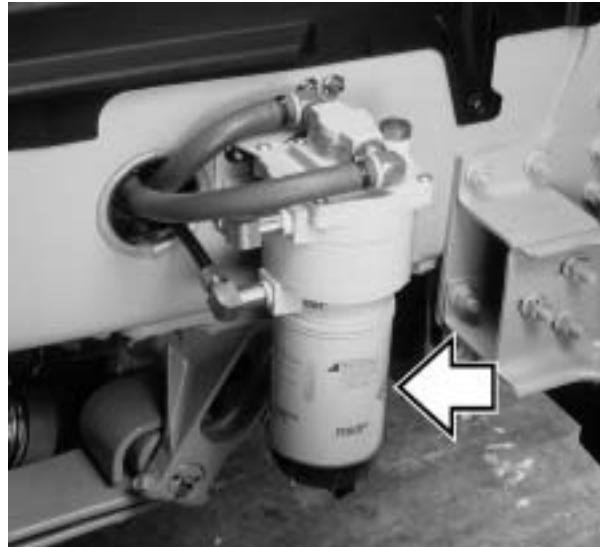
52 Fuel System

Fuel Filters

NOTE! When draining the fuel filters, collect the waste in a fuelproof container. Always dispose of coolant according to Federal or local regulations. Take the drained fuel and water to a recycle or waste management center.

For the Volvo engine, change the fuel filters at every other oil change when running the 15,000 mile (24,000 km) oil drain interval. Change the fuel filters every oil change when running the 25,000 mile (40,000 km) oil drain interval. Drain the primary filter watertrap daily.

For other engines, the engine manufacturers recommend changing the fuel filter at every oil change. For bleeding the fuel system, see page 134 for D12 and page 136 for D7 engines or the engine manufacturer's operator's manual for other engines.



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Fuel Sulfur Content

Fuel sold after 1994 for highway use can only contain a maximum sulfur content of 0.05% by weight. This was done to reduce particle emissions in the exhaust.

The sulfur content for off-highway use continues to be specified at a maximum of 0.5% by weight. The use of a fuel containing 0.5% or higher level of sulfur, necessitates more frequent engine oil changes because of sulfur deposits and higher corrosion risk. If using fuels with high sulfur content, the oil change intervals must be cut in half. See "Sulfur Level and TBN" page 68 for more information.

NOTE! The use of low sulfur diesel oil fuel does not permit extension of engine oil change intervals or oil filter changes.

Cetane Number

Direct injected diesel engines require a minimum cetane number of 40 under normal starting conditions. Fuel with a higher cetane value may be required for high altitude or cold weather operation.

Filtration

Fuel should be clean and free of contamination. Clean fuels should have no more than 0.1% of sediment and water.

If fuel is stored on site, make sure that:

- Keep storage tank covered to prevent water entry.
- Do not use a tank made of galvanized metal or any galvanized piping for diesel oil storage. Diesel will react with the zinc, forming solids that can clog fuel filters and cause engine damage.
- Fuel stored for a long time may oxidize and form solids, causing filtering problems.
- Keep the area around the fill cap clean. Tilt the tank slightly toward the drainplug area so water and sediment can be easily drained.

Generally, fuel contamination occurs as the result of improper fuel handling. The most common types of contamination are water, dirt and microbial growth (“black slime”). The formation of varnishes and gums resulting from poor fuel stability or long storage (“stale fuel”) also affects fuel quality. The best treatment for contamination is prevention by maintaining a clean storage system and choosing a reputable fuel supplier.

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Fuel Pour Point

Fuel pour point should be at least 10°F (6°C) lower than the lowest ambient temperature at which the engine must start and operate. Lower pour points of diesel fuel grade No. 1-D may be necessary in extremely cold weather.

Fuel Cloud Point

The cloud point should be below the lowest ambient temperature at which the engine must start and operate, to prevent the fuel filter elements from plugging with wax crystals.

Fuel Viscosity

Fuel viscosity must be kept above 1.4 cSt at 100°F (38°C) to provide adequate fuel system lubrication. The viscosity also has an effect on the atomization of the fuel when it is injected into the cylinders.

Fuel Additives

General

Fuel additives are generally not recommended or needed for fuels listed earlier. Cetane improvers can be used as necessary. Biocides may be needed to eliminate microorganism growth in storage tanks. In cold conditions, treatment for water in the vehicle tanks may also be necessary.

Consult your fuel supplier about the use of additives to prevent incompatibility among additives already in the fuel and the additives to be used.

Supplemental Fuel Enhancers



CAUTION

Supplemental additives are not recommended because of a high risk of injection system problems or engine damage.

There are many aftermarket products available today which are intended to be added by the customer. They generally increase operating cost without providing benefits. Included are a variety of independently marketed products which claim to be:

- Cetane improvers
- Emission control additives
- Detergents
- Combustion improvers
- Smoke suppressants
- Cold weather flow improvers

56 Fuel System

NOTE! Repair expenses resulting from malfunctions in the fuel system or with engine components when fuel enhancers have been used are not covered under warranty.

Some fuel additives can be used to provide temporary relief but they do not replace good fuel handling practices. These products can be used:

- **Isopropyl Alcohol** — Use 1 pint per 125 gallons (1/2 liter per 500 liters) of fuel for winter freeze-up protection.
- **Biocide** — For treatment of microbe growth or “black slime.” Follow manufacturer’s instruction for treatment.

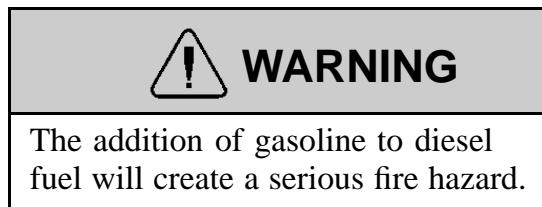
Prohibited Additives

The following additives are specifically NOT allowed and must NOT be mixed in with the vehicle diesel fuel:

Used Lubricating Oil:

Volvo Trucks North America, Inc. does not recommend the use of any type of used lubricating oil as an extender in the diesel fuel. **Used lubrication oil contains solids and acids from the combustion process that can severely corrode parts of the injection system, resulting in reduced power and higher maintenance cost over time.**

Gasoline:



Adding gasoline to diesel fuel will reduce the cetane number and increase combustion temperature. If a tank contains a diesel fuel/gasoline mixture, it should be drained and cleaned as soon as possible.

Alternative Fuels

Alternative fuels can be of several different types. There are vegetable based fuels, aviation fuel and recycled petroleum based fuels that are used in combustion engines. These are in general not compatible with modern heavy duty over-the-road vehicle engines.

The use of unauthorized fuels may compromise the levels of pollutants in the exhaust to the point where the engine does not meet the emission requirements. This would make the vehicle illegal to drive on public roads.

DO NOT use any kind of alternative fuel unless specifically authorized by Volvo Trucks North America, Inc.

Engine Oil

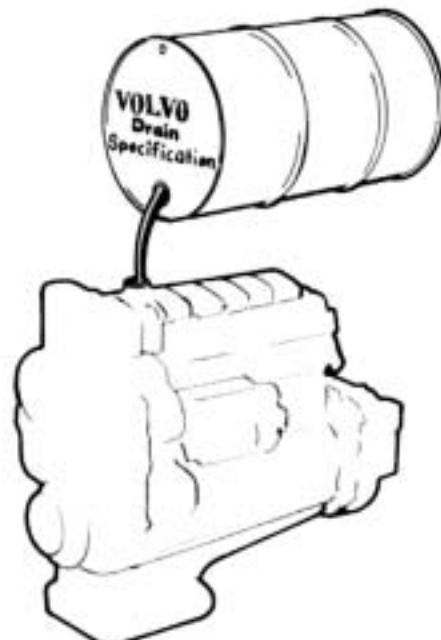
General

Keep the engine oil at the proper level and change it at the recommended intervals. Always replace the oil filters at the same time as when the oil is changed.

Always follow the oil change intervals and use the oil types that are recommended by the engine manufacturers. Oil change intervals for Volvo engines are found on page 61. Viscosity and capacity tables can be found beginning on page 166. Other engine manufacturers have different policies regarding their products and should be consulted if a different change interval is desired. Contact your Volvo Truck dealer for more information.

For information on synthetic oil, see page 66.

NOTE! Always dispose of oil according to Federal or local regulations. Used oil disposed of in nature or waterways contaminates our drinking water and kills wildlife. Take all used oil to a recycling or waste collection center.



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Oil Quality

Volvo Trucks North America, Inc. recognizes and recommends engine oils that meet or exceed the standards given by American Petroleum Institute (API) for the oil classifications listed in this manual.

Only oils licensed to carry the API symbol should be used. Lubricants meeting API standards have provided maximum engine life when used together with the recommended oil and oil filter change intervals.

Engines meeting the 2000 and 2001 emissions requirements operate under higher soot loading conditions than previous engines. This has led Volvo to require a higher grade oil that meets both API CH-4 and VDS-2 quality standards for model year 2000 and 2001 Volvo engines. This type oil is required for normal oil intervals.

Normal grade engine oils for all engines in vehicles produced by Volvo Trucks North America, Inc. must meet or exceed the API classifications CG-4 or CH-4. VDS and VDS 2 are Volvo oil standards.

See page 61 for interval recommendations for Volvo engines. See each other engine manufacturer's Operator's Manual for information on when and how to change the oil.

Oils that meet both API CH-4 and VDS-2 are required for model year 2000 and 2001 Volvo engines. Most major oil companies have oils that meet these specifications. A list of approved oils can be found in Service Bulletin 175-001, "Oil and Filter Change Intervals."



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Typical API Symbol



CAUTION

Extra oil additives must not under any circumstances be added to any engine oil used. Additives such as break-in oils, top oils, graphitizers and friction reducing liquids are not necessary and may even harm the engine.

Oil Change Intervals

The length of time an engine is operated before an oil change depends on which quality oil is used, the type of fuel used, engine oil consumption, vehicle application, level of dust in the air, etc. The change intervals given in this manual are maximum intervals. If the vehicle is operating in heavy-duty operation, dusty or off-road conditions, using high sulfur fuels, etc., adjust the intervals down for more frequent oil changes.

NOTE! Oil filters should always be changed when changing oil.

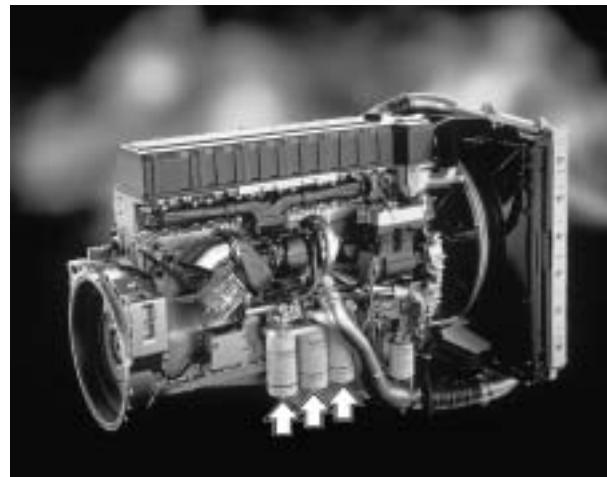
Oil Filters

Always change oil filters when changing the oil. There may be two or three filters on the engine, one of which is a bypass filter. This should be changed at the same time as the regular full-flow filter(s).



CAUTION

Use only the engine manufacturer's oil filter for replacement. Use of an oil filter that does not meet specification could result in severe damage to bearings, crankshaft, etc. as a result of unfiltered oil entering the lubrication system.



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D12 oil filters

Oil Change Intervals, Volvo D7 Engine

For the D7 engine, there are three columns of different oil change intervals depending on what application the vehicle is used in. Always use the correct oil quality for your application and distance driven.

For example, in longhaul transport, oil changes can be done every 15,000 miles (24,000 km) if the oil quality meets or exceeds both API CH-4 and VDS-2 quality standards. If the oil does not meet these requirements, oil change intervals must be 7,500 miles (12,000 km).

Volvo Trucks North America, Inc. does not issue a list of approved oils and oil companies for standard oil that is defined by the API classifications. For oils that meet both API CH-4 and VDS-2, which are required for model year 2000 and 2001 Volvo engines, there is a list that is periodically updated. For the complete list, see your Volvo Truck dealer. The list is contained in the Technical Service Information; refer to TSI 175-001, “*Oil and Filter Change Intervals*.”

Depending on the seasonal temperature changes, select the correct viscosity of the oil. See page 67 for more information over oil viscosity.

Engines meeting the 2000 and 2001 emissions requirements operate under higher soot loading conditions than previous engines. This has lead Volvo to require an oil that meets both API CH-4 and VDS-2 quality standards for model year 2000 and 2001 Volvo engines.

First oil change should be done at max. 6,000 miles (10,000 km).

D7 Oil Change Intervals

Type of Operation	<ul style="list-style-type: none"> Average fuel consumption is under 6.0 miles per gallon (over 4.0 liters per 10 km) Gross combined weight (GCW) is greater than 60,000 lb (27,000 kg) Idle time is 40% or higher Vehicle operates off road or in dusty areas Vehicle operates in inner city delivery 	<ul style="list-style-type: none"> Average fuel consumption is over 6.0 miles per gallon (under 4.0 liters per 10 km) Gross combined weight (GCW) is less than 60,000 lb (27,000 kg) Vehicle operates in regional distribution 	<ul style="list-style-type: none"> Average fuel consumption is over 7.0 miles per gallon (under 3.5 liters per 10 km) Gross combined weight (GCW) is less than 45,000 lb (20,000 kg) On highway operation only
Higher Oil Qualities			

Oil Quality	<i>VDS-2 plus CH-4</i>	<i>VDS-2 plus CH-4</i>	<i>VDS-2 plus CH-4</i>
Mileage*	10,000 miles (16,000 km)	12,000 miles (19,000 km)	15,000 miles (24,000 km)
Months*	4	4	4
Hours*	250	300	400
Fuel Usage*	1,500 gallons (5,700 liters)	1,800 gallons (6,800 liters)	2,200 gallons (8,300 liters)

Normal Oil Qualities			
Oil Quality	<i>CG-4, CH-4 or VDS</i>	<i>CG-4, CH-4 or VDS</i>	<i>CG-4, CH-4 or VDS</i>
Mileage*	5,000 miles (8,000 km)	6,000 miles (10,000 km)	7,500 miles (12,000 km)
Months*	4	4	4
Hours*	125	150	200
Fuel Usage*	800 gallons (2,900 liters)	900 gallons (3,400 liters)	1,100 gallons (4,200 liters)

* Whichever comes first

Oil Change Intervals, Volvo D12 Engine

For the D12 engine, there are three columns of different oil change intervals depending on what application the vehicle is used in. Always use the correct oil quality for your application and distance driven.

For example, in longhaul transport, oil changes can be done every 25,000 miles (40,000 km) if the oil quality meets or exceeds both API CH-4 and VDS-2 quality standards. If the oil does not meet these requirements, oil change intervals must be 19,000 miles (30,000 km).

Volvo Trucks North America, Inc. does not issue a list of approved oils and oil companies for standard oil that is defined by the API classifications. For oils that meet both API CH-4 and VDS-2, which are required for model year 2000 and 2001 Volvo engines, there is a list that is periodically updated. For the complete list, see your Volvo Truck dealer. The list is contained in the Technical Service Information binders; refer to TSI 175–001, “*Oil and Filter Change Intervals*.”

Depending on the seasonal temperature changes, select the correct viscosity of the oil. See page 67 for more information over oil viscosity.

Engines meeting the 2000 and 2001 emissions requirements operate under higher soot loading conditions than previous engines. This has lead Volvo to require an oil that meets both API CH-4 and VDS-2 quality standards for model year 2000 and 2001 Volvo engines.

First oil change should be done at max. 6,000 miles (10,000 km).

D12 Oil Change Intervals

Type of Operation	<ul style="list-style-type: none"> Average fuel consumption is under 5.0 miles per gallon (over 4.7 liters per 10 km) Gross combined weight (GCW) is greater than 100,000 lb (45,000 kg) Idle time is 40% or higher Vehicle operates off road or in dusty areas Vehicle operates in inner city delivery 	<ul style="list-style-type: none"> Average fuel consumption is between 5.0 and 6.5 miles per gallon (between 4.7 and 3.6 liters per 10 km) Gross combined weight (GCW) is less than 100,000 lb (45,000 kg) Vehicle operates in regional distribution 	<ul style="list-style-type: none"> Average fuel consumption is over 6.5 miles per gallon (under 3.6 liters per 10 km) Gross combined weight (GCW) is less than 80,000 lb (36,000 kg) On highway operation only
Higher Oil Qualities			

Oil Quality	<i>VDS-2 plus CH-4</i>	<i>VDS-2 plus CH-4</i>	<i>VDS-2 plus CH-4</i>
Mileage*	12,000 miles (19,000 km)	15,000 miles (24,000 km)	25,000 miles (40,000 km)
Months*	4	4	4
Hours*	300	400	600
Fuel Usage*	2,500 gallons (9,500 liters)	3,000 gallons (11,500 liters)	4,000 gallons (15,000 liters)

Normal Oil Qualities			
Oil Quality	<i>CG-4, CH-4 or VDS</i>	<i>CG-4, CH-4 or VDS</i>	<i>CG-4, CH-4 or VDS</i>
Mileage*	9,000 miles (14,000 km)	11,000 miles (18,000 km)	19,000 miles (30,000 km)
Months*	4	4	4
Hours*	250	300	450
Fuel Usage*	1, 900 gallons (7,100 liters)	2,200 gallons (8,500 liters)	3,000 gallons (11,500 liters)

* Whichever comes first

Synthetic Lubrication

Synthetic oils are offered as an alternative to the traditional, petroleum based oils for engines. These oils may be used in Volvo engines, provided they meet the quality levels specified on the previous pages, that is: API CG-4, CH-4, VDS or VDS-2.

Product information about synthetic oil should be reviewed carefully. Their use does not permit an automatic extension on recommended oil change intervals.

The ability to protect the engine is better in some ways compared with petroleum based oils but its lifetime in the engine is the same. This is because of the combustion by-products that contaminate the oil. These contaminates will make the change intervals the same as for petroleum based oils.

The use of synthetic oils does not permit the extension of the recommended oil change intervals.

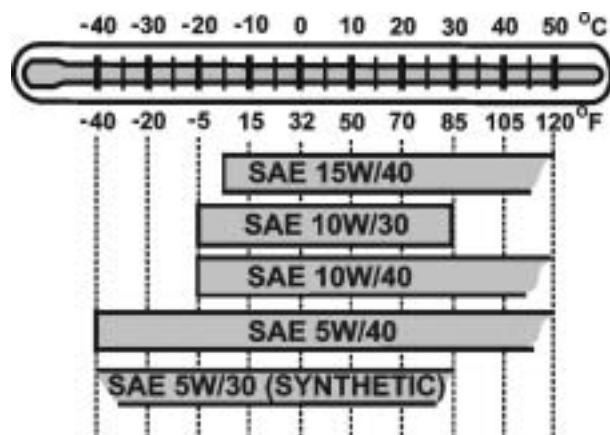
Synthetic oils offer improved low temperature flow properties and high temperature oxidation resistance. They are generally more costly than petroleum based oils. However, in extreme driving conditions, that is, in extreme cold or in desert operation, a synthetic oil may be the only choice for the application (see next page about viscosity).

Oil Viscosity

The viscosity grade defines the thickness of the oil. The oil must be thin enough at low temperatures for easy cold starts and thick enough to protect at high temperatures. An oil is not fully defined until both the API quality classification and the viscosity grade are specified.

Choose the viscosity grade for the typical ambient temperature for the application. Multigrade oils have a broad range that suit operation in changing temperature. Only choose a monograde oil if the temperature is holding steady over a long period of time

Volvo Trucks North America, Inc. recommends the viscosities shown in the viscosity/temperature table for Volvo engines. See page 167 for vendor engines. Choosing an oil with a lower viscosity can help improve the fuel economy. However, if this is done, make sure the upper temperature limit is not exceeded. Also, with low viscosity oil, oil consumption can increase.



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CAUTION

Extra oil additives must not under any circumstances be added to any engine oil used. Additives such as break-in oils, top oils, graphitizers and friction reducing liquids are not necessary and may even harm the engine.

Sulfur Level and TBN

Oils are available with different levels of Total Base Number (TBN) to counteract high sulfur levels in fuel. TBN measures an oil's alkalinity and ability to neutralize acid. Normally, the higher the fuel sulfur, the higher the TBN is needed. When US Federal fuel is used (sulfur less than 0.05%), a minimum TBN of 5 is highly recommended.

Sulfur creates highly acidic pollutants in the oil that break down the additives at a higher rate. The sulfur content in low-sulfur fuel has been regulated to a maximum of 0.05% by weight for No. 2-D diesel fuel. For fuels that have a sulfur content of 0.5% by weight and above, Volvo Trucks North America, Inc. recommends that oil change intervals are cut in half so a shorter mileage is run between oil changes.

Oil Additives



CAUTION

Extra oil additives must not under any circumstances be added to any oil used. A shortened engine life may be the result.

Using oils to the quality standards recommended in this manual makes the use of extra oil additives unnecessary, as these oils already contain a balanced treatment of additives. The use of extra oil additives such as break-in oils, top oils, graphitizers and friction reducing compounds are not necessary and can even be harmful to the engine.

Oil Consumption

Check the oil level daily with the engine stopped. If the engine has just been stopped and it is warm, wait approximately 20 minutes to allow the oil to drain back to the oil pan before checking. Add oil as necessary.

NOTE! Do not overfill. Oil may be blown out through the crankcase breather tube if the level is too high.

All diesel engines are designed to use some oil, so it is normal to add oil periodically.

An engine used in heavy duty operation will use more oil than one in normal operation.

Owners often ask what is considered “normal” oil consumption. This is all dependent on the operation of the engine. Just as one engine in a heavy operation may get only 5 mpg fuel consumption and another gets over 8 mpg, the oil consumption will vary in different applications.

To determine “normal” oil consumption, it is therefore important to establish what is normal for your engine in your application. Establish a record of oil usage and compare with other vehicles in your fleet. There are two methods that are frequently used:

- Miles per quart of oil. Simple way to establish a history of the consumption. Useful as a comparison to others only when vehicle and engine is compared to an identical vehicle and engine under identical operating conditions.
- Amount of fuel used per amount of fuel used (oil consumption relative to fuel consumption). Better way to relate the oil usage to the actual work of the engine. Also only useful in comparison when compared under identical conditions.

Oil Sampling

General

Oil sampling is a good tool for determining the condition of the engine. The oil samples are taken regularly over the life of the engine and establishes a history of each specific engine. The sampling results “paint a picture” of normal wear. When results occur that are outside of the normal, it indicates that something is happening that needs investigating.

It is important that regular sampling is done. One sample or irregular sampling will not give any meaningful information.

Taking Samples



WARNING

Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine and/or can cause serious burns.

Samples should be taken when the oil is warm and well mixed to be certain that the sample is representative of all the oil in the engine. Samples can be taken by having a sampling valve installed on the engine or sampling through the oil dipstick tube.

Follow the instructions in the sampling package closely. A contaminated or not representative sample will give false information of the health of the engine.

NOTE! Oil sample values can change slightly from one engine to another, even if they are of the same model and manufacturer. Base the decisions from regular sampling. Also note that repair work done will often give a change in readings until new parts are worn in.

Sampling Examples

A new engine has a tendency to indicate high iron (Fe), lead (Pb) and copper (Cu) content during breaking in. Any left-over particles from the manufacturing process (foundry sand, machining filings, etc.) increase wear at this stage. Wear at this point should not cause any alarm as higher wear particle values nearly always show up during the breaking in period. Wait to see whether the second and third oil analyses give any indication that the particle levels have changed to any extent.

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Wear Particles

The analysis values used for comparison with each other must always come from the same engine. The results must be evaluated with the knowledge of where the particles originate from. The particle level (ppm) depends on:

- Oil and filter system total volume
- Oil volume when taking sample
- Oil consumption
- Driving conditions, fuel consumption
- Time between oil changes

Wear Particles:	Cause/Origin	Normal Levels (ppm)
Fe - Iron	Crankshaft, liners, camshaft, tappet, valve guides	<100
Pb - Lead	Big end and main crankshaft bearing shells	<20
Cu - Copper	Big end and main crankshaft bearing shells	<20
Sn - Tin	Surface layer of sliding bearings	<20
Cr - Chrome	Piston rings, valve rod	<10
Al - Aluminum	Pistons	<10
Ni - Nickel	Layer between the surface and copper layers on a sliding bearing.	<5
Si - Silicon	Sand, dirt, etc.	<20
Insolubles	Carbonized oil, combustion particles, soot	<1.8% (by weight)
Water	Coolant liquid, condensation water	<0.1% (by weight)
Fuel Dilution	Incomplete combustion	<3.0% (by weight)
Antifreeze - Glycol	High levels of sodium and boron indicate coolant leak	Should not occur
Total Base Number (TBN) ¹	TBN shows the remaining alkalines used for acid neutralization	>4.0

> = more than; < = less than

¹ According to ASTM D2896

Recommendations

To get the best service life out of the engine, use oil sampling in addition to regular

maintenance. Oil analysis should only be

supplementary to maintenance. In the maintenance program, always:

- Select high quality oils.
- Follow the oil change interval recommendations.

It is not recommended to disassemble an engine simply on the basis of the oil analysis values. Instead, use the values as an indicator that something unusual is happening. Combine the oil analysis with other diagnostic methods to further confirm what the unusual might be.

For more information about oil intervals and oil sampling evaluation, it is available in the Technical Service Information, group 175, at your Volvo Trucks dealer.

General and Check-Chart

Severe Service is defined here for vehicles that typically do maintenance depending on the accumulated engine hours rather than distance travelled. This includes applications that operate on road surfaces made of concrete, asphalt, maintained gravel, crushed rock or hard packed dirt or similar surfaces for 90% of the time, and up to 10% of the time in muddy or sandy conditions. (**If more than 10% operation in muddy or sandy conditions, adjust to a more frequent lubrication schedule.**)

Vehicles are equipped with liftable auxiliary axle(s) over 14,000 lb (6 metric tons) each. Typically, GVWR is over 80,000 lb (36 metric tons) or GCWR is over 143,000 lb (65 metric tons) or GAWR is over 46,000 lb (21 metric tons).

The service categories show maximum allowable intervals. It is very important to tailor service to the actual application. For example, if the vehicle is used off-road, driving through deep, standing water, the lubrication schedule should be changed to lubricate exposed lubrication points as often as every day.

For example, if the vehicle is used off-road, driving through deep, standing water, the lubrication schedule should be changed to lubricate exposed lubrication points as often as every day.

Off-Road Application:

Any vehicle that operates more than 10% in sandy or muddy conditions.

Heavy Haul Application:

Typical operations include grades of maximum 12%, moving heavy equipment or material at legal maximums and special permit loadings (generally greater than 110,000 lbs [49 metric tons]), high-powered engines and auxiliary gearboxes are typical, more than 30 miles between starting and stopping, may use single retarder.

Vehicle types are: Lowboy, equipment hauling, steel hauler, flatbed trailer hauling.

Heavy Construction Application:

Typical operations include grades over 20%, only use one retarder and a relatively high number of starts/stops. More than 10% operation in muddy or sandy conditions, or more than 20% off paved roads.

Vehicle types are: Concrete mixer/pumper, flatbed truck, material hauler, dumper, asphalt truck, municipal dump, block truck or crane operation.

Heavy Refuse Application:

Typical operations include grades over 20%, residential refuse and recycle pickup, commercial and industrial pickup, typically a high number of stops per mile. More than 10% operation in muddy or sandy conditions, or more than 20% off paved roads.

Vehicle types are: Rear, front or side loader, liquid waste, roll-off, recycling or residential pickup, transfer, scrap material handling, sewer/septic vacuum, and commercial pickup.

Mining Application:

Typical operations include grades of maximum 12%, moving rock, ore, gravel and material between mining sites and delivery locations, highpowered engines, 3 to 30 miles between starting and stopping, 100% loading one way and empty return, may use single retarder. 90% of operation is on highway and up to 10% in sandy or muddy conditions.

Vehicle types are: Bottom dump trailer, semi-end dump, transfer dump, hopper trailer combination, Michigan special gravel trains and frameless dumps.

Oil Field Application:

Typical operations include grades of maximum 12%, moving oil production related materials, supplies and tools between job sites or movement of processing equipment and laboratories on the job site, highpowered engines, low mileage operation, 100% loading one way and empty return, may use single retarder. 90% of operation is on highway and up to 10% in sandy or muddy conditions.

Vehicle types are: Bottom dump trailer, semi-end/transfer/frameless dumpers, hopper trailer combination and Michigan special gravel trains.

Logging Application:

Typical operations include grades of maximum 20%, moving logs, chip, and pulp between logging sites and mill, highpowered engines and retarders, 3 to 30 miles between starting and stopping, 100% loading one way and empty return. 90% of loaded operation is on highway and up to 10% in sandy or muddy conditions.

Vehicle types are: Chip hauler, log hauler/skidder, pole trailer, tractor-trailer with jeeps, Michigan special log hauler.

The table on the next page is a check-chart to keep track of performed services and can be used for planning service work also. The table is laid out with the maximum intervals in hours. There are also maximum intervals based on the calendar. Each maintenance interval should be carried out at the indicated accumulated hours or maximum every month and a half — whichever comes first.

Before putting your vehicle to work, determine what service schedule works the best for your application. The recommended schedules in the is manual are for typical applications. If the schedule does not fit your application, make modifications based on your experience of your application. Your Volvo Trucks dealer is also equipped to help you optimize the maintenance to suit your vehicle and application the best.

When the interval hours or calendar time are reached, refer to the check-sheet to see what service categories need to be done. Carry out each step described in the list for each category corresponding to that interval.

There are references in the lists to pages in this manual where more information on the maintenance point is available. However, this manual is not to be considered as a substitute for the Preventive Maintenance Service Manual. Information on ordering Technical Service Information can be found on page 172.

Severe Service Schedule for VHD-Series

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Severe Service Check-Chart

Hours	Service Interval	Hours	Service Interval	Hours	Service Interval
250	a <input type="checkbox"/>	6,250	a <input type="checkbox"/>	12,250	a <input type="checkbox"/>
500	a A <input type="checkbox"/>	6,500	a A <input type="checkbox"/>	12,500	a A <input type="checkbox"/>
750	a <input type="checkbox"/>	6,750	a <input type="checkbox"/>	12,750	a <input type="checkbox"/>
1,000	a A B <input type="checkbox"/>	7,000	a A B <input type="checkbox"/>	13,000	a A B <input type="checkbox"/>
1,250	a <input type="checkbox"/>	7,250	a <input type="checkbox"/>	13,250	a <input type="checkbox"/>
1,500	a A <input type="checkbox"/>	7,500	a A <input type="checkbox"/>	13,500	a A <input type="checkbox"/>
1,750	a <input type="checkbox"/>	7,750	a <input type="checkbox"/>	13,750	a <input type="checkbox"/>
2,000	a A B C <input type="checkbox"/>	8,000	a A B C <input type="checkbox"/>	14,000	a A B C <input type="checkbox"/>
2,250	a <input type="checkbox"/>	8,250	a <input type="checkbox"/>	14,250	a <input type="checkbox"/>
2,500	a A <input type="checkbox"/>	8,500	a A <input type="checkbox"/>	14,500	a A <input type="checkbox"/>
2,750	a <input type="checkbox"/>	8,750	a <input type="checkbox"/>	14,750	a <input type="checkbox"/>
3,000	a A B <input type="checkbox"/>	9,000	a A B <input type="checkbox"/>	15,000	a A B <input type="checkbox"/>
3,250	a <input type="checkbox"/>	9,250	a <input type="checkbox"/>	15,250	a <input type="checkbox"/>
3,500	a A <input type="checkbox"/>	9,500	a A <input type="checkbox"/>	15,500	a A <input type="checkbox"/>
3,750	a <input type="checkbox"/>	9,750	a <input type="checkbox"/>	15,750	a <input type="checkbox"/>
4,000	a A B C <input type="checkbox"/>	10,000	a A B C <input type="checkbox"/>	16,000	a A B C <input type="checkbox"/>
4,250	a <input type="checkbox"/>	10,250	a <input type="checkbox"/>	16,250	a <input type="checkbox"/>
4,500	a A <input type="checkbox"/>	10,500	a A <input type="checkbox"/>	16,500	a A <input type="checkbox"/>
4,750	a <input type="checkbox"/>	10,750	a <input type="checkbox"/>	16,750	a <input type="checkbox"/>
5,000	a A B <input type="checkbox"/>	11,000	a A B <input type="checkbox"/>	17,000	a A B <input type="checkbox"/>
5,250	a <input type="checkbox"/>	11,250	a <input type="checkbox"/>	17,250	a <input type="checkbox"/>
5,500	a A <input type="checkbox"/>	11,500	a A <input type="checkbox"/>	17,500	a A <input type="checkbox"/>
5,750	a <input type="checkbox"/>	11,750	a <input type="checkbox"/>	17,750	a <input type="checkbox"/>
6,000	a A B C <input type="checkbox"/>	12,00	a A B C <input type="checkbox"/>	18,000	a A B C <input type="checkbox"/>

Maintenance Categories

Category a: Every 250 Hours or 1 1/2 Months

(Whichever comes first)

- 1 Perform the daily checks as described in the beginning of the vehicle Operator's Manual.
- 2 Change engine oil. (See page 116.)
- 3 Change oil filters, both full-flow and bypass. (See page 117.)
- 4 Lubricate the chassis according to the lubrication chart on page 163.



CAUTION

If the vehicle is driven in extremely severe road or off-road conditions in salt, snow, deep water and/or mud, adjust the lubrication schedule to as often as once per day. See the lubrication chart notes for more information.

- 5 Inspect all steps and grabhandles. Make sure they are properly fastened and that there are no signs of breakage.

Category A: Every 500 Hours or 3 Months

(Whichever comes first)

- 1 Clean engine and chassis before inspection.
- 2 Do the maintenance points as described under Category a.
- 3 Change primary (see page 129) and secondary (see page 131) fuel filters.
- 4 Visually inspect the component and all fluid pipes, hoses, seals, gaskets and connection points on engine, transmission and rear axle(s) for exterior signs of leakage.
- 5 If using standard antifreeze in the engine cooling system, check the SCA level of the coolant. (See page 45.)
- 6 Check the amount of fluid in the air tanks. (See page 145.)
- 7 Check all instrument telltales for function. (See the Operator's Manual for function description.)
- 8 Start the engine and check the starter motor function and that the engine starts normally.
- 9 Check operation of all interior lights.
- 10 Test the function of the horn(s).
- 11 Check the function of the low pressure warning switches in the air system. (See page 148.)
- 12 Test air compressor cut-in and cut-out pressure. (See the Operator's Manual.)
- 13 Check the parking brake function. Check clutch operation and pedal free play. Adjust if necessary.

- 14 Check wiper blades and wiper/washer operation.
- 15 Check operation of heater, defroster and/or air conditioner.
- 16 Using the tachometer, check and record the high and low engine idle speeds.
- 17 Using the oil gauge, check and record the high and low engine oil pressures.
- 18 Check the engine for excessive smoke, surging, misfiring or any abnormal noise indicating malfunction.
- 19 Check steering for excessive play. Check steering for unusual binding or free spots. (See page 143.)
- 20 Check condition of cab interior, floor, seats and panels.
- 21 Inspect the safety belt and mounting hardware for condition. (See the Operator's Manual)
- 22 Check that all safety equipment are present and in good working order.
- 23 Check operation of all windows and doors.
- 24 Check all glass, mirrors and mirror brackets.
- 25 Check that inspection stickers and licences are current.
- 26 Check the cab ventilation filters. Change if necessary.

Exterior

- 27 Turn on and check all exterior lights. Inspect exposed wiring.
- 28 Check the hood or cab lock-down latches for wear and alignment.
- 29 Check that the cab mounts are securely bolted to the frame and cab. Check the cab suspension for function.
- 30 Check condition of air hoses and pipes. (See page 148.)
- 31 Check frame rails for cracks and damage. Note if there are any distortions.
- 32 Check transmission mounting.
- 33 Check transmission rear bearing for abnormal clearance. Check transmission top cover and shift tower for loose or missing bolts.
- 34 Check rear axle mounting and U-bolts. (See page 155.) Check axle flange nuts. Check axle alignment.
- 35 Check torque on carrier assembly mounting bolts.
- 36 Check pinion bearing for wear.

NOTE! The Volvo forward tandem axle pinion is designed with a large bearing clearance.
- 37 Check the presence and condition of mud guards or flaps. Check condition of brackets and hardware.
- 38 Check body-to-frame or fifth wheel mounting.
- 39 Check the fifth wheel latch operation and wear in jaw or pivot points.
- 40 Check condition and mounting of air deflectors.

- 41 Check condition of paint and overall appearance of vehicle.

Fuel System

- 42 Inspect fuel tanks for damage, leaks or corrosion.
- 43 Drain the fuel separator and clean the view glass. (See page 128.)
- 44 Inspect the fuel lines for signs of wear or chafing.

Electrical

- 45 Inspect battery mounting for proper placement, secureness and free from corrosion. Inspect the cables for proper length, undamaged insulation and broken wire strands. Check terminal ends for secureness and cracks. (See page 149.)
- 46 Test the batteries (Maintenance-free batteries: check the charging indicator to determine if the battery is in need of charging.)

Brakes

- 47 Check the air dryer function. Check for oil in the dryer discharge. (See page 145.)
- 48 Inspect all air lines for routing, mounting, chafing and signs of leaks. Check all brake valves for secure mounting and audible leaks.
- 49 Check that the dual brake system works properly. (See page 147.)
- 50 Check slack adjuster operation, mounting and adjustment. (See page 146.)

Steering and Suspension

- 51 Check condition of air springs (if applicable).

Wheels and Tires

- 52 Check the tightness of all wheel nuts with a torque wrench. Check the tire tread depth. (See page 152.)
- 53 Inspect each tire for unusual wear patterns. (See page 153.)
- 54 Check tire inflation. Check for leaks in the valves. (See page 154.)

Engine Compartment

- 55 Visually inspect the component and all fluid pipes, hoses, seals, gaskets and connection points on engine, transmission and rear axle(s) for exterior signs of leakage.
- 56 Inspect all hoses for cracking, cuts, tightness, routing, chafing and evidence of leaks. Inspect steel-braided lines for wear and rust. Inspect clamps for tightness and insulation.
- 57 Check all fluid levels.
- 58 Clean the radiator and charge air cooler. (See page 127.)
- 59 Inspect radiator shrouds for secureness and evidence of fan contact.
- 60 Inspect all drive belts on the engine for cuts, wear, weathering, proper tension and alignment. Check the function of the belt tensioner or measure the belt tension. (See page 120.)
- 61 Test fuel pressure, relief valve pressure and feed pressure. Inspect fuel pump for secure mountings.

- 62 Check the engine air filter restriction gauge. Change the filter if necessary. (See page 119.)
- 63 Check engine mounts.
- 64 Check crankcase breather or tube. (See page 118.)

Road Test

- 65 Operate the clutch several times. Check for smooth engagement and operation of clutch brake.
- 66 While driving, apply brakes and check for even stopping and quick release.
- 67 Check the ABS function.
- 68 Check engine controls and performance.
- 69 Shifting through the gears, check the transmission for smoothness of operation.
- 70 Listen for unusual noises. Make sure the vehicle is riding smoothly and is

free from roughness or excess vibration.

- 71 Check for excessive free play in the steering wheel. Turning operation should be smooth and free of rough spots. Check for vibration in the steering wheel or column.
- 72 Check exhaust brake and/or engine brake operation. Brake should engage/disengage as the pedal is applied/released
- 73 If equipped, check the cruise control for proper function.

After Road Test

- 74 Check all major components for fluid leaks.
- 75 Install new maintenance sticker (if applicable).

Category B: Every 1,000 Hours or 6 Months

(Whichever comes first)

- 1 Do the maintenance points as described under Category a and Category A.
- 2 Check the frame for lose bolts. If necessary, tighten M14 bolts to a torque of 150 ± 24 ft-lb (200 ± 33 Nm).
- 3 Drain water from the fuel tank. (See page 138.)
- 4 Remove corrosion from cable terminals and battery posts. Spray the area with a corrosion preventive.
- 5 Make sure all ground connections are secure. Check battery terminal connections.
- 6 On engines with intake air preheater: test the function.
- 7 Measure and record brake lining thickness. (See page 146.)
- 8 Check wheel brake components for wear and general condition.
- 9 Check front spring, shackles, brackets and U-bolts. (See page 155.)
- 10 Check the steering gear mounting to the frame. Check pitman arm mounting for secureness and wear. Check the steering linkage for wear.
- 11 Check the steering knuckle bearings for wear.
- 12 Inspect level and condition of power steering oil. (See page 143.)
- 13 Check front and rear wheel bearings. (See page 154.)
- 14 Check rear suspension, springs, mounts and U-bolts. (See page 155.)
- 15 Check shock absorber mountings and for signs of leakage.
- 16 Examine all rims for cracks. Inspect for rust streaks around the nuts. (See page 152.)
- 17 Inspect coolant pump, engine fan and fan hub for wear. Test the function of the fan engagement.
- 18 Pressure check cooling system. Inspect for leaks in the cooling system.
- 19 Inspect vibration damper for leakage, wobble, swelling or deformation.
- 20 Check engine valve clearance after the first 6 months. Check every 12 months thereafter. Adjust if necessary.
- 21 Check the turbocharger mounting. Inspect for leakage. Inspect impeller axle for looseness and end play. Inspect the turbocharger for internal oil leaks.
- 22 Examine air intake piping from the air cleaner to the turbocharger. Check for loose clamps, cracks, punctures or tears.
- 23 Disconnect and inspect the inside of air intake pipes for buildup or deposits of foreign material. If deposits are found, clean and reassemble.
- 24 Inspect the exhaust system for signs of leakage. Check all clamps and brackets for cracks and looseness.
- 25 Inspect air condition compressor brackets and mounting hardware for cracks or looseness.

Category C: Additional Service Points

- 1 Do the maintenance points as described under Category a, A and B.
- 2 Change standard antifreeze every 4,000 hours. (See page 122 or page 124.)
- 3 Extended life antifreeze should have an extender package added at 3,000 hours and then changed at 6,000 hours. (See page 122 or page 124.)
- 4 Check coolant thermostat function every 2,000 hours.
- 5 Pressure test injectors or adjust height:
 - Volvo D7: Every 12 months or 2,000 hours.
 - Volvo D12: No recommendation.
 - Cummins: Every 21 months or 3,800 hours.
 - Detroit Diesel: Every 21 months or 3,800 hours
- 6 Check and adjust valves on the engine:
 - Volvo: Every 12 months or 2,000 hours.
 - Cummins: Every 21 months or 3,800 hours.
 - Detroit Diesel: Every 21 months or 3,800 hours.
- 7 Change power steering filter annually. (See page 143.)

General and Check-Chart

Heavy-Duty Service is defined here for vehicles that typically travel an annual distance of maximum 65,000 miles (105,000 km) per year or less and operate under Heavy-Duty conditions. This include applications that travel primarily on freeways with some or frequent stop-and-go driving. Typical applications include: local transport with occasional freeway travel and a majority of stop-and-go driving.

Vehicles may be equipped with liftable auxiliary axle(s) less than 14,000 lb (6 metric tons) each. Typically, GVWR is less than 80,000 lb (36 metric tons) or GCWR less than 143,000 lb (50 metric tons) or GAWR less than 46,000 lb (21 metric tons).

The service categories show maximum allowable intervals. It is very important to tailor the service to the actual application. Adjust the recommended service intervals to your operation.

For example, if the vehicle is used off-road, driving through deep, standing water, the lubrication schedule should be changed to lubricate exposed lubrication points as often as every day.

Construction Application:

Typical operations include movement of material to and from job sites, grades less than 20%, only use one retarder and a relatively high number of starts/stops. Operation on road surfaces made of concrete, asphalt, maintained gravel, crushed rock and hard packed dirt or other similar surface for 90% of the time and up to 10% operation in muddy or sandy conditions.

Vehicle types are: Concrete mixer/pumper, landscaping truck, flatbed truck, material hauler, dumper, asphalt truck, municipal dump, block truck, tank truck, crane operation, utility truck or snowplow/blower.

Refuse Application:

Typical operations include grades less than 12%, residential refuse and recycle pickup, commercial and industrial pickup, typically a high number of stops per mile, 10 miles or greater per trip. Operation on road surfaces made of concrete, asphalt, maintained gravel, crushed rock and hard packed dirt or other similar surface for 90% of the time and up to 10% operation in muddy or sandy conditions.

Vehicle types are: Rear, front or side loader, liquid waste, roll-off, recycling or residential pickup, transfer, scrap material handling, sewer/septic vacuum, and commercial pickup.

Heavy Line / Long Haul Application:

Typical operations include grades of maximum 12%, moving different types of freight in high mileage operations more than 65,000 miles (105,000 km) per year. Operation should be on normal highway surfaces of good to excellent concrete or asphalt. Greater than 30 miles between starting and stopping.

Vehicle types are: trailer combinations and straight trucks, double trailers, triple trailers, tankers.

Fire Service Application:

Typical operations include fighting structural fires on on/off highways with grades of maximum 20%. Low mileage operation, 3 miles or less between starting and stopping, high horsepower engines are typical. Typically, GCWR for this application is less than 88,000 lb (40 metric tons). Operation on road surfaces made of concrete, asphalt, maintained gravel, crushed rock and hard packed dirt or similar surfaces.

Vehicle types are: Ambulance, aerial platform or ladder truck, Tanker truck, pumper truck, emergency service or utility body.

Rescue Service Application:

Typical operations include specialized vehicles for rapid acceleration to crash sites away from fire hydrant hookups, grades of maximum 20%. Low mileage operation, 3 miles or less between starting and stopping, high horsepower engines are typical. Typically, GCWR for this application is less than 88,000 lb (40 metric tons). Operation on road surfaces made of concrete, asphalt, maintained gravel, crushed rock and hard packed dirt or other similar surface

Vehicle types are: Airport fire rescue, rapid intervention, wrecker, crash fire rescue or emergency service.

The table on the next page is a check-chart to keep track of performed services and can be used for planning service work also. The table is laid out with the maximum intervals in distance. There are also maximum intervals based on the calendar. Each maintenance interval should be carried out at the indicated accumulated mileage or maximum every fourth month — whichever comes first.

Before putting your vehicle to work, determine what service schedule works the best for your application. The recommended schedules in the is manual are for typical applications. If the schedule does not fit your application, make modifications based on your experience of your application. Your Volvo Trucks dealer is also equipped to help you optimize the maintenance to suit your vehicle and application the best.

When the interval mileage or calendar time are reached, refer to the check-sheet to see what service categories need to be done. Carry out each step described in the list for each category corresponding to that interval.

There are references in the lists to pages in this manual where more information on the maintenance point is available. However, this manual is not to be considered as a substitute for the Preventive Maintenance Service Manual. Information on ordering Technical Service Information can be found on page 172.

Check-Chart for Vehicles with D7 Engine

miles (km) X 1,000	Service Interval	miles (km) X 1,000	Service Interval	miles (km) X 1,000	Service Interval
12.5 (20)	A <input type="checkbox"/>	212.5 (340)	A <input type="checkbox"/>	412.5 (660)	A B C <input type="checkbox"/>
25 (40)	A <input type="checkbox"/>	225 (360)	A B C <input type="checkbox"/>	425 (680)	A <input type="checkbox"/>
37.5 (60)	A B C <input type="checkbox"/>	237.5 (380)	A <input type="checkbox"/>	437.5 (700)	A <input type="checkbox"/>
50 (80)	A <input type="checkbox"/>	250 (400)	A <input type="checkbox"/>	450 (720)	A B C <input type="checkbox"/>
62.5 (100)	A <input type="checkbox"/>	262.5 (420)	A B C <input type="checkbox"/>	462.5 (740)	A <input type="checkbox"/>
75 (120)	A B C <input type="checkbox"/>	275 (440)	A <input type="checkbox"/>	475 (760)	A <input type="checkbox"/>
87.5 (140)	A <input type="checkbox"/>	287.5 (460)	A <input type="checkbox"/>	487.5 (780)	A B C <input type="checkbox"/>
100 (160)	A <input type="checkbox"/>	300 (480)	A B C <input type="checkbox"/>	500 (800)	A <input type="checkbox"/>
112.5 (180)	A B C <input type="checkbox"/>	312.5 (500)	A <input type="checkbox"/>	512.5 (820)	A <input type="checkbox"/>
125 (200)	A <input type="checkbox"/>	325 (520)	A <input type="checkbox"/>	525 (840)	A B C <input type="checkbox"/>
137.5 (220)	A <input type="checkbox"/>	337.5 (540)	A B C <input type="checkbox"/>	537.5 (860)	A <input type="checkbox"/>
150 (240)	A B C <input type="checkbox"/>	350 (560)	A <input type="checkbox"/>	550 (880)	A <input type="checkbox"/>
162.5 (260)	A <input type="checkbox"/>	362.5 (580)	A <input type="checkbox"/>	562.7 (900)	A B C <input type="checkbox"/>
175 (280)	A <input type="checkbox"/>	375 (600)	A B C <input type="checkbox"/>	575 (920)	A <input type="checkbox"/>
187.5 (300)	A B C <input type="checkbox"/>	387.5 (620)	A <input type="checkbox"/>	587.5 (940)	A <input type="checkbox"/>
200 (320)	A <input type="checkbox"/>	400 (640)	A <input type="checkbox"/>	600 (960)	A B C <input type="checkbox"/>

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Check-Chart for Vehicles with D12, Cummins or Detroit Diesel Engines

miles (km) X 1,000	Service Interval	miles (km) X 1,000	Service Interval	miles (km) X 1,000	Service Interval
15 (24)	A <input type="checkbox"/>	255 (408)	A <input type="checkbox"/>	495 (792)	A B C <input type="checkbox"/>
30 (48)	A <input type="checkbox"/>	270 (432)	A B C <input type="checkbox"/>	510 (816)	A <input type="checkbox"/>
45 (72)	A B C <input type="checkbox"/>	285 (456)	A <input type="checkbox"/>	525 (830)	A <input type="checkbox"/>
60 (96)	A <input type="checkbox"/>	300 (480)	A <input type="checkbox"/>	540 (864)	A B C <input type="checkbox"/>
75 (120)	A <input type="checkbox"/>	315 (504)	A B C <input type="checkbox"/>	555 (888)	A <input type="checkbox"/>
90 (144)	A B C <input type="checkbox"/>	330 (528)	A <input type="checkbox"/>	570 (912)	A <input type="checkbox"/>
105 (168)	A <input type="checkbox"/>	345 (552)	A <input type="checkbox"/>	585 (936)	A B C <input type="checkbox"/>
120 (192)	A <input type="checkbox"/>	360 (576)	A B C <input type="checkbox"/>	600 (960)	A <input type="checkbox"/>
135 (216)	A B C <input type="checkbox"/>	375 (600)	A <input type="checkbox"/>	615 (984)	A <input type="checkbox"/>
150 (240)	A <input type="checkbox"/>	390 (624)	A <input type="checkbox"/>	630 (1,008)	A B C <input type="checkbox"/>
165 (264)	A <input type="checkbox"/>	405 (648)	A B C <input type="checkbox"/>	645 (1,032)	A <input type="checkbox"/>
180 (288)	A B C <input type="checkbox"/>	420 (672)	A <input type="checkbox"/>	660 (1,056)	A <input type="checkbox"/>
195 (312)	A <input type="checkbox"/>	435 (696)	A <input type="checkbox"/>	675 (1,080)	A B C <input type="checkbox"/>
210 (336)	A <input type="checkbox"/>	450 (720)	A B C <input type="checkbox"/>	690 (1,104)	A <input type="checkbox"/>
225 (360)	A B C <input type="checkbox"/>	465 (744)	A <input type="checkbox"/>	705 (1,128)	A <input type="checkbox"/>
240 (384)	A <input type="checkbox"/>	480 (768)	A <input type="checkbox"/>	720 (1,152)	A B C <input type="checkbox"/>

Maintenance Categories

Category A:

Every 12,000 miles (19,000 km) or 4 Months

(For Vehicles with D7 Engine Using VDS-2 plus CH-4 oil)

Every 15,000 miles (24,000 km) or 4 Months

(For Vehicles with D12 Using VDS-2 plus CH-4 oil, Cummins or Detroit Diesel Engine)

(Whichever comes first)

- 1 Perform the daily checks as described in the beginning of the vehicle Operator's Manual.
- 2 Change engine oil. (See page 116.)
- 3 Change oil filters, both full-flow and bypass. (See page 117.)
- 4 Lubricate the chassis according to the lubrication chart on page 162.
- 5 Look for signs of fluid leaks as the vehicle is approached.
- 6 Clean the vehicle if necessary. All areas that need close inspection must be clean.
- 7 Check that all appropriate licences and stickers are in place and that they are valid.
- 8 Check all telltale and warning indicators in instrument cluster. (See Operator's Manual.)
- 9 Check lights before going on road test.

Road Test

- 10 Start engine; check starter motor.
- 11 Operate the clutch several times. Check for smooth engagement and operation of clutch brake.
- 12 Check parking brake hold.
- 13 While driving, apply brakes and check for even stopping and quick release. Check ABS function.
- 14 Check engine controls and performance.
- 15 Check exhaust brake and/or engine brake operation. Brake should engage/disengage as the pedal is applied/released.
- 16 Shifting through the gears, check transmission for smoothness of operation.
- 17 Check cruise control, if equipped.
- 18 Check for excessive free play in the steering wheel. Turning operation should be smooth and free of rough spots. Check for vibration in the steering wheel or column.
- 19 Listen for unusual noises. Make sure vehicle is riding smoothly; free from roughness or excessive vibration.
- 20 Check instrument and gauge operation.
- 21 Check heater and air conditioning.

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In the Shop Yard

- 22 Check function of pneumatic controls.
- 23 Check steering column adjustment function, if equipped.
- 24 Check horns.
- 25 Record engine low idle.
- 26 Check low air warning switches. (See page 148.)
- 27 Check manifold dash valve function.
- 28 Check compressor loading function.
- 29 Check air brake system for leaks.
- 30 Check wipers and washer function.
- 31 Check door switches and controls for function.
- 32 Check the radio function.
- 33 Check all interior lights.
- 34 Check interior; upholstery and glass.
- 35 Check safety belts. (See Operator's Manual.)
- 36 Check driver and passenger seats.
- 37 Open hood, check lock function.

Exterior

- 38 Inspect steps and grabhandles. Make sure they are properly fastened and that there are no signs of breakage.
- 39 Check pedal carrier play.
- 40 Check door alignment, weather stripping and mirrors.
- 41 Check all safety equipment.
- 42 Check all lamps, lights, wires and trailer light cord for function.
- 43 Check trailer air hoses, exhaust stack, deck plates and air fairings.
- 44 Check frame and all brackets for loose bolts and signs of cracks. If necessary, tighten M14 bolts to a torque of 150 ± 24 ft-lb (200 ± 33 Nm).
- 45 Check hood condition and its restraints and splash shields.
- 46 Check wiper arms and blades.
- 47 Check clutch slave cylinder for leaks, wear and adjustment.
- 48 Check around transmission for signs of leaks and wear.
- 49 Check under cab; exhaust flex line, fluid and electric lines for wear or leaks. Check cab suspension.
- 50 Check rear axle for loose bolts and leaks. Check brackets for shock absorbers, brake chambers and springs for loose bolts or cracks. Check spring U-bolt nut tightening torque. (See page 155.)

- 51 Check rear suspension torque rods, hangers and brackets for looseness or cracks. Check springs for broken leaves or wear and cracks on air springs.
- 52 Inspect rear shock absorbers for leaks.
- 53 Check rear tandem axle components as the front tandem axle. Check interaxle driveshaft.
- 54 Check fifth wheel for loose bolts. Check lock mechanism wear with a gauge. Check slide mechanism for function and wear (if equipped).

Fuel System

- 55 Check fuel tank(s) for rotation, leaks and damage. Check J-brackets.
- 56 Check fuel lines for routing, wear and leaks.

Wheels and Hubs

- 57 Check wheel rims for signs of cracks. Check tighten wheel nuts. (See page 152.)
- 58 Check tire pressure. Check tire tread for unusual wear pattern. Measure tread depth. (See page 153.)
- 59 Check wheel hubs for leaks and proper oil level. (See page 154.)
- 60 Check wheel bearing clearance.

Brakes

- 61 Drain air tanks. If a lot of condensate is drained, check air dryer. (See page 145.)
- 62 Measure thickness of brake linings. (See page 146.)
- 63 Check slack adjuster throw and operation. (See page 146.)
- 64 Check dual brake system operation (tank check valves). (See page 147.)
- 65 Inspect air tubing for routing and wear. (See page 148.)

Steering and Suspension

- 66 Check steering wheel play. (See page 143.)
- 67 Check front springs and fasteners. Check tighten the spring U-bolt nuts. (See page 155.)
- 68 Check front shock absorbers for leaks.
- 69 Check steering gear for leaks.
- 70 Check pitman arm for signs of looseness in fasteners.
- 71 Check steering shaft, drag link and tie-rod for damage and wear.

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Engine Compartment

- 72 Visually inspect the component and all fluid pipes, hoses, seals, gaskets and connection points on engine, transmission and rear axle(s) for exterior signs of leakage.
- 73 Inspect all hoses for cracking, cuts, tightness, routing, chafing and evidence of leaks. Inspect steel-braided lines for wear and rust. Inspect clamps for tightness and insulation.
- 74 Check radiator package mounts and shroud molding. Clean front of radiator if necessary. (See page 127.)
- 75 Inspect all drive belts on the engine for cuts, wear, weathering, proper tension and alignment. Check the function of the belt tensioner or measure the belt tension. (See page 120.)
- 76 Test coolant. Adjust additives as necessary, change filter if necessary. If equipped with long life coolant, do not add additives. (See page 45.)
- 77 Change primary (see page 129) and secondary (see page 131) fuel filters as recommended.
- 78 Check clutch fluid level.
- 79 Check windshield washer fluid.
- 80 Check engine air filter gauge. Change filter if necessary. (See page 119.)
- 81 Check around turbo for signs of exhaust or oil leakage. Check bolts for looseness.
- 82 Check front engine mounts for wear or cracks.
- 83 Check A/C compressor mounts for secureness and cracks.
- 84 Check A/C receiver/dryer for signs of moisture in the system. Check the A/C diagnostic module codes.
- 85 Check air compressor mounts for secureness and cracks.

Category B: Annually

- 1 Check headlight aim and adjust if necessary.
- 2 Remove wheels and brake drums on all wheels. Inspect all wheel brake components and parts for signs of wear, warping and cracks.
- 3 Check function of tractor protection valve.
- 4 Check for spring pin wear. (See page 156.)
- 5 Measure wear in steering knuckles.
- 6 Measure wear in steering linkage.
- 7 Check wheel toe-in.
- 8 Check tandem axle alignment.
- 9 Pressure test cooling system and check for leaks and proper relief valve pressure.
- 10 Remove fan belts and check all hubs and pulleys for signs of wear and cracks. Inspect fan for cracks and damage. Inspect water pump for wear and leaks.
- 11 Change power steering filter. (See page 143.)
- 12 Remove the cab fresh air filter after 60,000 miles (96,000 km) or at least once per year and clean in a soap solution. Dry and reinstall. Change filter after third use or maximum 240,000 miles (385,000 km).
- 13 Remove inlet air hose to the turbo. Check turbo shaft for wear. Check hose and inside turbo for signs of oil leakage past the shaft seals.
- 14 Check starter motor current draw. Inspect mounting for looseness and cracks. Check wires for wear and fraying and terminal tightness.
- 15 Test alternator voltage and ampere output. Check mounts for secureness and cracks.
- 16 Check battery hold-downs for proper placement and tightness. Check all wire terminal condition and tightness. Clean all terminals and apply corrosion preventive.
- 17 Check power and ground studs from batteries and also in engine compartment.
- 18 If equipped with a Volvo engine, check function of engine preheater.

94 Heavy-Duty Service Schedule for VHD-Series

Category C: Additional Service Points

- 1 Do the maintenance points as described under Categories A and B.
- 2 Standard antifreeze should be changed every 4,000 hours. (See page 122 or page 124.)
- 3 Extended life antifreeze should have an extender package added at 3,000 hours and then changed at 6,000 hours. (See page 122 or page 124.)
- 4 Check coolant thermostat function every 2,000 hours.
- 5 Pressure test injectors or adjust height:
 - Volvo D7: Every 12 months or 2,000 hours.
 - Volvo D12: No recommendation.
 - Cummins: Every 21 months or 3,800 hours.
 - Detroit Diesel: Every 21 months or 3,800 hours
- 6 Check and adjust valves on the engine:
 - Volvo: Every 12 months or 2,000 hours.
 - Cummins: Every 21 months or 3,800 hours.
 - Detroit Diesel: Every 21 months or 3,800 hours.

Engine Maintenance

Exhaust Emissions

General

USA

The Federal Clean Air Act, Section 203 (a) (3), states the following concerning the removal of air pollution control devices or modification of a certified engine to a non-certified configuration:

“The following acts and the causing thereof are prohibited:

(3) For any person to remove or render inoperative any device or element of design installed on or in a motor vehicle or motor vehicle engine in compliance with regulations under this part prior to its sale and delivery to the ultimate purchaser, or for any manufacturer or dealer knowingly to remove or render inoperative any such design after sale and delivery to the ultimate purchaser.”

Specifically, please note that no person may make such changes prior to the sale and

Canada

The same conditions that apply in the USA apply to Canada, with one exception. After the vehicle is sold to a retail customer, that is, the end user, the jurisdiction controlling the emission control devices becomes the province in which the vehicle is licensed. No changes should be made that render any or all of the devices inoperative.

Should the owner/operator wish to make any changes to the emission control devices, check with the provincial authority before making any such changes.

delivery of the vehicle to the ultimate purchaser, and, in addition, no manufacturer or dealer may make take such action after sale and delivery of the vehicle to the ultimate purchaser. The law provides a penalty of up to \$10,000 for each violation.

Modifications, such as reprogramming of the fuel system so the engine will exceed the certified horsepower or torque, or removing the mufflers are examples of illegal changes.

Changes should not be made to a certified engine that would result in an engine that does not match the configuration of an engine model that is currently certified to meet Federal Standards.

Mexico

The same conditions that apply in the USA apply to Mexico. Refer to the Mexican Federal Law for Emission Control which adheres to EPA regulations. No changes should be made that render any or all of the emissions control devices inoperative.

Should the owner/operator wish to make any changes to the emission control devices, check with the state authority before making any such changes.

California Emission Control Warranty Statement

YOUR WARRANTY RIGHTS AND OBLIGATIONS

The California Air Resources Board and Volvo Trucks North America , Inc. (VTNA) are pleased to explain the emission control system warranty on your vehicle. In California, new motor vehicles must be designed, built and equipped to meet the State's stringent anti-smog standards. Volvo Trucks North America, Inc. must warrant the emission control system on your vehicle for the periods of time listed listed below provided there has been no abuse, neglect or improper maintenance of your vehicle.

Your emission control system may include parts such as carburetor or fuel injection system and engine computer. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, Volvo Trucks North America, Inc. will repair your vehicle at no cost to you including diagnosis, parts and labor.

MANUFACTURER'S WARRANTY COVERAGE

This warranty is applicable for a period of five years, 100,000 miles or 3,000 hours of operation, whichever first occurs. If an emission-related part of your vehicle is defective, the part will be repaired or replaced by Volvo Trucks North America, Inc.

This is your emission control system DEFECTS WARRANTY.

OWNER'S WARRANTY RESPONSIBILITIES

As the vehicle owner, you are responsible for the performance of the required maintenance listed in your owner's manual. Volvo Trucks North America, Inc. recommends that you retain all receipts covering maintenance on your truck but Volvo Trucks North America, Inc. cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

You are responsible for presenting your vehicle to a Volvo Trucks North America, Inc. dealer as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

As the vehicle owner, you should also be aware that Volvo Trucks North America, Inc. may deny you warranty coverage if your vehicle or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

If you have any questions regarding your warranty rights and responsibilities, you should contact Volvo Trucks North America, Inc., Warranty Administration, (336) 393-2000 or the California Air Resources Board at 9480 Telstar Avenue, El Monte, CA 91731.

EMISSION CONTROL SYSTEM WARRANTY

Volvo Trucks North America, Inc. WARRANTS TO THE ORIGINAL OWNER, AND EACH SUBSEQUENT OWNER, OF A NEW TRUCK POWERED BY A VOLVO DIESEL ENGINE THAT THE EMISSION CONTROL SYSTEM OF YOUR TRUCK:

- 1 Is designed, built and equipped so as to conform at the time of sale to all regulations of the U.S. Environmental Protection Agency and the California California Air Resources Board applicable at the time of the manufacture; and
- 2 Is free from defects in material and workmanship which will cause the emission control components not to function as designed for a period of use of 5 years or 100,000 miles or 3,000 hours of engine operation, whichever comes first.

The 5 years/100,000 miles/3,000 hour warranty period shall begin on the date the vehicle is first delivered to the first retail purchaser or if the vehicle is placed in service as a demonstrator company vehicle prior to the sale at retail, on the date the vehicle is the first placed in service.

The emission control system of your new Volvo engine was designed, built and tested using genuine Volvo parts, and the engine is certified as being in conformity with Federal and California emission control regulations. Accordingly, it is recommended that any replacement parts used for maintenance, replacement or repair without invalidating this warranty; the cost of such services or parts, however, will not be covered under the warranty except in an emergency situation. A part not being available or a repair not being completed within 30 days also constitutes an emergency.

Use of replacement parts which are not of equivalent quality may impair the effectiveness of emission control systems. If other than Volvo parts are used for maintenance, owner should obtain assurances that such parts are warranted by their manufacturer to be equivalent to genuine Volvo parts. However, the use of other than Volvo replacement parts does not invalidate the warranty on other components, unless such parts cause damage to warranted parts.

Repairs and service covered by the warranty will be performed by an authorized Volvo Trucks North America, Inc. dealer at his place of business with no charge for parts or labor (including diagnosis) using Volvo parts for the emission control system, that requires replacement and is covered by the warranty and found defective. In case of an emergency, where an authorized Volvo Trucks North America, Inc. dealer is not available, repairs may be performed at any available service establishment or by the owner, using any equivalent replacement parts and Volvo Trucks North America, Inc. will reimburse the owner for such repairs (including diagnosis) not to exceed Volvo Trucks North America, Inc.'s suggested retail price for the warranted parts and the labor rate appropriate for the geographical area and the tasks performed.

Replaced parts and paid invoices must be presented to a Volvo Trucks North America, Inc. dealer for reimbursement.

The emissions control parts covered by this Emission Control System Warranty are listed under "What Is Covered by the Emissions Warranty." You are responsible for the performance of all required maintenance on your new Volvo engine, including maintenance or repairs needed due to severe operating conditions. Volvo Trucks North America, Inc. will not deny a warranty claim solely because you have no record of maintenance. However, Volvo Trucks North America, Inc. may deny a warranty claim if your failure to perform required maintenance resulted in the failure of a warranted part. Receipts covering the performance of regular maintenance should be retained in the event questions arise concerning maintenance. The receipts should be transferred to each subsequent owner of the vehicle with the emission warranted engine.

CUSTOMER ASSISTANCE

Volvo Trucks North America, Inc. wishes to help to assure that the Emission Control System Warranty is properly administered. In the event that you do not receive the warranty service to which you believe you are entitled under the Emission Control System Warranty, you should contact Volvo Trucks North America, Inc. Warranty Administration, (336) 393-2000. The address and telephone number of each Regional Office is in your vehicle owner's manual. If you need additional assistance or information concerning the Emission Control System Warranty, contact: Volvo Trucks North America, Inc., Warranty Administration, (336) 393-2000.

WHAT IS NOT COVERED BY THE EMISSION WARRANTY

This warranty does not cover:

- 1 Malfunctions in any part caused by any of the following: misuse, abuse, improper adjustments unless performed by a Volvo Trucks North America, Inc. dealer, modifications, alterations, tampering, disconnection, improper or inadequate maintenance, or use of fuels not recommended for the engine as described in the owner's manual.
- 2 Damage resulting from accident, acts of nature or other events beyond the control of Volvo Trucks North America, Inc.
- 3 The replacement of expendable maintenance items such as filters, hoses, belts, oil, thermostat and coolant made in connection with scheduled maintenance services once these parts have been replaced. Any parts replaced under warranty before the first required replacement point are warranted for the remainder of the warranty period.
- 4 Replacement items which are not genuine Volvo parts or not authorized by Volvo Trucks North America, Inc.
- 5 Loss of time, inconvenience, loss of use of vehicle or engine, or commercial loss.
- 6 Any vehicle on which the odometer or hourmeter has been disconnected or the mileage (or hours) has been altered so the actual usage cannot be readily be determined.
- 7 Any vehicle registered and normally operated outside the United States.

WHAT IS COVERED BY THE EMISSION WARRANTY

The following is a list of the items that are considered a part of the Emission Control Systems and are covered by the Emission Warranty when installed as original equipment by Volvo Trucks North America, Inc. on vehicles which were built to conform to Environmental Protection Agency and California Air Resources Board regulations

IMPORTANT - This may not include expendable maintenance items. Emission related parts requiring scheduled maintenance are warranted until their first scheduled replacement point.

I. Fuel Injection System

II. Air Induction System

A. Intake Manifold

B. Turbocharge System

C. Charge Air Cooler (Intercooler)

III. Exhaust Manifold

IV. Miscellaneous Items Used in Above Systems

A. Hose, clamps, fittings and tubing

B. Pulleys, belts and idlers

C. Vacuum, temperature, and time sensitive valves and switches

D. Mounting hardware, sealing gaskets and PVC (if applicable)

THIS CALIFORNIA EMISSION CONTROL WARRANTY STATEMENT IN NO WAY
REPLACES, MODIFIES, ALTERS OR SUPERSEDES THE TRUCK WARRANTY CER-
TIFICATE, ITS TERMS AND CONDITIONS, AND ITS
LIMITATIONS AND EXCLUSIONS.

**BE CERTAIN YOU READ AND UNDERSTAND ALL WARRANTIES WHICH
ACCOMPANIED YOUR VEHICLE.**

NOTE! Warranty coverage is subject to change without notice. Contact your Volvo Truck dealer for the current warranty statement.

EPA Emissions Performance Warranty

YOUR WARRANTY RIGHTS AND OBLIGATIONS

The U.S. Environmental Protection Agency (EPA) and Volvo Trucks North America, Inc. (VTNA) are pleased to explain the emissions performance warranty on your vehicle. In compliance with section 207(b) of the Clean Air Act, VTNA must warrant the emission control system on your vehicle for the periods of time listed below, provided there has been no abuse, neglect or improper maintenance of your vehicle.

This manual contains maintenance information, including time and/or mileage intervals at which such maintenance should be performed.

Your emission control system may include parts such as carburetor or fuel injection system and engine computer. Also included may be hoses, belts, connectors or other emission-related assemblies.

Refer to the Warranty Certificate for complete coverage details.

Federal warranty provisions apply to all vehicles sold in all U.S. states and territories regardless of whether a state has enacted state warranty provisions that differ from the federal provisions.

Where a warrantable condition exists, VTNA will repair your vehicle at no cost to you (including diagnosis, parts and labor) any emission control device or system which causes a vehicle to fail an EPA-approved emission short test during its useful life, if you have maintained and operated the vehicle in accordance with the written instructions of VTNA.

If a facility at which the vehicle is initially presented for repair is unable for any reason to honor the claim, then, unless you waive in writing, the repair facility must forward the claim to VTNA warranty Administration, (336) 393-2000.

MANUFACTURER'S WARRANTY COVERAGE

This warranty is applicable for a period of five years, 100,000 miles or 3,000 hours of operation, whichever first occurs. If an emission-related part of your vehicle is defective, the part will be repaired or replaced by VTNA.

This is your emission control system DEFECTS WARRANTY.

OWNER'S WARRANTY RESPONSIBILITIES

As the vehicle owner, you are responsible for the performance of the required maintenance listed in your owner's manual. Volvo Truck North America, Inc (VTNA) recommends that you retain all receipts covering maintenance on your truck, but VTNA cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

You are responsible for presenting your vehicle to a VTNA dealer as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days. Claim procedures are outlined in the "Volvo Service Operations Manual."

As the vehicle owner, you should also be aware that VTNA may deny you warranty coverage if your vehicle or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

If you have any questions regarding your warranty rights and responsibilities, you should contact VTNA Warranty Administration, (336) 393-2000.

EMISSION CONTROL SYSTEM WARRANTY

Volvo Trucks North America, Inc. WARRANTS TO THE ORIGINAL OWNER, AND EACH SUBSEQUENT OWNER, OF A NEW TRUCK POWERED BY A VOLVO DIESEL ENGINE THAT THE EMISSION CONTROL SYSTEM OF YOUR TRUCK:

- 1 Is designed, built and equipped to conform at the time of sale to all regulations of the U.S. Environmental Protection Agency, applicable at the time of the manufacture; and
- 2 Is free from defects in material and workmanship which will cause the emission control components not to function as designed for a period of use of 5 years or 100,000 miles or 3,000 hours of engine operation, whichever comes first.

The 5 years/100,000 miles/3,000 hour warranty period shall begin on the date the vehicle is first delivered to the first retail purchaser or if the vehicle is placed in service as a demonstrator company vehicle prior to the sale at retail, on the date the vehicle is the first placed in service.

The emission control system of your new Volvo engine was designed, built and tested using genuine Volvo parts, and the engine is certified as being in conformity with federal emission control regulations. Accordingly, it is recommended that any replacement parts used for maintenance, replacement or repair be Volvo parts.

The owner may elect to have maintenance, replacement or repair of the emission control components and systems performed by any vehicle repair establishment or individual and may elect to use parts other than Volvo parts for such maintenance, replacement or repair without invalidating this warranty; the cost of such services or parts, however, will not be covered under the warranty except in an emergency situation. A part not being available or a repair not being completed within 30 days also constitutes an emergency.

Use of replacement parts which are not of equivalent quality may impair the effectiveness of emission control systems. If other than Volvo parts are used for maintenance, owner should obtain assurances that such parts are warranted by their manufacturer to be equivalent to genuine Volvo parts. However, the use of other than Volvo replacement parts does not invalidate the warranty on other components, unless such parts cause damage to warranted parts.

Repair and service covered by the warranty will be performed by an authorized VTNA dealer at his place of business with no charge for parts or labor (including diagnosis). The dealer uses Volvo parts for the emission control system, that required replacement and is covered by the warranty and if found defective.

In case of an emergency, where an authorized VTNA dealer is not available, repairs may be performed at any available service establishment or by the owner, using any equivalent replacement parts and VTNA will reimburse the owner for such repairs (including diagnosis) not to exceed VTNA's suggested retail price for the warranted parts and the labor rate appropriate for the geographical area and the tasks performed.

Replaced parts and paid invoices must be presented to a VTNA dealer for reimbursement.

The emissions control parts covered by this Emission Control System Warranty are listed under "What Is Covered by the Emissions Warranty." You are responsible for the performance of all required maintenance on your new Volvo engine, including maintenance or repairs needed due to severe operating conditions. VTNA will not deny a warranty claim solely because you have no record of maintenance. However, VTNA may deny a warranty claim if your failure to perform required maintenance resulted in the failure of a warranted part. Receipts covering the performance of regular maintenance should be retained in the event questions arise concerning maintenance. The receipts should be transferred to each subsequent owner of the vehicle with the emission warranted engine.

If the warranty claim is denied, VTNA shall provide a written basis for denial within 30 days or a shorter time if required by local, state or federal law. Failure to provide written basis for denial within 30 days or shorter time limit required by state, local or federal law or for reasons not attributable to the vehicle owner or events beyond the control of VTNA shall result in VTNA being responsible for repairing the vehicle free of charge to the vehicle owner.

CUSTOMER ASSISTANCE

Volvo Trucks North America, Inc. wishes to help assure that the Emission Control System Warranty is properly administered. In the event that you do not receive the warranty service to which you believe you are entitled under the Emission Control System Warranty, you should contact Volvo Trucks North America, Inc. Warranty Administration, (336) 393-2000. The address and telephone number of each Regional Office is in your vehicle owner's manual. If you need additional assistance or information concerning the Emission Control System Warranty, contact: Volvo Trucks North America, Inc., Warranty Administration, (336) 393-2000.

You can obtain further warranty information or report violations of the terms of Emissions Performance Warranty by contacting the Manager, Certification and Compliance Division (6405J), Warranty Claims, Environmental Protection Agency, Ariel Rios Building, 1200 Pennsylvania Ave. N.W., Washington, D.C. 20460.

WHAT IS NOT COVERED BY THE EMISSION WARRANTY

This warranty does not cover:

- 1 Malfunctions in any part caused by any of the following: misuse, abuse, improper adjustments unless performed by a VTNA dealer, modifications, alterations, tampering, disconnection, improper or inadequate maintenance, or use of fuels not recommended for the engine as described in the owner's manual.
- 2 Damage resulting from accident, acts of nature or other events beyond the control of VTNA.
- 3 The replacement of expendable maintenance items such as filters, hoses, belts, oil, thermostat and coolant made in connection with scheduled maintenance services once these parts have been replaced. Any parts replaced under warranty before the first required replacement point are warranted for the remainder of the warranty period.
- 4 Replacement items which are not genuine Volvo parts or not authorized by VTNA.
- 5 Loss of time, inconvenience, loss of use of vehicle or engine, or commercial loss.
- 6 Any vehicle on which the odometer or hourmeter has been disconnected or the mileage (or hours) has been altered so the actual usage cannot be readily determined.
- 7 Any vehicle registered and normally operated outside the United States.

WHAT IS COVERED BY THE EMISSION WARRANTY

The following is a list of the items that are considered a part of the Emission Control Systems and are covered by the Emission Warranty when installed as original equipment by VTNA on vehicles which were built to conform to Environmental Protection Agency regulations.

IMPORTANT - This may not include expendable maintenance items. Emission related parts requiring scheduled maintenance are warranted until their first scheduled replacement point.

I. Fuel Injection System

II. Air Induction System

A. Intake Manifold

B. Turbocharge System

C. Charge Air Cooler (Intercooler)

III. Exhaust Manifold

IV. Miscellaneous Items Used in Above Systems

A. Hose, clamps, fittings and tubing

B. Pulleys, belts and idlers

C. Vacuum, temperature, and time sensitive valves and switches

D. Mounting hardware, sealing gaskets and PVC (if applicable)

THIS EMISSIONS PERFORMANCE WARRANTY STATEMENT IN NO WAY
REPLACES, MODIFIES, ALTERS OR SUPERSEDES THE TRUCK WARRANTY CER-
TIFICATE, ITS TERMS AND CONDITIONS, AND ITS
LIMITATIONS AND EXCLUSIONS.

BE CERTAIN YOU READ AND UNDERSTAND ALL WARRANTIES WHICH
ACCOMPANIED YOUR VEHICLE.

Noise Emissions

Volvo Trucks North America, Inc. warrants to the first person who purchases this vehicle for purposes other than resale and to each subsequent purchaser, that this vehicle as manufactured by Volvo Trucks North America, Inc. was designed, built and equipped to conform, at the time it left Volvo Trucks North America, Inc.'s control, with all applicable U.S. EPA Noise Control Regulations.

This warranty covers this vehicle as designed, built and equipped by Volvo Trucks North America, Inc., and is not limited to any particular part, component or system of the vehicle manufactured by Volvo Trucks North America, Inc. Defects in design, assembly or in any part, component or system of the vehicle as manufactured by Volvo Trucks North America, Inc., which, at the time it left Volvo Trucks North America, Inc.'s control, caused noise emissions to exceed Federal standards, are covered by this warranty for the life of the vehicle.

Tampering with Noise Control System

Federal law prohibits the following acts or the causing thereof:

(1) The removal or rendering inoperative by any person, other than for purposes of maintenance, repair, or replacement, of any device or element of design incorporated into any new vehicle for the purpose of noise control prior to its sale or delivery to the ultimate purchaser or while it is in use;

or

(2) the use of the vehicle after such device or element of design has been removed or rendered inoperative by any person.

Among those acts presumed to constitute tampering are the acts listed:

Noise Shields and Insulation

Removing or rendering inoperative the engine and/or transmission noise deadening panels, shields or insulating materials.

Removing or rendering inoperative the cab-tunnel or hood noise insulating materials.

Removing or rendering inoperative any truck body mounted sound insulation components and/or shields (cab or fender shields, skirts, wheel housing splash shields, etc.).

Engine Control and Fuel Systems

Removing or rendering inoperative, or modifying the engine control system (such as the ECU or the fuel system components) in order to allow the engine to operate outside of the manufacturer's specifications (e.g., exceeding the manufacturer's engine speed limits).

Cooling System

Removing or rendering inoperative cooling system components (such as the temperature modulated fan clutch, fan shroud, fan ring, recirculation shields, etc.).

Exhaust System

Removing or rendering inoperative exhaust system components (such as the muffler, pipes, clamps, etc.).

Air Intake System

Removing or rendering inoperative air intake/induction system components (filter, filter housings, ducts, etc.).

Noise Control System, Operator Inspection and Maintenance Requirements



DANGER

Before inspecting a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

A Noise Control System Maintenance Log is located in “Noise Control Log” page 114. This log should be used to document all Noise Control System related maintenance, whether the maintenance results from a specific noise control system inspection, or a deficiency identified during another general maintenance event.

If additional log space is needed, further entries may be added on a separate sheet of paper. Store these additions with the main log to preserve a comprehensive record. It is recommended that copies of all noise emissions related maintenance invoices be retained.

The following Noise Control System inspection and maintenance instructions contain suggested maintenance intervals. These intervals may need adjustment in order to best accommodate the specific vehicle usage. The following instructions only concern Noise Emissions related items and do not address or modify any general vehicle maintenance requirements.

Exhaust System

Make sure the exhaust system is intact. Inspect for damage, misalignment and/or leakage. Primary system components requiring noise related inspection include muffler body, exhaust manifold, turbocharger, and all exhaust system (rigid and flexible) piping. Closely check the system for exhaust leaks. Special attention should be given to all welds, seams, gaskets, support points, clamps, couplings and connections.

Inspect all exhaust system fasteners, brackets, and clamps for damage and tightness. Check integrity of internal muffler baffling by revving the engine through normal operating speeds. Excessive rattling sounds or very loud operation indicates a failure within the muffler.

Repair or replace components as required. See local dealer for Service Information in Group 177-500, Preventive Maintenance, Basic Service VN, VHD and Group 177-501 Preventive Maintenance, Annual Service VN, VHD for detailed repair and replacement procedures.

Inspection interval: Once every year.



WARNING

Hot engine! Keep yourself clear of all moving parts or hot engine parts, exhaust gases, and/or fluids. A hot engine, exhaust, and/or fluids can cause burns.

Air Intake/ Air Induction System

Make sure the air intake system is intact. Inspect components for damage, misalignment and/or leakage. Primary system components requiring noise related inspection include the air cleaner housing, air cleaner element, turbocharger, charge air cooler and intake manifold.

Also inspect all ducts, pipes, hoses, tubing and elbows used to interconnect the system. Special attention should be given to all welds, seams, gaskets, support points, clamps, couplings and connections.

Inspect all intake system fasteners, brackets, and clamps for damage and tightness.

Repair or replace components as required. See local dealer for Service Information in Group 177-500, Preventive Maintenance, Basic Service VN, VHD and Group 177-501 Preventive Maintenance, Annual Service VN, VHD for detailed repair and replacement procedures.

Inspection interval: Once every year.

Cooling System



WARNING

Do not work near the fan with the engine running or the ignition in the ON position. The engine fan can engage at any time without warning. Anyone near the fan when it turns on could be seriously injured.

Visually inspect cooling system components for damage, and/or misalignment.

Primary system components requiring noise related inspection include fan blades, fan clutch, fan shroud, fan ring, and recirculation shields. Check fan blades, fan ring, fan shroud, and recirculation shields for any damage. Verify that fan blades clear the fan ring. Inspect all related fasteners, brackets, and clamps for damage and tightness. Confirm operation of temperature modulated fan clutch.

Repair or replace components as required. See local dealer for Service Information in Group 177-500, Preventive Maintenance, Basic Service VN, VHD and Group 177-501 Preventive Maintenance, Annual Service VN, VHD for detailed repair and replacement procedures.

Inspection interval: Once every year.

Sound Shielding and Insulation Devices

Make sure sound shielding and insulating devices are intact. Inspect components for damage. Primary system components requiring noise related inspection include the hood, engine compartment insulating materials (including hood insulation, bulkhead insulation, doghouse insulation, etc.) splash shields, cab skirts, fender shields, and body panels. Inspect all related fasteners, brackets, and clamps for damage and tightness.

Repair or replace components as required. See local dealer for Service Information in Group 177-500, Preventive Maintenance, Basic Service VN, VHD and Group 177-501 Preventive Maintenance, Annual Service VN, VHD for detailed repair and replacement procedures.

Inspection interval: Once every year.

Noise Control Log

Maintenance Hazards



DANGER

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.



DANGER

Do not attempt to repair or service this vehicle without having sufficient training, correct service literature and the proper tools. Failure to follow this could lead to personal injury or death, or making your vehicle unsafe.



CAUTION

Prolonged contact with used engine oil may be harmful. Use rubber gloves when handling used oil. Wash skin thoroughly if it comes in contact with used oil.

NOTE! Read all the safety information starting on page 3 before working on the vehicle.

Oil Change



DANGER

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.



WARNING

A hot engine or engine oil can be dangerous. Serious burns can result from contact with a hot engine or oil. Take precautions when draining the oil. Wear gloves or let the engine cool down before draining.

For information on the type of oil recommended for your engine, see "Engine Oil" page 59 for application tips and "Viscosity and Capacity Tables" page 166 for quantities and viscosities or refer to other engine manufacturer's operator's manual.

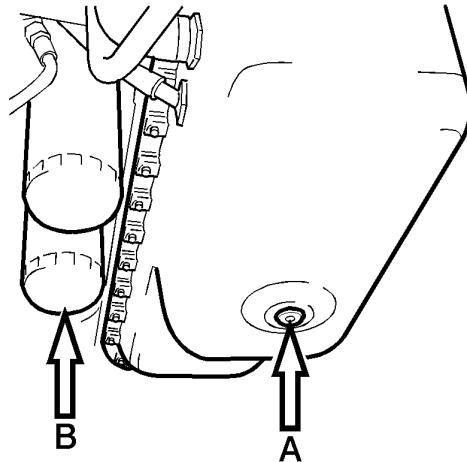


WARNING

When draining the oil, use the proper tools and keep away as far as possible. Raise the elbow so the forearm is parallel to the ground to avoid oil running down the arm, causing burns.

It is important to drain as much oil as possible. Try to change oil immediately after driving, when the oil is warm. Always replace the oil filters when changing oil.

NOTE! Always dispose of oil according to Federal or local regulations. Used oil disposed of in nature or waterways contaminates our drinking water and kills wildlife.



T1006392

D7 Engine:

A Oil plug

B Oil Filter



CAUTION

Prolonged contact with used engine oil may be harmful. Use rubber gloves when handling used oil. Wash skin thoroughly if it comes in contact with used oil.

Oil Filters



DANGER

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.



WARNING

Hot oil can cause severe burns. Do not allow hot oil to contact the skin. When changing oil, wear protective gloves.



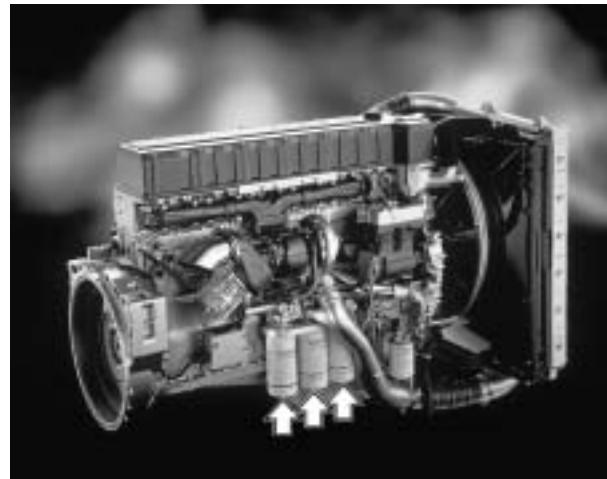
CAUTION

Use only the engine manufacturer's oil filter for replacement. Use of an oil filter not built to specification could result in severe damage to bearings, crankshaft, etc. as a result of unfiltered oil entering the lubrication system.

NOTE! Always dispose of oil filters according to Federal or local regulations. Used oil disposed of in nature or waterways contaminates our drinking water and kills wildlife.

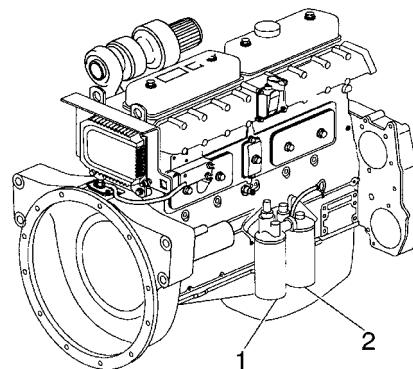
Install new filters as follows:

- Coat the filter gasket with oil.
- Install the filter and turn it by hand until the gasket makes contact with the sealing surface.
- Then turn the filter an additional 3/4 turn.



W2003480

D12 Oil Filters



W2003078

D7 Oil Filters:

- 1 Full-flow Filter
- 2 Bypass Filter

Checking Oil Level

NOTE! Do not let the oil level fall below the lower marking on the dipstick. Do not overfill so the level is above the upper marking on the dipstick.

Wait five minutes after shutting off the engine before checking the oil level. This gives the oil time to drain back to the oil pan.

Crankcase Air Breather



CAUTION

If the crankcase breather is not maintained on a regular basis, it will become plugged. When plugged, excessive crankcase pressure buildup may cause crankshaft seal leakage.

Check and clean the crankcase ventilation system at every annual service.

Engine Air Filter



DANGER

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

The engine air filter is monitored by a pressure restriction gauge mounted on the air filter housing. The gauge may be connected to the instrumentation to give a telltale signal when the air filter needs to be changed; see the vehicle Operator's Manual. A manual gauge needs to be inspected regularly. The filter should be replaced according to the gauge or after a maximum of two years, whichever comes first. Extra filter insert should be changed with every third main air filter.



CAUTION

Continued operation with the gauge showing in the red may cause damage to the engine. Operating the engine with a damaged filter allows dust to pass directly into the engine, causing damage. Replace damaged or clogged filters.

To change the filter, remove the fasteners around the outer cover and remove the cover. Pull out the filter from the container and discard.

Make sure the new filter seal is in good condition. Install the new filter in the filter container so the seal enters the guide in the back of the container. Reinstall the cover.



W2003507



W2002521



W2002522

Fan Drive Belts



DANGER

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.



WARNING

Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine and/or can cause serious burns.



W2001070

All engine belts should be checked at each service point. Inspect for cracked or frayed material. Most belts have automatic belt tensioners to keep the correct tension without adjustment. Some belts are still adjusted with an adjusting mechanism to get the correct tension. Check with your dealer to get the correct tension value for the different belts.



CAUTION

Do not tighten the belts over recommended values. Over-tightening a belt may damage bearings as well as belts.

Flushing Cooling System, D7

Coolant Filter

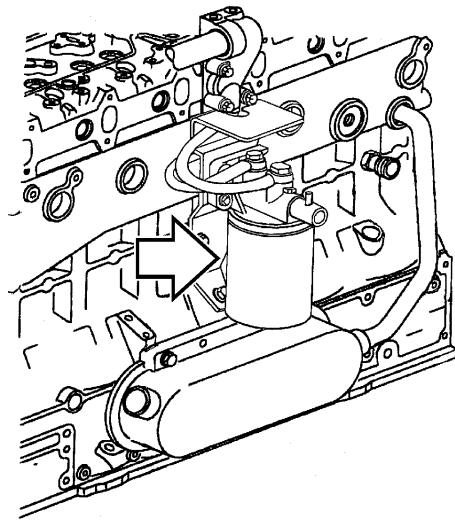


WARNING

Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine and/or fluid can cause serious burns.

When using standard antifreeze, use a coolant filter containing the additives necessary for replenishing the used-up additives. If using extended life antifreeze, the coolant filter should be empty. Do not install additive type filters on an engine filled with extended life type coolant.

See page 45 for information on coolant testing and page 44 for standard coolant or page 49 for extended coolant change intervals.



W2002709

Draining Cooling System**DANGER**

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

**WARNING**

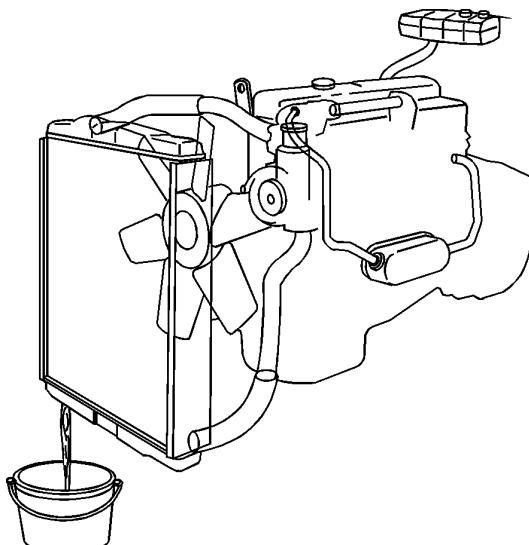
Do not remove the cap to the coolant surge tank while the engine and radiator are still hot and under pressure. Scalding fluid and/or steam may be blown out under pressure if the cap is taken off too soon.

**WARNING**

Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine and/or can cause serious burns.

- 1 Remove system fill cap.
- 2 Open drain cocks located in the bottom of the radiator and on the block (You may have to use special tool 9996049 for quick-connect fittings).
- 3 Open the drain valve on the air compressor.

NOTE! Always dispose of coolant according to Federal or local regulations. Take all used coolant to a recycling or waste collection center.



W2003079



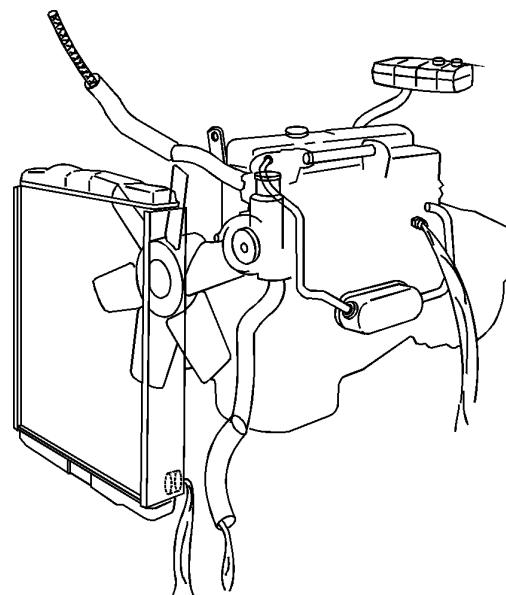
W0001746

Special tool 9996049

Flushing Cooling System

Before filling, flush out the system thoroughly with clean water. Before flushing out the radiator, remove the lower radiator hose to allow a quicker and more efficient draining.

When flushing the radiator, keep the water pressure low so the radiator tubes are not damaged.

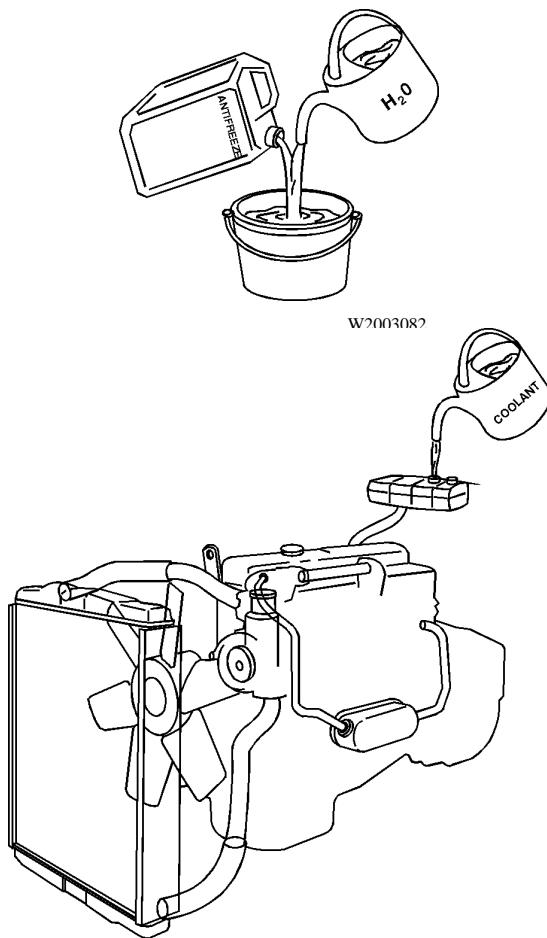


W2003080

Filling Cooling System

Always use a pre-mixed solution of 50/50 clean water and antifreeze. Do not fill system with water and then add antifreeze. A mixture with less than 35% antifreeze does not give adequate corrosion protection. Concentrations of antifreeze above 60% does not give added freeze protection. The system is self-venting.

- 1 Fill the system with clean coolant through the fill neck in the middle of the surge tank. The fill rate is not to exceed 2 gpm (8 L/min.). The engine should not be running and the heater control should be on WARM.
- 2 Fill up to the top of the surge tank.
- 3 Check the level after running the engine at high idle for approximately five minutes. Add coolant as required.



W2003081

Flushing Cooling System, D12

Draining Cooling System



DANGER

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.



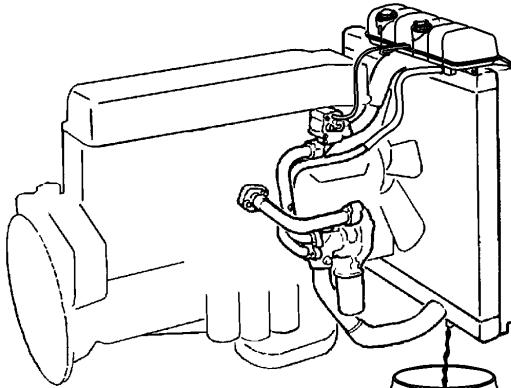
WARNING

Do not remove the cap to the coolant surge tank while the engine and radiator are still hot and under pressure. Scalding fluid and/or steam may be blown out under pressure if the cap is taken off too soon.



WARNING

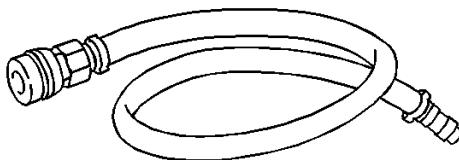
Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine and/or fluid can cause serious burns.



W2002059

- 1 Remove system fill cap.
- 2 Open drain cocks located in the bottom of the radiator or on the bottom radiator hose and on the block (You may have to use special tool 9996049 for quick-connect fittings).
- 3 Open the drain valve on the air compressor.

NOTE! Always dispose of coolant according to Federal or local regulations. Take all used coolant to a recycling or waste collection center.



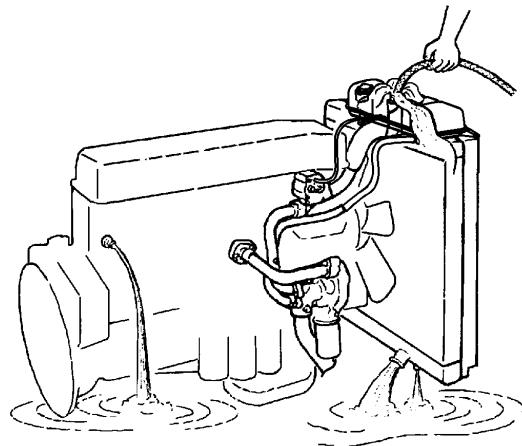
W0001746

Special tool 9996049

Flushing Cooling System

Before filling, flush out the system thoroughly with clean water. Before flushing out the radiator, remove the lower radiator hose to allow a quicker and more efficient draining.

When flushing the radiator, keep the water pressure low so the radiator tubes are not damaged.

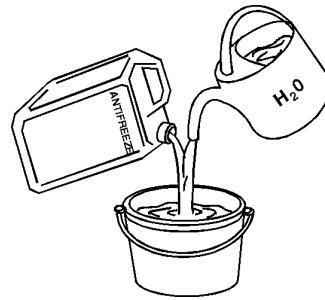


W2002057

Filling Cooling System

Always use a pre-mixed solution of 50/50 clean water and antifreeze. Do not fill system with water and then add antifreeze. A mixture with less than 35% antifreeze does not give adequate corrosion protection. Concentrations of antifreeze above 60% does not give added freeze protection. The system is self-venting.

- 1 Fill the system with clean coolant through the fill neck in the middle of the surge tank. The fill rate is not to exceed 2 gpm (8 L/minute). The engine should not be running and the heater control should be on WARM.
- 2 Fill up to the top of the surge tank.
- 3 Check the level after running the engine at high idle for approximately five minutes. Add coolant as required.



W2003082

Turbo and Charge Air Cooler

General



DANGER

Do not remove, attach or tighten turbocharger air intake ducting while the engine is operating, or operate the engine while the ducting is removed. Working around the turbo with the ducting removed may cause severe personal injury.

Visually inspect turbo mountings, intake and exhaust ducting and connections for leaks on a daily basis. Check oil inlet and outlet for leaks or signs of restrictions to oil flow. Check for unusual noise or vibration. If any faults are detected, do not operate the engine until the cause is determined and repaired.



DANGER

If oil leaks internally from the turbocharger to the engine intake, the oil acts as a fuel. Watch for excessive exhaust smoke. Do not operate engine until problem is corrected. There is no way to regulate the engine speed if it runs on oil and it may overspeed. Loss of control of vehicle may lead to an accident causing severe personal injury or death.

Periodically inspect the front of the radiator/charge-air-cooler package for buildup of dirt, mud, insects, etc. Over time, there may be a build-up of dirt, mud, insects, etc., between the radiator and charge-air-cooler. Inspect for build-up and remove the cooler package to clean, if necessary.

Cleaning Charge-Air-Cooler and Radiator Package

Over time, dirt and insects will accumulate between the fins of the radiator, air conditioning condenser and charge-air-cooler. The reduced air flow reduces the heat transfer from the components to the air. This increases the load on the fan and air conditioning compressor and can result in engine overheating and other performance related problems, such as high fuel consumption, etc. Make sure the radiator/charge-air-cooler package is inspected regularly. Clean if necessary.

DANGER

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.



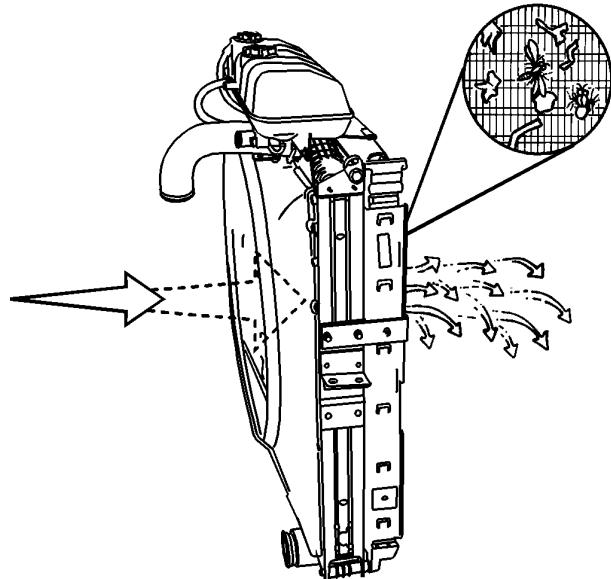
WARNING

Always wear eye protection when cleaning radiator, charge-air-cooler and condenser. Failure to follow this recommendation may result in eye injury.

The simplest method to clean the package is to use air pressure or a water stream. This should be done from the back of the core. Air pressure should not exceed 30 psi (200 kPa) for radiator and charge-air-cooler cores. The use of a fin comb is also a good tool to loosen bugs and dirt from the fins.

If dirt can not be cleaned off with this procedure, consult your Volvo Truck dealer.

Inspect the charge-air-cooler for cracks at every inspection. Do not operate the vehicle with a damaged or broken charge-air-cooler. To do so would void the warranty and the engine will not meet emission regulation requirements.



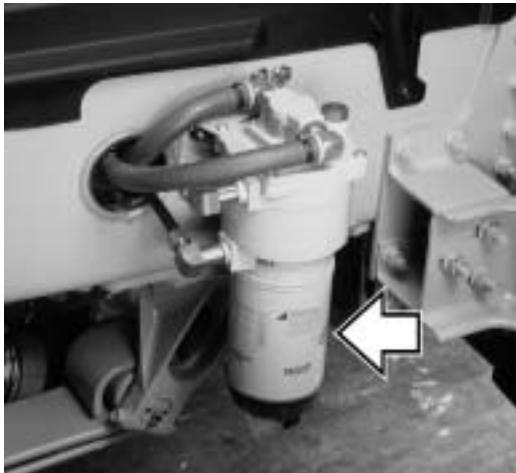
W2001496

Replacing Fuel Filters

General

The filters are an important part of the fuel system. Always replace the filters at the recommended intervals and use the recommended filter types for the best engine operation and service life.

A primary fuel filter is located on the outer, right or left frame rail behind the cab. This filter consists of a filter cartridge, a water separation bowl and may have a fuel heater built in.



W2001067

The secondary fuel filter is located on the left side, under the control unit on D12 and on the left, front side on the D7 engine. The filter is contained in a disposable cartridge.



W2001079

Fuel Filter Change Intervals

Filter change intervals should be tied to the oil change intervals. Depending on the oil change intervals and/or the fuel cleanliness, the filters can be changed every or every other oil change.

Maximum mileage between fuel filter change is 25,000 miles (40,000 km) or 600 hours.

Fuel System Service

Changing the Primary Fuel Filter



DANGER

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

The standard primary filter is manufactured by Racor. Use only their **30 micron** (red coded) element. Failure to do so could result in reduced power.

To replace the primary fuel filter element:

1



DANGER

To avoid potential fire hazard, do not service any part of the fuel system while smoking or in the presence of flames, sparks or hot surfaces, or when working on an operating engine. Failure to follow these precautions can result in fire. To guard against burns from direct contact with hot fuel, wear adequate protective clothing (face shield, heavy gloves and apron, etc.) when working on a hot engine.

Open the drain valve and drain off some fuel into a container. Use a strap wrench to remove the filter cartridge together with the bowl.

- 2 Separate the filter and the bowl.

NOTE! Always dispose of fuel according to Federal or local regulations.

Take all waste fuel to a recycling or waste collection center.

- 3 Clean and dry the bowl. Attach it to a new filter. Use new seals at both bowl and filter head joint. Install both on the filter head in the vehicle.



CAUTION

Never fill filter with fuel before installing. Contaminated fuel causes accelerated wear to fuel system components.

- 4 To eliminate air from the filter, operate the primer pump to draw fuel and fill the filter.

5



DANGER

Do not work on or near the fan with the engine running. The fan is of an automatic-on type and can be engaged without warning. Fingers, tools and equipment can be damaged if the fan turns on when you do not expect it.

Start the engine and check for leaks. Correct any leaks with the engine stopped.

Changing the Secondary Fuel Filter



DANGER

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

1



WARNING

Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine and/or can cause serious burns.

Clean around the fuel filter. This is important — if dirt mixes with the fuel from this filter, it will end up in the injection system.

2



DANGER

To avoid potential fire hazard, do not service any part of the fuel system while smoking or in the presence of flames, sparks or hot surfaces, or when working on an operating engine. Failure to follow these precautions can result in fire. To guard against burns from direct contact with hot fuel, wear adequate protective clothing (face shield, heavy gloves and apron, etc.) when working on a hot engine.

Remove the filter element. Dispose of it in a safe and responsible manner.

- 3 Wet the seal on the new filter with clean engine oil or fuel.

4



CAUTION

Never fill filter with fuel before installing. Contaminated fuel causes accelerated wear to fuel system components.

Spin on the new filter onto the filter head until it contacts the seal fully (no side movement evident). Tighten an additional 1/2 to 3/4 turn **by hand**. Do not overtighten!

- 5 To eliminate air from the filter, operate the primer pump to draw fuel and fill the filter.

6



DANGER

Do not work on or near the fan with the engine running. The fan is of an automatic-on type and can be engaged without warning. Fingers, tools and equipment can be damaged if the fan turns on when you do not expect it.

Start the engine and check for leaks. Correct any leaks with the engine stopped.

Bleeding the Fuel System

The fuel system will have to be bled if:

- The tank has been emptied of fuel.
- The engine has not been running for some time. (See also page 33 for oil pressure preparation).
- Service work has been done on the fuel system, for example cleaning or replacing fuel filter elements.
- The engine is new or rebuilt.

NOTE! It is very important to maintain high cleanliness when working in the fuel system. If dirt is mixed in with the fuel after the filters, it will cause damage to the injectors. Dirt can also cause air leakages that rob the engine of power.

Bleeding D12 Engine**DANGER**

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

1

**WARNING**

Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine and/or can cause serious burns.

Clean well around the bleed nipples on the fuel filter head and the cylinder head.

2

**DANGER**

To avoid potential fire hazard, do not service any part of the fuel system while smoking or in the presence of flames, sparks or hot surfaces, or when working on an operating engine. Failure to follow these precautions can result in fire. To guard against burns from direct contact with hot fuel, wear adequate protective clothing (face shield, heavy gloves and apron, etc.) when working on a hot engine.

Remove the protection cap from the filter bleed nipple. Connect a transparent 5/16 in. (8 mm) plastic hose to the nipple. Open the nipple with an 11 mm wrench and pump the hand primer until clean, air-free fuel flows out of the hose. Tighten the bleed nipple while fuel is still flowing.

- 3 Remove the hose and install the protection cap on the nipple.
- 4 Remove the protection cap from the cylinder head bleed nipple. Connect the plastic hose to the nipple. Open the bleed nipple with an 11 mm wrench and pump the hand primer until clean, air-free fuel flows out of the hose. Tighten the nipple while fuel is still flowing.

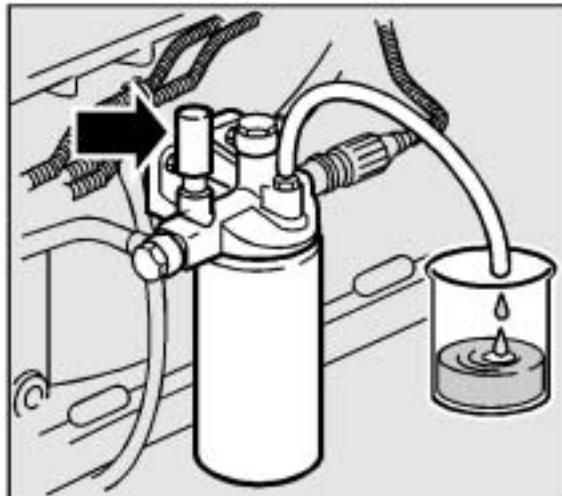
5



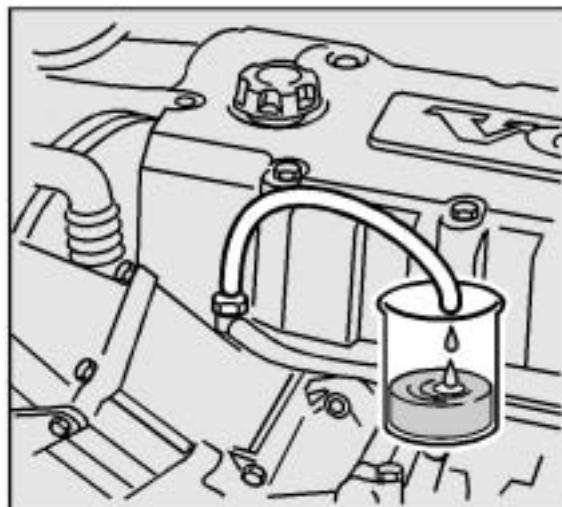
DANGER

Do not work on or near the fan with the engine running. The fan is of an automatic-on type and can be engaged without warning. Fingers, tools and equipment can be damaged if the fan turns on when you do not expect it.

Start the engine and run it at an increased idle speed for approximately 5 minutes to remove any remaining air in the system. Check the fuel system for leaks.



T0008116



T0008115

Bleeding D7 Engine



DANGER

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

1



WARNING

Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine and/or fluid can cause serious burns.

Clean well around the bleed nipple on the fuel filter head.

- 2 Make sure the ignition is ON. The fuel system is not activated with the ignition key switch off.

3

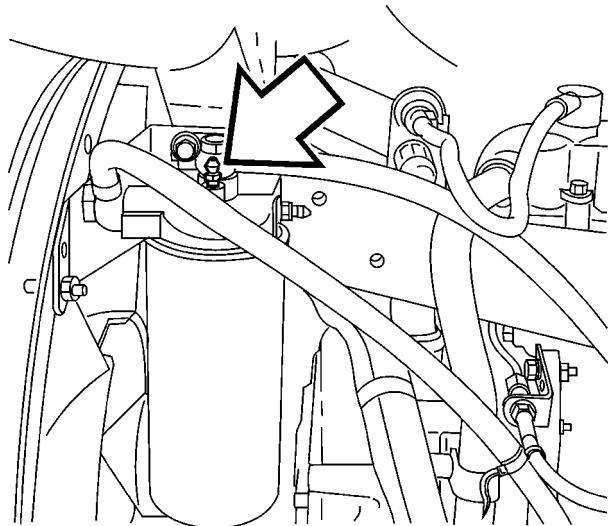


DANGER

To avoid potential fire hazard, do not service any part of the fuel system while smoking or in the presence of flames, sparks or hot surfaces, or when working on an operating engine. Failure to follow these precautions can result in fire. To guard against burns from direct contact with hot fuel, wear adequate protective clothing (face shield, heavy gloves and apron, etc.) when working on a hot engine.

Remove the protection cap from the filter bleed nipple. Connect a transparent 5/16 in. (8 mm) plastic hose to the nipple. Open the nipple with an 11 mm wrench and pump the hand primer until clean, air-free fuel flows out of the hose. Tighten the bleed nipple while fuel is still flowing.

- 4 Remove the hose and install the protection cap on the nipple.
- 5



W2003174



DANGER

Do not work on or near the fan with the engine running or the ignition in the ON position. The fan is of an automatic-on type and can be engaged without warning. Fingers, tools and equipment can be damaged if the fan turns on when you do not expect it.

Start the engine and run it at an increased idle speed for approximately 5 minutes to remove any remaining air in the system. Check the fuel system for leaks.

Draining Water from the Fuel Tank



DANGER

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Water accumulates in the fuel tank in the process of air entering the tank and water vapor condensating. This water will collect in the bottom of the tank and should be emptied out regularly.

To minimize the water vapor condensing inside the tank, the fuel level should be kept high when the vehicle is parked. Always fill up the tank at the end of the trip to minimize the amount of air in the tank.



DANGER

Do not service any part of the fuel system while smoking or while in the presence of flames, sparks or hot surfaces. Failure to follow these precautions can result in fire.

NOTE! When draining the fuel tank, collect the waste in a fuelproof container. Take the drained fuel and water to a recycle or waste management center.

To drain the tank, place a container under the tank. Remove the plug in the bottom. Drain fluid until there is only fuel coming out. Install the plug and check for leaks.

NOTE! Always dispose of fuel according to Federal or local regulations. Take all waste fuel to a recycling or waste collection center.

Transmission and Rear Axle Maintenance

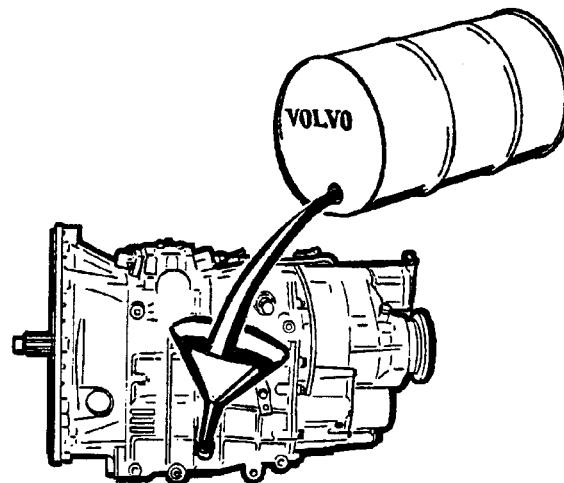
Transmission

General

Transmissions should not be operated consistently at temperatures above 250°F (120°C). If the temperature reaches 285°F (140°C), stop the vehicle to let the temperature go down (see the vehicle Operator's Manual for information on the optional transmission temperature gauge). Operating temperatures above 250°F (120°C) increase the lubricant's rate of oxidation and shorten its effective life.

If the transmission oil temperatures are consistently high, change oil more often or install an oil cooler. With lengthy or continuous driving at altitudes of more than 6,000 ft (2,000 m) above sea level, more frequent oil changes will be necessary.

NOTE! Always dispose of oil according to Federal or local regulations. Used oil disposed of in nature or waterways contaminates our drinking water and kills wildlife. Take all used oil to a recycling or waste collection center.



W4001387

Oil Quality**WARNING**

Use only the specified type of single weight oils. Do not use multigrade oils or EP gear oils (for example axle lube oil such as GL-5 gear oils) as they may damage components.

Monograde motor oils or transmission oil type API GL-1 are recommended for transmissions. Choose the correct viscosity for the outside temperature the vehicle will be operated in. See page 166 for the beginning of viscosity charts.

If using synthetic base oils, the change interval goes up to 250,000 miles (400,000 km), or 500,000 miles (800,000 km) if using the manufacturer approved brand of oil filled from the factory.

Oil Filter

Oil filters should be changed at the same time as the oil. Also, make sure that magnetic bottom plugs are cleaned before installing. Change the filters in accordance with the manufacturer's Operator's Manual.

DriveShaft



DANGER

If the driveshaft universal joints are not lubricated properly, they can be damaged to the point of the driveshaft separating from the vehicle. Driveshaft separation may cause loss of control of the vehicle resulting in severe personal injury or death. Make sure grease is purging from all four ends of the universal joint. If the universal joint can not be properly lubricated, replace it.

Rear Axle

General

NOTE! Most rear axles today are run with a synthetic base oil. The Volvo rear axles are an exception. Do not use a synthetic base oil in Volvo rear axles. Seals will deteriorate and leaks will develop.

Rear axles should not be operated if the oil temperature exceeds 250°F (120°C). Choose the correct viscosity for the temperature the vehicle is operated in. See page 166 for a beginning of viscosity charts.

Checking and Draining Oil

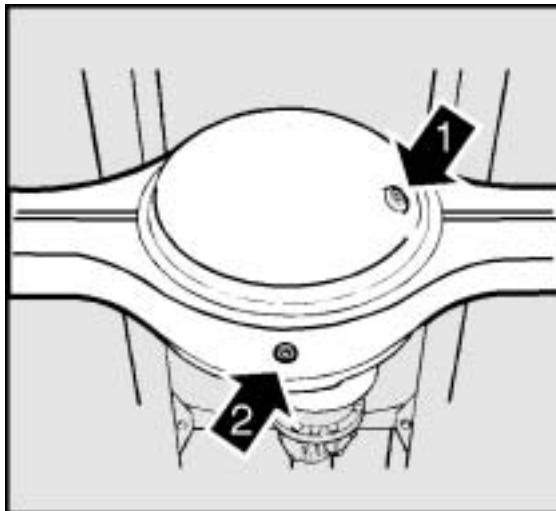
Check the oil level through the top plug (1). The oil should be level with the hole. Add oil if necessary.

Drain oil through the bottom plug. Oil should be drained immediately after driving while it is still hot.



WARNING

Hot oil can cause severe burns. Do not allow hot oil to contact the skin. When changing oil, wear protective gloves.



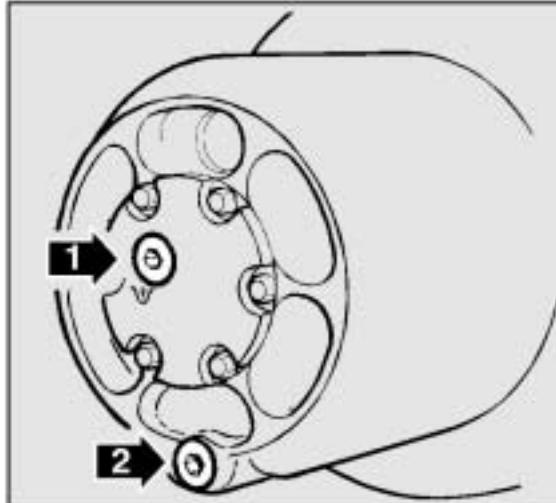
T0008128

NOTE! Also check the rear axle ventilation for blockage. A blockage can cause over-pressure in the axle and start oil leaks.

Hub Reduction

If the axle is equipped with hub reduction, when changing oil, each hub must be emptied separately. Turn the wheel until the drain plug (2) is its lowest position. Remove plug and drain.

Fill oil through the level/fill plug (1) hole. Fill each hub reduction before filling oil in the rear axle.



T0008164

Steering and Brakes Maintenance

Steering System

Excessive play in the steering system is checked by turning the steering wheel while the engine is stopped. With the front wheels pointing straight ahead, turn the steering wheel until the front wheel starts moving. Then, turn the steering wheel the other way until the front wheel moves. Slack should not be more than 1 in. (25 mm) at the rim of the steering wheel.

If the slack is excessive, check the steering linkage for looseness, wear, etc. Make necessary repairs before driving the vehicle.

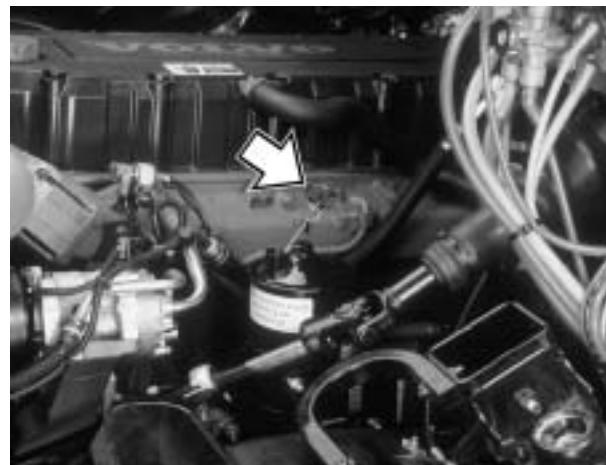


W6000830

Power Steering Reservoir

The power steering fluid reservoir is filled with Automatic Transmission Fluid (ATF) Dexron® III for the power steering system. Change fluid every 150,000 miles (240,000 km). Change filter every year or more often if necessary.

If the fluid has darkened, it indicates that the power steering system is running hotter than normal and the fluid is overheating. Take the vehicle to a Volvo Truck dealer for troubleshooting the overheating and to have the fluid changed.



W6001428

Steering Linkage Wear Check

Wear is checked by gripping the linkage, tie rod or draglink, close to the ball joint and moving the seat of the ball axially. The joint should not move more than maximum 1/8 in. (3mm) measured with hand pressure only. If there is a larger movement, remove the vehicle from service and have the linkage replaced before driving.

Brake Safety Information



DANGER

The brake system is a critical vehicle safety system. For your safety and for those around you, follow the recommended preventive maintenance checks. If any problems occur, have them investigated immediately by an authorized service facility. Failure to properly maintain the brake system can result in compromised brake efficiency and may lead to loss of control of the vehicle resulting in severe personal injury or death.



DANGER

Do not use replacement parts anywhere in the brake system unless it conforms exactly to original specifications. A non-conforming part in your vehicle's brake system could cause a malfunction, leading to loss of control of the vehicle resulting in severe personal injury or death.



DANGER

Do not release the parking brake or attempt to move the vehicle until brake air pressure in both circuits is at least 100 psi (690 kPa). Failure to follow this procedure may lead to uncontrolled vehicle movement and cause severe personal injury or death.



DANGER

Drain the air system tanks at the recommended intervals. If condensation accumulates, moisture can enter the brake system air valves, causing corrosion or clogging. The safety of the brake system could be compromised, leading to an accident causing severe personal injury or death.



DANGER

Do not inspect or adjust parts or components in the brake system without setting the parking brake, placing the transmission in neutral and securely chocking the wheels. If the vehicle is not secured to prevent uncontrolled vehicle movement, it could roll and cause severe personal injury or death.



WARNING

Do not use penetrating oil, brake fluid or wax-based oils in the air system. These fluids may cause severe damage to air system components.

Air Tanks



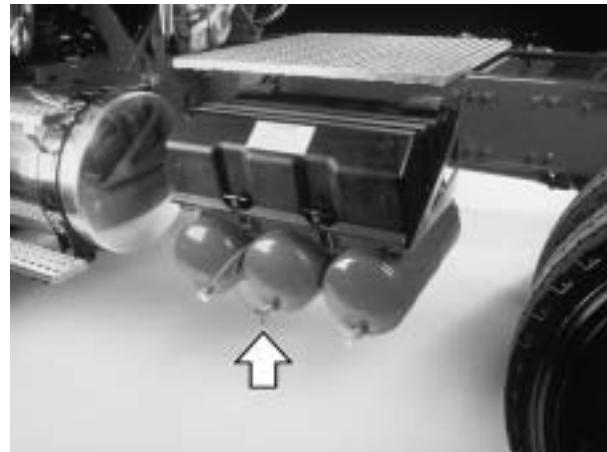
WARNING

When draining the air tanks, do not look into the area of the draining air. Dirt or sludge particles may be in the air stream that could cause eye injury.

Air tanks should be drained daily. Make sure the drain cocks close properly after draining. Empty moisture from air tanks by pulling the drain valve wire. The tanks should be checked for condensation fluid, even if an automatic drain valve is installed.

It is very important that the air system is kept clean. Air reservoirs should be drained daily or even twice a day on very hot days. Daily drainage expels any condensation in the air reservoirs. If sludge or oil is found in the drainage, the air compressor should be checked for proper operation.

If an excessive amount of fluid is drained out of the tanks (even when drained daily) have the system checked for possible problems with the air dryer.



W5001203

Air Dryers

Air dryers have a regeneration system that cleans out the accumulated moisture but eventually the drying medium will be filled up. Change the dryer cartridge when more water than usual is noticed at the daily tank drainings. The volume of daily drain water will change depending on temperature, geographical location and how much the brakes are used.

Dryer manufacturers recommends changing the cartridge every 2 to 3 years but the intervals need to be adjusted for vehicle application. In hot, coastal climates, the cartridge may have to be changed every year.

Brake Slack Adjusters and Cam

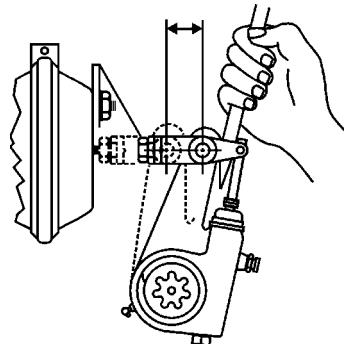


DANGER

Before checking the slack adjusters, set the parking brakes, place the transmission in neutral and block the wheels.

Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

To check the slack adjusters for proper throw, use a breaker bar to lever the slack adjuster out. Measure the distance of the travel. It should not exceed 1 to 1 1/4 in. (25 to 30 mm) for a 6 in. slack adjuster and should not exceed 3/4 to 1 in. (20 to 25 mm) for a 5 1/2 in. slack adjuster. Also make sure that the length of the slack adjuster is the same on an axle.



W5000613

Brake Linings



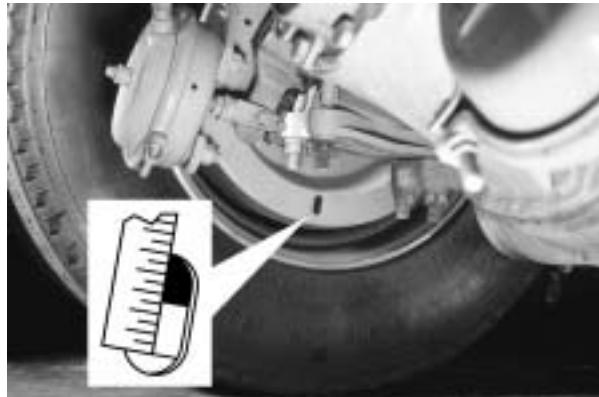
DANGER

Before measuring the brake linings, set the parking brakes, place the transmission in neutral and block the wheels.

Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Measure the brake lining thickness. If the brakes are equipped with backing plates, measure through the inspection holes in the plate. Reline the brake shoes if the lining thickness is 1/4 in. (6 mm) or less at the middle of the shoe.

Check the brake drums for any visible cracks or signs of oil or grease.



W5000610

Check Valves



DANGER

Before working on or inspecting the vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Follow the procedure below to check out the air tank check valves at least once a year. This is to see if air pressure is maintained in the tanks when the air pressure is depleted in the supply tank (wet tank).

NOTE! The check valves should be checked at least once per year.

- 1 Chock the rear wheels.
- 2 Let the compressor build up air pressure to the governor cut-off.
- 3 Bleed the air pressure from the supply tank (wet tank).
- 4 Check the air pressure gauges on the instrument panel to see if the pressure is maintained in both primary and secondary air tanks.
- 5 Any bleed-off from one or both of the tanks indicates a defective check valve; replace valve.
- 6 Repressurize the system and remove the wheel chocks.



DANGER

Compressed air components can separate violently during disassembly if air pressure is present. Before servicing any part of the brake air system, completely release the air pressure. Failure to do so can result in serious personal injury or death.

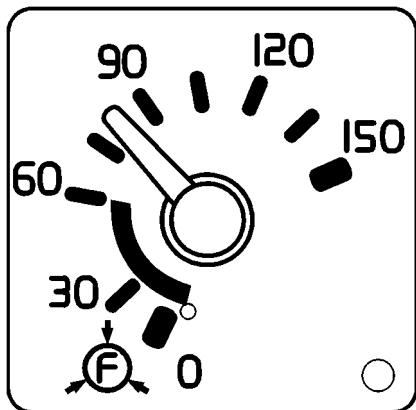


WARNING

To prevent personal injury, always drain the air supply from the vehicle before attempting to repair or replace a component. Wear eye protection and take care not to get fingers caught in the slack adjusters when spring brakes are applied.

Air System Pressure

Air pressures in the two circuits are monitored by two pressure gauges on the right side of the instrument panel. The gauge for the primary (rear) brake circuit is marked with an "R" within a symbol and the gauge for the secondary (front) brake circuit is marked with an "F" within a symbol. The two pointers should register equal or nearly equal pressure. By observing the gauge pointers, the operator is forewarned in the event of a pressure drop in either or both of the circuits, and also may readily identify the specific circuit.



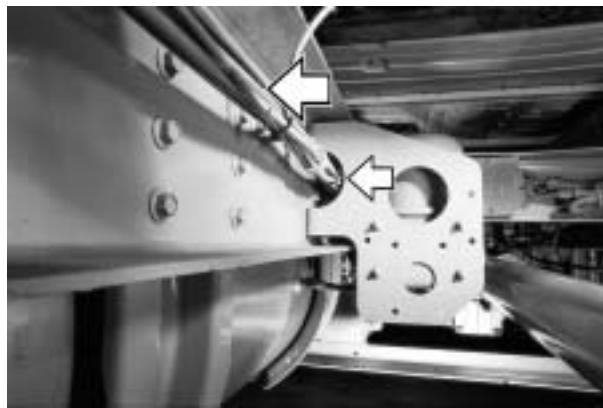
W3000609

Before operating the vehicle, check the air gauges which indicate air pressure. They should not register less than 105 psi (725 kPa). Maximum pressure at any time should not exceed 150 psi (1035 kPa).

Air Tubing and Hoses

All compressed air tubing and hoses need regular inspection. Check for signs of wear and that the routing is not near parts that can cause damage.

Have any damaged tubing or hoses replaced by your local Volvo Truck dealer.



W3000838

Electrical System Maintenance

Battery Care



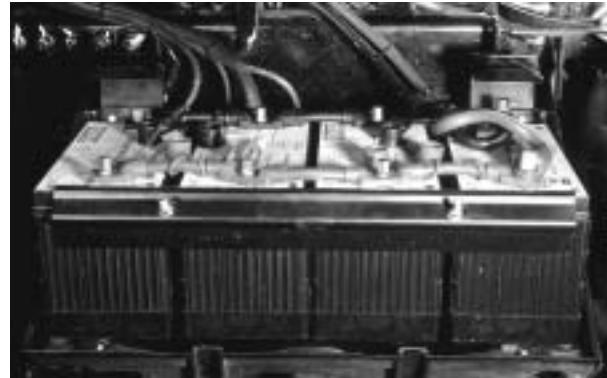
WARNING

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

The electrolyte level on maintenance free batteries cannot be checked. Periodically, the condition and the state-of-charge of each battery should be checked by a Volvo Truck dealer. Maintenance free batteries do not require any attention other than keeping them clean and firmly clamped in place in their respective trays. Keep the cable connections clean and tight. Check the battery state-of-charge indicators periodically to determine battery condition.

Check for worn cables at every major inspection. Replace worn cables. Check battery terminals for cracks.

When disconnecting battery terminals, always disconnect the ground terminal first. When reconnecting, always connect the ground terminal last.



W3002368



WARNING

Always wear eye protection when working around batteries to prevent the risk of injury due to contact with sulfuric acid or an explosion.

Lighting

Check the lights on the vehicle daily. Replace burnt out inserts and bulbs. See next page for a listing of bulb types. Replace any broken or cracked side or rear reflectors.

Headlights should be checked for aim at least once per year.



W3004425

Bulb Replacement List

Bulb	Number	Max. Rating
Headlamp, Hi/Low Beam Insert	2C1	45/60 W
Headlamp, Hi Beam Insert	1C1	60 W
Back-Of-Cab Lamp	1156	25 W
Back-up Lamp	1156	25 W
Cab Marker Lamp (w/o sunvisor)	67	10 W
Driving Lamp (Spotlight)	H9420	50 W
Fog Lamp	H9415	37.5 W
Instrument Telltale Lamps	3919844 (Volvo)	1.5 W
Door Courtesy Lamp	67	10 W
All Overhead Dome/Spot Lamp	1156 (dome) 67 (spot)	25 W 10 W
Side Repeater	1156	25 W
Turn Signal/Parking Lamp (front)	3357 (amber)	25/8 W
Turn Signal and Stop Lamp/Parking (rear)	1157	25/8 W

Tires, Wheels and Hub Maintenance

Wheel Safety Information



DANGER

Do not attempt to repair wheels or tires unless you are trained and equipped to do so. Wheel and tire assemblies cannot be worked on without proper tools and equipment. Failure to follow this may lead to serious personal injury or death.



DANGER

Do not use mismatched wheel components. If they do not exactly match the original design specifications, they may cause failure or separation leading to an accident causing serious personal injury or death.



DANGER

Failure to properly torque-tighten the wheel nuts can result in the breakage of wheel studs and the subsequent loss of wheels. Loss of vehicle control and serious personal injury or death can occur.



DANGER

Do not install tires with a load rating that is less than stated on the Certification Label in the door frame. The tire could be unintentionally overloaded, leading to an accident, causing serious personal injury or death.



DANGER

Do not use oil or grease on studs or nuts. The tightening torque is affected and can lead to incorrect clamping loads between the rim and hub. This could lead to a loss of the wheel. Loss of vehicle control and serious personal injury or death can occur.



DANGER

Do not use mismatched tires on the same axle. Always use the same type (radial or bias ply) or size. Mixing tires on the same axle will affect the road-holding and can lead to an accident causing serious personal injury or death.



DANGER

Do not install regrooved, retreaded or repaired tires on the steering axle(s). They could fail unexpectedly and cause the loss of vehicle control, leading to serious personal injury or death.

Wheels



DANGER

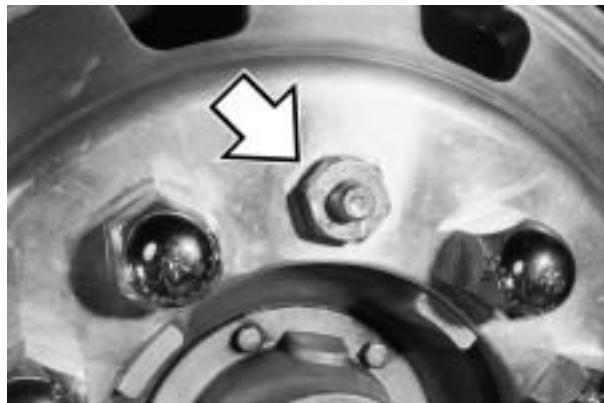
Before checking the wheels, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.



DANGER

Wheels must be serviced only by a qualified technician. Do not do this work yourself. Inflated tires on wheels contain compressed air and if suddenly released, do so with an explosive force. Serious personal injury or death can occur.

Check wheels for signs of rust streaks around the wheel nuts. This indicates looseness (steel rims). Inspect all types of rims for cracks. Cracks can appear in many places but typically radiate out from where a load is applied. Inspect closely around wheelnuts, handholes and inside circumference.



W7000445

Wheel Nut Tightening

After the initial tightening, retightening must be made within the first 500 miles (800 km). After the first retightening, only normal inspection of nut tightness is needed.

Check front and rear wheel nut tightness with a torque wrench. All disc wheels for Volvo vehicles have a tightening torque of 450 ft-lb (610 Nm). Tighten the nuts in the correct sequence. For spoke wheels, check the manufacturer's specifications. Inspect bolts and nuts for signs of wear or cracks. Make sure that the bolts are not bent.



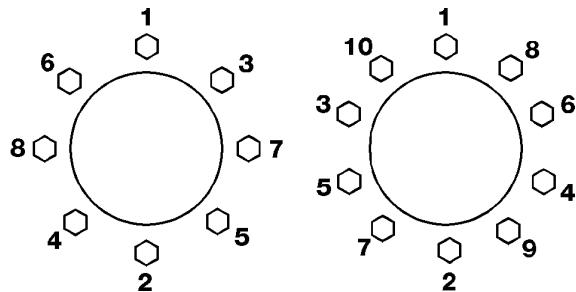
W7001132



DANGER

Failure to properly torque-tighten the wheel nuts can result in the breakage of wheel studs and the subsequent loss of wheels. Loss of vehicle control and serious personal injury or death can occur.

This check tightening is particularly important when rims or brake drums are newly painted. Paint can flake off from these surfaces, causing the nuts to lose their grip and the wheel to loosen.



W7000774

8 and 10-stud wheelnut tightening sequence.

Tire Inflation and Wear



DANGER

Before checking the tires, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

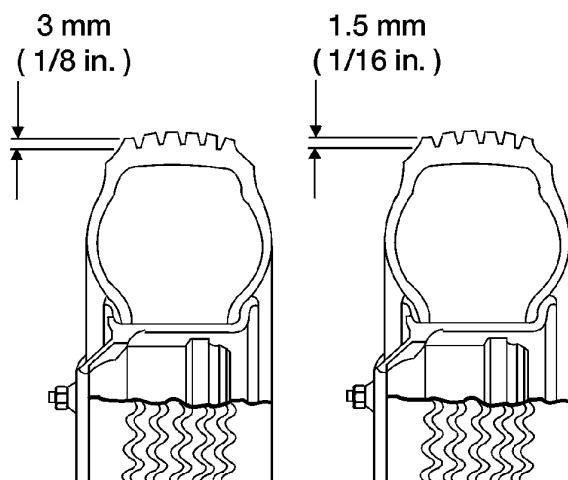


WARNING

Check tire pressure when the tire is cool. Never bleed the air from hot tires. Increased tire pressure measured in a hot tire is normal. Low pressures may cause side wall flexing, resulting in increased heat, leading to tire failure.

Measure the tread depth. The depth should not be less than $4/32$ in. (3.2 mm) on front tires and not less than $2/32$ in. (1.6 mm) on drive tires.

It is important to have the wheels correctly aligned. Check for uneven tire wear frequently. Uneven tire wear is a sign of wheels out of alignment. Refer to page 184 for examples of typical tire wear.



STEER TIRE

DRIVE TIRE

W7000773



DANGER

Do not operate the vehicle with underinflated tires. Always keep your tires inflated to the manufacturer's recommendation. Increased flexing in the tire sidewall produces heat. The heat can build to the point of blowing the tire out causing an accident and lead to serious personal injury or death.



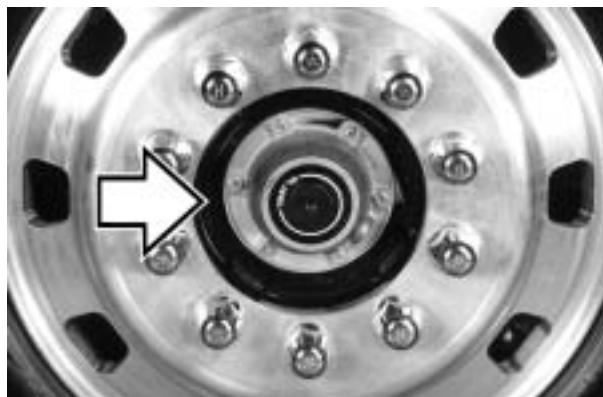
W7000437

Remove stones lodged in ribs or in between double-mounted wheels. Check the tire pressure and leak-test the valve stems.

Front Wheel Hubs

The front wheel hubs can be filled with one of several types of oil. Motor oil should be SAE 30 or 15W40. The oil can be either petroleum based or synthetic (synthetic should not be used for the Volvo axle). Axle oil, API GL-5, SAE 75W-90, can also be used.

There are no set change intervals for hub lubrication. The only requirement is that if the hub is opened, the lubricant must be changed.



W7000438



DANGER

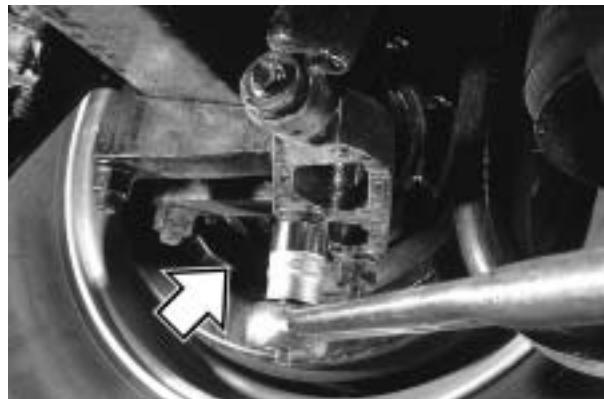
Failure to keep wheel bearings properly adjusted may result in accelerated tire wear, poor handling and, in extreme cases, wheel separation from the hub or from the spindle resulting in loss of vehicle control and serious personal injury or death.

Chassis Maintenance

Springs

NOTE! This work is best performed by a Volvo Truck dealer or other service outlet having the proper equipment.

The spring package is fastened to the axle beam with U-bolts. It is important that the U-bolt nuts are properly tightened. The nuts may loosen up with time. Severe roads and service will loosen them faster. Loose U-bolts can cause springs to break, axle misalignment, hard steering and abnormal tire wear.



W6000875



DANGER

Do not operate the vehicle if the U-bolts are loose. If the U-bolts are loose, the axle is not properly secured to the suspension. This could cause loss of control of the vehicle leading to an accident resulting in personal injury or death.

The U-bolt nuts need to be retightened to the proper torque, both on front and rear axles, at 15,000 miles (24,000 km). Torque for the front axle is 310 ft-lb (420 Nm) and for the rear axle it is 370 ft-lb (500 Nm).

Spring Bushings

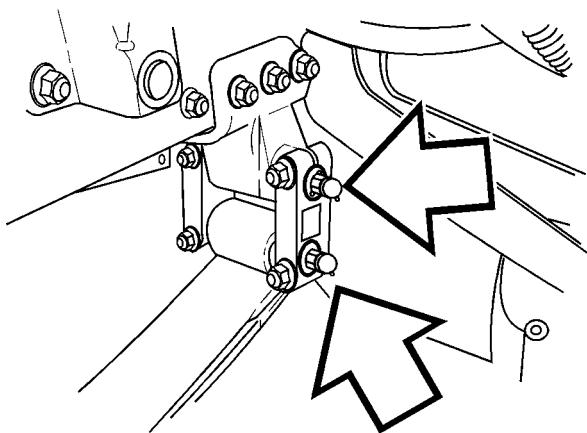


DANGER

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

When lubricating the springs, lift the axle off of the floor, suspend the frame with axle stands and lower the axle. The spring bushings are now in the position where grease can be added to the contact surfaces. If the spring bushings are greased without taking the load off, high wear and lower lifetime will occur because of no grease reaching the contact surfaces.

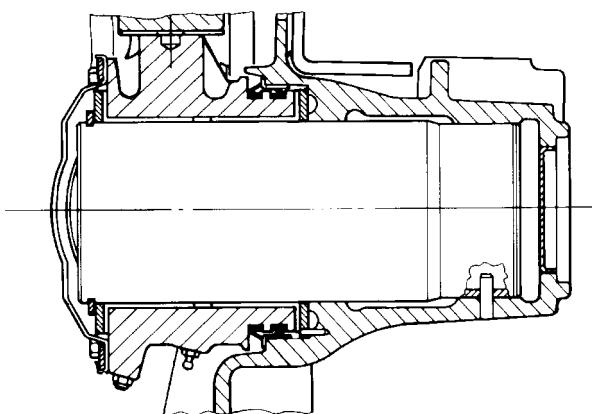
If the vehicle is being driven in severe climates with a lot of wet, slushy, highly dusty roads, or in off-road service, increase the frequency of spring bushing lubrication.



W7000449

T-Ride Equalizer Beams

The Volvo T-Ride suspension has equalizer beams between the tandem axles. The beam bushing needs to be lubricated at the normal lube intervals for normal highway driving. If the vehicle is being driven in severe climates with a lot of wet, slushy, highly dusty roads, or in off-road service, increase the frequency of lubrication. If driving in severe duty, where water may enter the bushing, daily lubrication may be necessary.



W6000838

Cab Maintenance

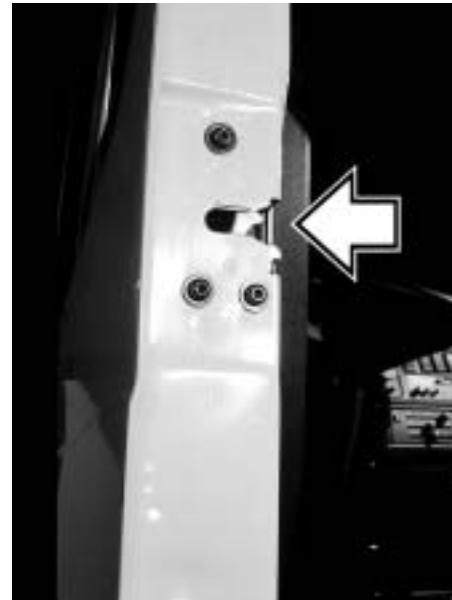
Doors

The door lock mechanism should be greased annually using white grease. Lubricate the door lock cylinder with liquid graphite annually, or more often in climates with a lot of snow and salt on the roads. Coat the door stop arm with white grease annually.

On wet and salted roads, roadspray can enter the door lock key cylinder. Lubricate the cylinder with liquid graphite annually or more often if necessary.

The door hinge pins are treated at manufacturing and then sealed. No lubrication is necessary.

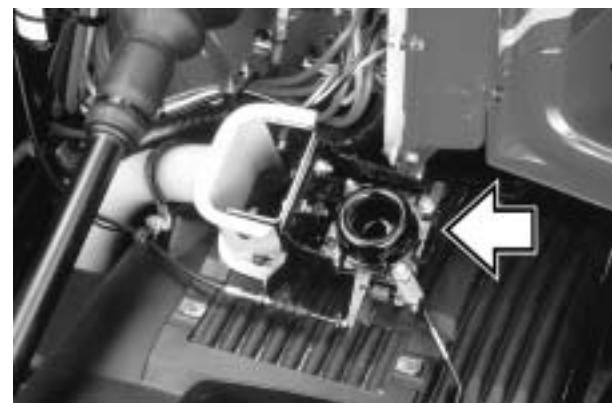
To keep the door rubber moldings and seals around the windows in good working order and to prevent them from freezing shut during the cold season, occasionally spray on a silicone compound.



W8000949

Hood

The hood latch mechanism should be greased with white grease yearly. If the mechanism is hard to work or binds, the latch should be cleaned before greasing.



W8000888

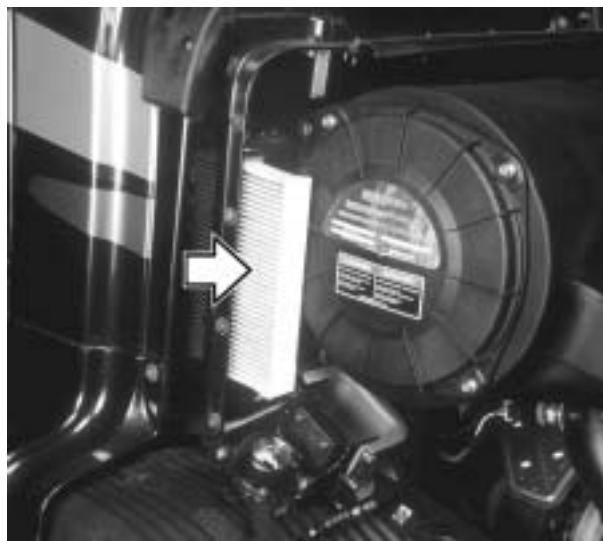
Rustprotection

The rustprotection applied when the cab was produced is adequate for normal use and service. If an extension of the cab rustprotection is desired or if the vehicle is used in a severe application, it is recommended that cavity wax is re-applied every 3rd year.

Cab Air Filter

Air going into the cab passes a filter located on the right, front side of the cab. Remove the filter and clean with an air gun (no more than 20 psi pressure) after 40,000 miles (64,000 km), (in dusty conditions as often as every 10,000 miles [16,000 km]). Make sure the air stream is directed from the inside out.

The filter should not be cleaned and reused more than once. Replace with a new filter after maximum 70,000 miles (110,000 km), or earlier if driving in dusty conditions. A clogged filter decreases the efficiency of the air conditioning system.



W8002474

Lacquer and Brightwork Care

Paint

Cab

Wash all exterior painted surfaces frequently to remove dirt. It is especially important to wash off salt-laden snow and ice during the cold season. A mild detergent can be used but avoid strong detergents.

NOTE! Do not aim the water jet directly at door and window seals or door locks. If locks are filled with water, use compressed air to clean the water out and then apply liquid graphite. Be especially careful of leaving water in locks or around seals during freezing weather.

Wet the surface with water to loosen dirt. The use of steam or high pressure water will help in removing loose dirt. Wash the surface with a sponge using a lot of water to flush away dirt. Dry the surface with a towel or chamois. Do not wait until it is dry as dry-dusting will scratch the surface.

Apply a coat of wax regularly. This will help the paint and other surfaces keep their luster. If the surface gets dull, use a restoring cleaner specially designed for this. Clean off all tar spots and tree sap before waxing.

When the vehicle is new, allow for enough time for the paint to cure. Wait about 30 days after the date of manufacture before putting on the first coat of wax. Never wax on a hot day under the sun and do not apply too much pressure with a buffer as burns may develop from the friction.

Chassis

Keep the chassis free from buildup of dirt. Make sure the chassis is cleaned before the maintenance inspections to help spotting leaks, etc. As salt can be part of the road sludge during the cold season, remove buildup of snow and ice so it does not promote corrosion. At the end of the cold season, thoroughly flush away all collected dirt from the chassis.

Stainless Steel

Stainless steel will rust if exposed to salt for too long. Wash frequently, especially during the cold season, to remove salt-laden snow and ice. If rust appears, wash the surface and use a rubbing compound to remove the rust. Apply a coat of wax as a finish (do not wax parts that get hot, such as exhaust pipes, etc.).

NOTE! Never use steel wool to clean stainless steel. Pieces of the steel wool breaks off and give rust stains on the surface.

Chrome

Chromed surfaces will rust if they are not protected. This is especially important during the cold season when roads are salted or in coastal areas where the salt level in the air is high.

Clean chrome surfaces with clean water. If the surface has heavy dirt or tar spots, use a tar remover. To remove rust spots, use a non-abrasive chrome cleaner and apply a coat of wax as a finish (do not wax parts that get hot, such as exhaust pipes, etc.).

NOTE! Never use steel wool to clean chrome. Pieces of the steel wool breaks off and give rust stains on the surface.

Aluminum

Unprotected aluminum surfaces will form an oxide layer if not maintained. This is especially important during the cold season when roads are salted or in coastal areas where the salt level in the air is high. Clean with steam or high pressure water. Use a mild detergent if the dirt is heavy. Rinse well.

Clean aluminum surfaces with warm water. If the surface has heavy dirt or tar spots, use a tar remover. To prevent spotting, wipe aluminum surfaces dry after washing.

Upholstery

Clean vinyl and cloth upholstery with light brushing or vacuuming. If heavily soiled, use warm water with mild soap such as saddle or oil soap.

Lubrication, VHD

Chassis Lubrication



DANGER

Before working on or servicing a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

General lubrication includes lubricating all the grease fittings in the drivetrain, front and rear suspensions, power steering, and front axle, using a grease gun.

Grease the chassis every 15,000 miles (24,000 km). However, if the vehicle is in a demanding application or running in a dirty or corrosive atmosphere, adjust the lubrication intervals to reflect heavy-duty use. For example, if driven in heavy stop-and-go traffic with a lot of maneuvering, the lubrication intervals should be every 10,000 miles (16,000 km) or less.

All lubricating points are found on the chassis lubrication chart on the next page.

Lubricating Grease

Use grease with a lithium base with EP additives and a consistency of NLGI No. 2. The No. 2 consistency is suitable for most temperatures. Use NLGI No. 1 or No. 0 for extremely low temperatures.

Care should be taken not to use any grease other than one with EP additives for the driveshaft. Do not use any solid lubricants, such as graphite, copper or molybdenum disulfide.

Lubrication Procedure

Make sure the grease fittings are cleaned off before filling grease. Dirt on the fitting that is not cleaned off is pushed into the part together with the new grease. Always fill grease to the point where old grease and contaminants are forced out from the part and only new grease comes out. If new grease cannot be filled so old grease is flushed out, the part needs to be checked for problems. If a fitting does not accept lubrication due to damage or internal stoppage, replace it with a new fitting.

NOTE! Think of greasing the same way as an oil change. All old grease needs to come out and replaced with new grease.

Where rubber or plastic parts are involved, do not heat part for better grease application.

Remove excess grease from fittings, shackles and other surfaces.

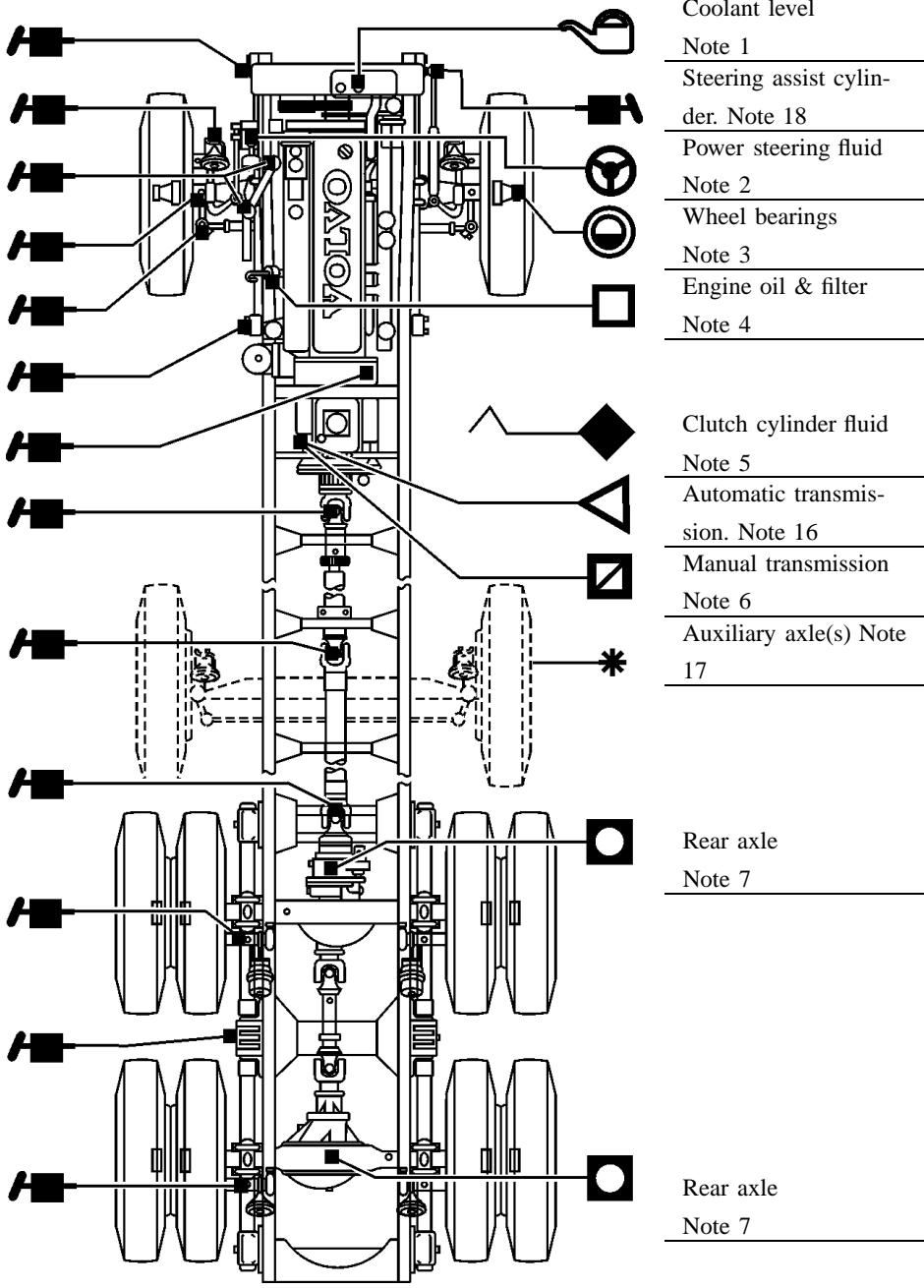
NOTE! Always grease a Volvo front axle with the wheels on the ground.

Lubrication Chart

Spring hanger (2)	
Note 8	
Slack adjuster & brake	
cam (4) Note 9	
Steering gear (1)	
Note 10	
Kingpin, upper & lower (4)	
Note 11	
Tierod (2)	
Note 12	
Spring hanger (4)	
Note 8	
Clutch bearing and linkage.	
Note 15	
U-Joint (1)	
Note 13	

U-Joint (1)	
Note 13	
Slack adjuster & brake	
Cam (4) Note 9	
T-Ride bogie beam (2)	
Note 14	

Slack adjuster & brake	
Cam (4) Note 9	



W1000146

There are notes for each type of lubrication on the next pages. Read these notes before selecting a lubricant.

- Grease
- Hub Oil
- Engine Oil
- ◀ Hydraulic Oil
- Steering Fluid

- ▶ Coolant
- ◀ Aut. Transm. Fluid
- Man. Transm. Oil
- Rear Axle Oil
- ◆ Brake Fluid

Lubrication Chart Notes

- 1 Add if necessary. Only use pre-mixed clean water and antifreeze in a 50/50 mix.
Add only the same type antifreeze, that is: extended life or standard.
- 2 Check the fluid in the reservoir with the dipstick. Add if necessary. Use ATF Dexron® III. Change fluid every 150,000 miles (240,000 km). Change filter every year.
- 3 There is no set change interval. Change the oil (or grease) only in connection with work on the hub or if dirt is found in the lubrication. Use motor oil SAE 30.
- 4 Change the oil according to the schedule on page 61.
- 5 Check that the fluid is at the correct level. If needed, add fluid using brake fluid DOT 4. Fluid should be replaced every 2 years.
- 6 Use a mineral or synthetic oil. Check oil level periodically. Level should be to the bottom of the inspection hole. See page 166 for oil types.
- 7 Check the oil level in the rear axles. The level should be level with the inspection hole. Add if necessary. See page 169 for oil types.
- 8 Use a lithium based grease with specification API NLGI No. 2. When lubricating the springs, lift the axle off of the floor, suspend the frame with axle stands and lower the axle. The spring bushings are now in the position where grease can be added to the contact surfaces.
- 9 Use a lithium based grease with specification API NLGI No. 2. Use liberally in the slack adjuster. Make sure the grease purges through the seal on the brake cam.

NOTE! If the brake cam seal does not purge, make sure the inner seal does not purge into the brake drum and onto the brake linings.
- 10 Use a lithium based grease with specification API NLGI No. 2. Only use a hand operated grease gun. The high pressure from an air operated grease gun will damage the seal.
- 11 Use a lithium based grease with specification API NLGI No. 2.

NOTE! Always grease a Volvo front axle with the wheels on the ground.

NOTE! To grease non-Volvo axles, they are typically greased with the wheels on the ground. Consult with the axle manufacturer for the latest recommendation.

-
- 12 Use a lithium based grease with specification API NLGI No. 2.

NOTE! Volvo axles may use a greased-for-life tierod. No provisions for adding grease are available.

- 13 Use a lithium based grease with EP additives to specification API NLGI No. 2.

NOTE! Make absolutely sure that grease purges out of all four seals of the U-joint.

- 14 Use a lithium based grease with EP additives to specification API NLGI No. 2. Make sure the grease purges out of both the outer and inner seals. If necessary, adjust the lubrication schedule to include greasing the bogie bearing as often as daily, in applications where the bogie runs in corrosive conditions or is submerged in water.

- 15 Use a lithium based grease with EP additives to specification API NLGI No. 2. Do not over-grease the throwout bearing as grease may get into the clutch.

- 16 Use Dexron® III Automatic Transmission fluid. See the manufacturer's Operator's Manual for intervals and quantity.

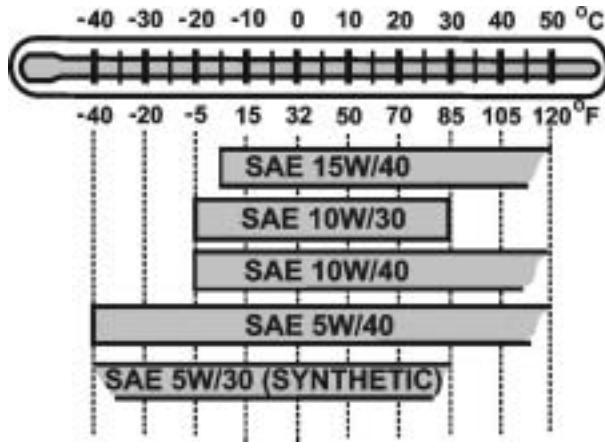
- 17 If equipped with auxiliary lift axles, grease and lubricate according to notes 3, 9, 11 and 12.

- 18 Use a lithium based grease with EP additives to specification API NLGI No. 2 to grease both ball joints.

Viscosity and Capacity Tables

Volvo Engine D7C

For oil change intervals, see page 61	
First oil and filter change	After 1 month or 6,000 miles (10,000 km)
Capacity (including filters)	
D7C service	22 quarts (21 liters)
Oil volume between high and low on dipstick	7.0 quarts (6.5 liters)



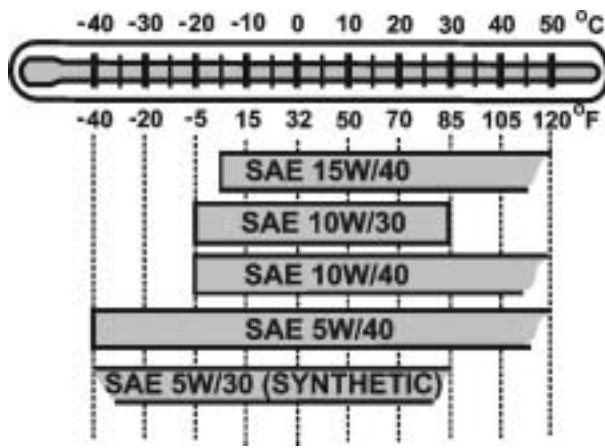
W1000144

1 Only completely synthetic and/or VDS/VDS-2 oils.

2 Only VDS-2 oils.

Volvo Engine D12

For oil change intervals, see page 61	
First oil and filter change	After 1 month or 6,000 miles (10,000 km)
Capacity (including filters)	
D12 service	37 quarts (35 liters)
Oil volume between high and low on dipstick	7.5 quarts (7.0 liters)



W1000144

1 Only completely synthetic and/or VDS/VDS-2 oils.

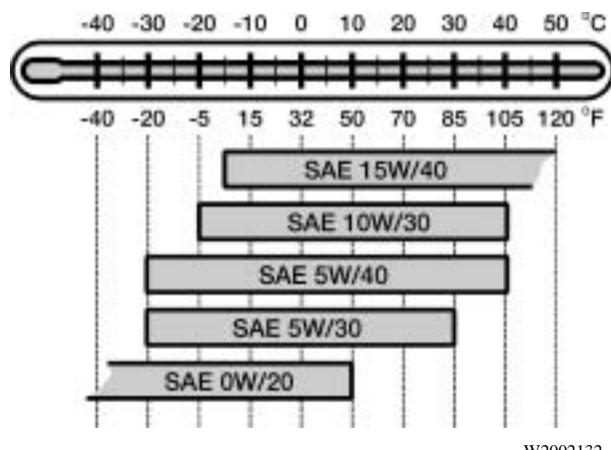
2 Only VDS-2 oils.

Cummins Engine ISM

For oil change intervals, see the manufacturer's Operator's Manual

Capacity (including filters)

ISM, service	39 quarts (37 liters)
ISM, oil volume between high and low on dipstick	7-9 quarts (6.5-8.5 liters)
ISX, service	41 quarts (39 liters)
ISX, oil volume between high and low on dipstick	8-9.5 quarts (7.5-9 liters)



W2002132

Cooling System Capacity*

VHD, D12	39 liters (9.8 US gal.)
VHD, D7	36 liters (9.5 US gal.)

* approximate volumes

Clutch Hydraulic System

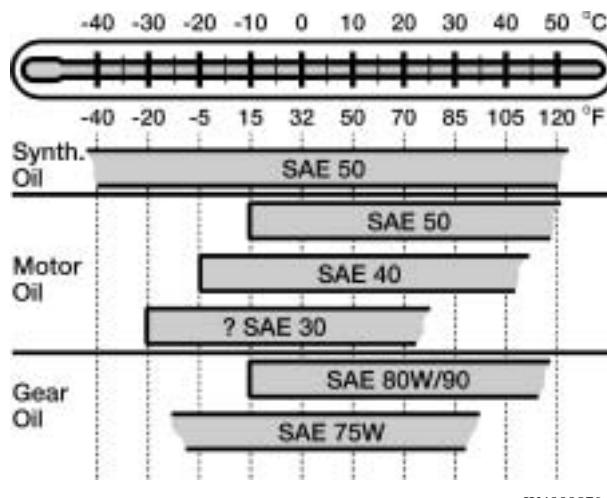
Clutch system fluid	brake fluid according to DOT 4 (SAE J 1703)
Replacement interval	every two years

Fuller Transmission 9,10, 13, 15 and 18-speed

For oil change intervals, see the manufacturer's Operator's Manual

Capacity:

9-speed	13.5 quarts (12.0 liters)
10, 13, 15 and 18-speed	14.0 quarts (13.0 liters)



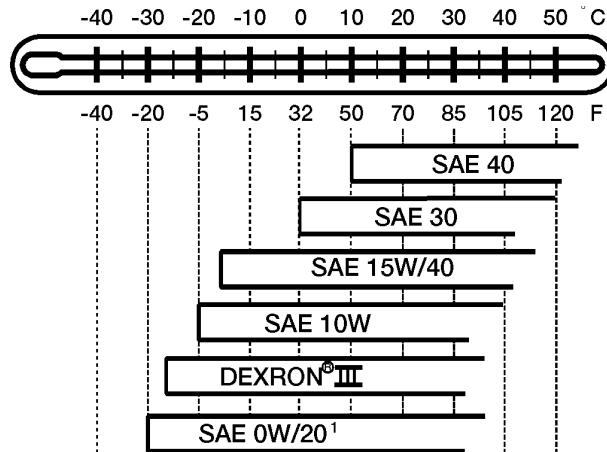
W4000879

Allison Automatic Transmission

For oil change intervals, see the manufacturer's Operator's Manual.

Approximate Capacity:

MD3560P 5-speed	19.0 quarts
MD3060P 5-speed	(18.0 liters)
HD4060P 5-speed	39.0 quarts
HD4560P 5-speed	(37.0 liters)
Oil drain plug torque	18-24 ft-lb (25-32 Nm)



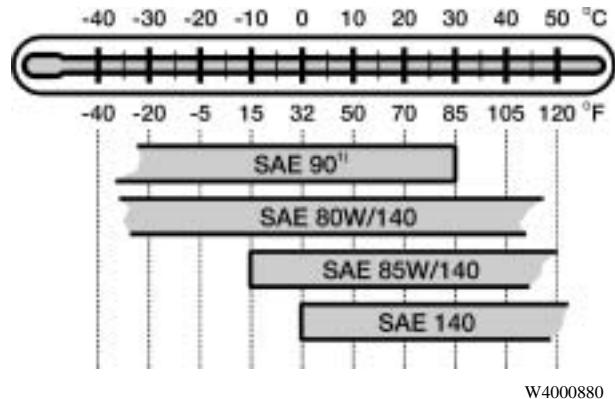
W1000143

- 1) "Arctic" as defined by MIL-L-46167B

NOTE! Fluid may require change sooner than listed intervals depending on operating conditions. Fluid must also be changed whenever there is evidence of dirt or high temperature condition as indicated by discoloration, strong odor or fluid analysis.

Volvo Tandem CTEV87 and RT3210

Oil type:	
<i>Petroleum based oil</i>	API-GL5, MIL-PRF-2105E
First oil change	After one month or 6 000 miles (10 000 km)
Normal oil change interval	every 12 month or 75 000 miles (120 000 km)
Capacity:	
<i>CTEV87</i>	
front tandem, EV87	21.0 quarts (20.0 liters)
rear tandem	9.5 quarts (9.0 liters)
<i>RT2610</i>	
front tandem	24.5 quarts (23.0 liters)
rear tandem	20 quarts (19.0 liters)
hub reduction, each hub ¹	3.7 quarts (3.5 liters)
<i>RT3210</i>	
front tandem	29.5 quarts (28.0 liters)
rear tandem	24.5 quarts (23.0 liters)
hub reduction, each hub ¹	3.2 quarts (3.0 liters)



- 1) For very hard or continuous operation above an altitude of 6 000 ft (2 000 m) above sea level, a viscosity of SAE 140, SAE 80W/140 or SAE 85W/140 is recommended for use instead of SAE 90.

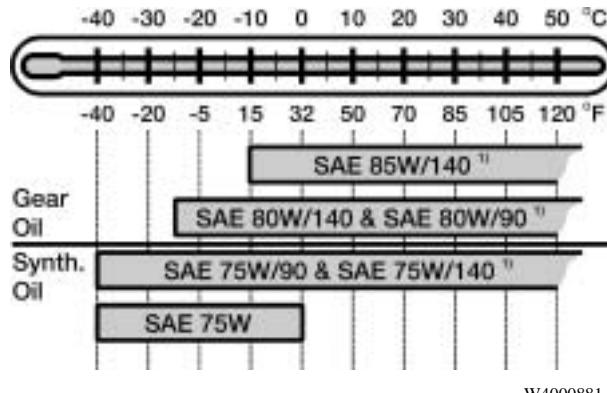
¹ Fill each hub before filling the rear axle.

Meritor Single RS23, 25, 26 and 30 Meritor Tandem RT40, 44 and 46

For oil change intervals, see the manufacturer's Operator's Manual

Capacity:

RS23-160	20 quarts (19 liters)
RS23-185	23.5 quarts (22.5 liters)
RT40-145, front tandem	15 quarts (14 liters)
RT40-145, rear tandem	13 quarts (12 liters)



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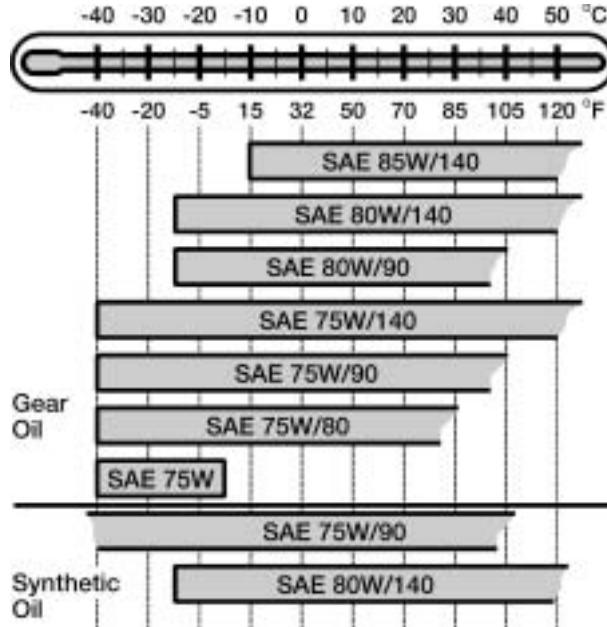
- 1) Select viscosity from the table above. Temperatures refer to stable ambient temperature readings. There is no upper limit to these outside temperatures but the axle sump temperature **MUST NEVER EXCEED 250°F (120°C)**.

Eaton Single 23080, 23105, 26105 and 30105 Eaton Tandem DS405, DD405, DDH44 and DS462

For oil change intervals, see the manufacturer's Operator's Manual

Capacity:

23080	20 quarts (19 liters)
23105 and 26105	28 quarts (26.5 liters)
DD404, front tandem	15.5 quarts (14.5 liters)
DD404, rear tandem	14 quarts (13 liters)
DS404, front tandem	15.5 quarts (14.5 liters)
DS404, rear tandem	14 quarts (13 liters)



W4000882

Steering Hydraulic System

Fluid type	Automatic Transmission Fluid (ATF) Dexron® III
Change interval	every 150,000 miles (240,000 km)

Hubs

Oil type ¹	Temperature
Motor oil API CD or CE, SAE 30, 15W40 or synthetic	Minimum: -15°F (-25°C) Maximum: No limit
Gear oil API GL5, SAE 75W90	Minimum: -40°F (-40°C) Maximum: No limit

¹For axles with hub reduction, see page 169

Service Assistance and Manuals

Your Volvo Truck dealer is trained and equipped to perform expert service on your Volvo vehicle. Your dealer has direct access to Volvo Trucks North America, Inc. for technical help, parts or service information.

There is also a direct number to Volvo Action Service (VAS), staffed 24 hours a day, if you are in need of assistance. The number to the Customer Support Center is: 1 (800) 528-6586 (or (800) 52-VOLVO).

Also on the internet:
www.vas.volvo.com

VAS can offer:

Delivery Assurance

If you have a breakdown, VAS can arrange for load forwarding or equipment rental.

Personal Assurance

Trained staff for handling any vehicle problems.

Uptime Assurance

VAS will locate the nearest service provider and guarantee payment so you can get on the road as soon as possible.

Price Assurance

VAS audits service and parts billing to ensure guaranteed labor rates and preferred parts pricing for Volvo components.

There are also five regional offices that can give information and help. They are located in five cities around the US:

Northeast Region - Philadelphia

Ph. (610) 695-6940
 Fx. (610) 993-2881

Southeast Region - Atlanta

Ph. (770) 751-3120
 Fx. (770) 751-3149

Midwest Region - Chicago

Ph. (630) 734-4600
 Fx. (630) 734-3086

Southwest Region - Dallas

Ph. (972) 404-3100
 Fx. (972) 404-3125

West Region - Salt Lake City

Ph. (801) 352-6301
 Fx. (801) 352-6350

To order a single Service Manual or a Service Manual Set for your vehicle, you should contact your authorized Volvo Truck dealer or fax a request to the Volvo Truck North America, Inc. publications warehouse (Fax: (336) 668-3625). They will help you locate the manual(s) you need.

To be able to handle the order correctly, you must give the model, year and VIN (for VIN location, see the vehicle Operator's Manual).

Prices for a Service Manual Set vary depending on what model of vehicle and what engine it is. Billing will be done through the nearest Volvo Truck dealer.

Name	Company
Address	
CSZ (Province, Postal Code)	
Vehicle Model	Telephone/Fax
Model Year	VIN
Item 1:	
Item 2:	
Item 3:	
Item 4:	
Item 5:	

Scheduled Services

The vehicle had a pre-delivery inspection before being delivered to you, the customer. Regular maintenance inspections should be continued. The maintenance program and lubrication intervals that are listed in this manual may not suit your operation. Contact your nearest Volvo dealer, who can help with designing a maintenance program that works in your application.

For regular service or maintenance, call the dealer in advance and arrange for a service appointment. This gives the dealer time to schedule the correct equipment and provide a trained technician to service the vehicle. Setting an appointment can decrease vehicle downtime.

When in for service at an authorized dealer, ask for outstanding safety related recalls that relate to the vehicle. This service is available only at an authorized dealership.

NOTE! It is strongly recommended that you do not attempt to service, repair or maintain the vehicle yourself unless you are fully trained and have the proper tools,

equipment and parts. Some procedures are better performed by your Volvo Truck dealer who has the proper equipment and trained technicians.

176 Service Charts

Repair Record

Keep track of repairs being made. This helps over the lifetime of the vehicle to spot trends that can be used to alter maintenance schedules, for example.

178 Service Charts

Repair Record

Repair Record

Repair Record

Tire Record

Tire Hints

Hints on How to Avoid Unnecessary Tire Wear

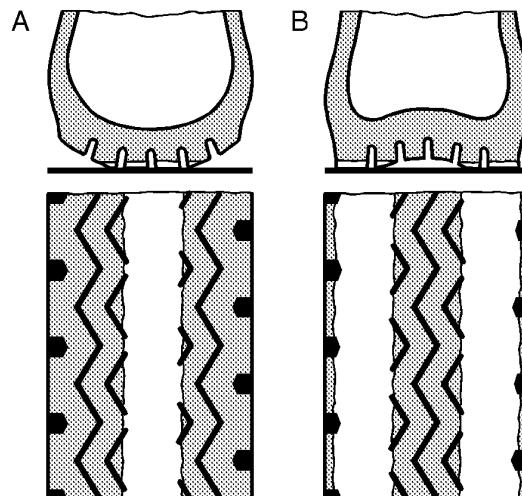
- Maintain correct tire pressure
- Check the tire pressure when the tires are cold
- Check that valve caps are not missing
- Keep the wheels balanced
- Tire wear increases with speed
- Overloading not only decreases tire life but also creates a hazard
- Incorrect front end alignment causes increased wear
- Unnecessary tire rotation may cause excessive wear

NOTE! A cold weather initial driving period will increase the life of new or retreaded tires. Dual mounted wheels should always be of the same type and diameter (maximal diameter difference allowed is 1/4 in. [6 mm]).

Typical Wear Patterns

Incorrect Air Pressure

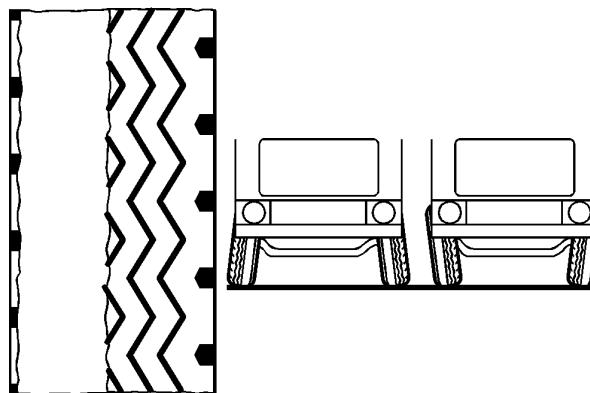
- A Too high air pressure gives rapid wear in the middle.
- B Too low air pressure gives rapid shoulder wear.



T1006457

Incorrect Camber

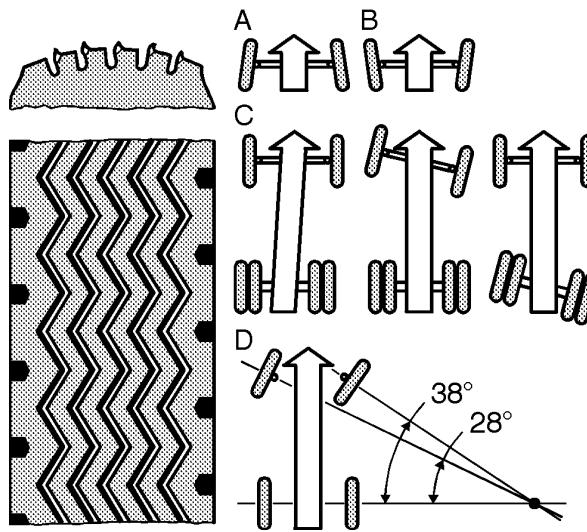
Incorrect camber gives abnormal wear on one half of the tire.



T1006458

Incorrect Toe and Axle Alignment

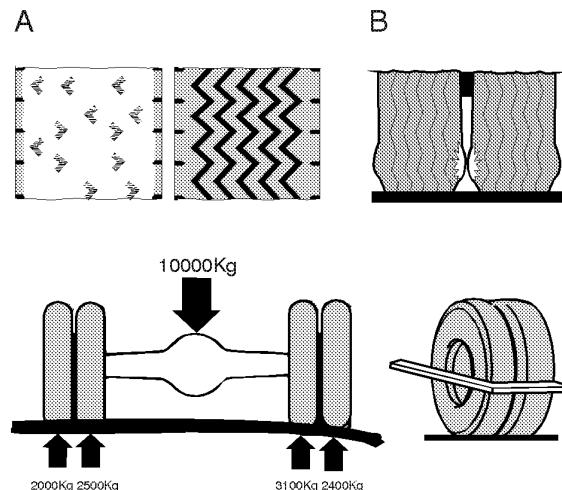
- A Incorrect toe-in.
- B Incorrect toe-out.
- C Out-of-line axle
- D Steering arm defect



T1006459

Dual Wheel Mounting

- A** Excessive road camber, different types of tire, different circumference or off-center loading gives faster wear on one tire.
- B** Too low air pressure, mismatched rims for the tire type and dimension, excess flexing in tire wall, or different types of tires in inner and outer tires gives contact wear.

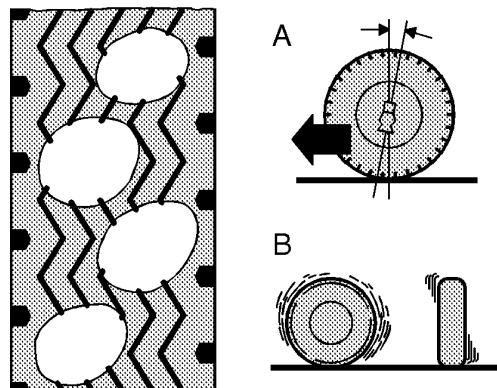


T1006718

Incorrect Caster and Imbalance

- A** Caster angle.
- B** Imbalance.

Also rapidly wears the mechanical parts of steering linkage, kingpin and wheel bearing.

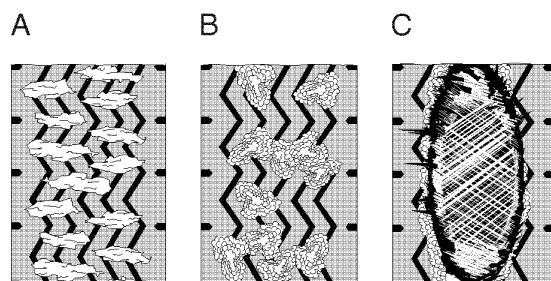


T1006460

Cuts in the Tire Tread

- A** Cuts.
- B** Flaking cuts.
- C** Rubber flaking.

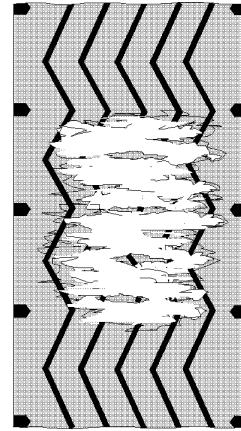
Cuts are due to poor roads, air pressure too high or incorrect tire type.



T1006720

Spot Wear

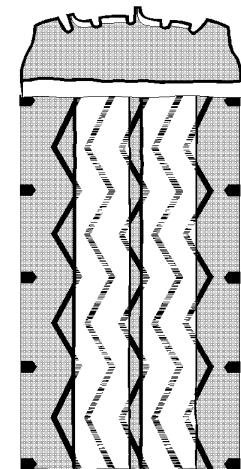
Sudden braking, locking brakes or out-of-round brake drums gives spot wear.



T1006721

Feathered Edges

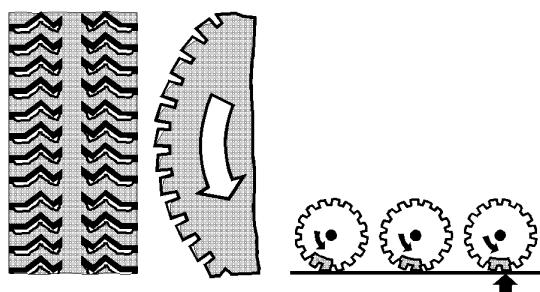
Normal occurrence on non-driving wheels on good roads and high mileage.



T1006722

Cupping

Cupping is a normal occurrence that depends on the tread pattern; the higher the load, the greater the wear.



T1006723

AXLE LOAD/TIRE PRESSUREAxe Load
lb (kg)Recommended tire pressure
psi (kPa)**1****2****3** **4****5** **6****7** **8****9** **10****11** **12****13** **14****15** **16****17** **18**

W1000109

Tire Record

Tire Record

Tire Record

Fuel and Oil Record

Keeping track of the fuel and oil consumption gives a record of what is normal for the vehicle. This can be compared with other vehicles in the same service application to indicate what is normal fuel and oil consumption for a certain application.

196 Service Charts

198 Service Charts

200 Service Charts

202 Service Charts

204 Service Charts

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VHD Technical and Parts Support Group

If you need technical assistance, the group for technical and parts support is available 24 hours per day, 7 days per week at 1-877-978-6586.

This assistance is available to help you with solving technical issues and parts issues regarding the Volvo Heavy Duty (VHD) model vehicle. A trained Volvo VHD Specialist for Technical and Parts Support will give you the assistance you need to resolve your problem.

1-877-97-VOLVO

VOLVO Action Service (VAS) Support Center

If you need breakdown assistance, contact the VAS support center for towing or repair. VAS is available 24 hours per day, 7 days per week at **1-800-528-6586**. A Volvo Customer Support Specialist will answer your questions or arrange for the assistance you need.

1-800-52-VOLVO

VOLVO

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