



**OPERATOR'S MANUAL
VEHICLE MAINTENANCE
VN,VHD**

VOLVO D11F AND D13F ENGINES

Volvo Trucks. Driving Success.®



Foreword	1
Warning Label Information	2
General Information	3
Information for the Owner	3
Exhaust and Noise Emissions	5
Label Information	21
Fuse and Relay Location	22
Safety Information	24
Proper Maintenance Procedure	24
Injury Prevention	26
Engine Damage Prevention	34
Electric System Damage Prevention	36
Reporting Safety Defects	38
General Engine Information	39
Engine Overview, D11F and D13F Left Side View	39
Engine Overview, D11F and D13F Right Side View	40
Engine Storage	41
Engine Storage	41
Maintenance and Service	42
Maintenance Hazards	42
Engine Components, Service Schedules	43
Cooling System	44
Fuel System	49
Engine Oil	57
Engine Air Filter	63
Diesel Particulate Filters (If Equipped)	65
Fan and Auxiliary Drive Belts	66
Turbocharger and Charge Air Cooler	68
Fuel System Service	70
Transmission, Clutch and Rear Axle Maintenance	73
Steering and Brakes Maintenance	76
Electrical System Maintenance	80
Tires, Wheels and Hub Maintenance	82
Chassis Maintenance	95
Cab Maintenance	97
Lubrication	102
Oil Capacity Tables and Viscosity Charts	108

Service Check List	111
Preventive Maintenance	112
Service Charts	115
Scheduled Services	116
Repair Record	118
Tire Record	119
Fuel and Oil Record	120
Literature	121
Engine Data	121
Service Assistance and Manuals	122
Index	123

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 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.

<h2>NOTE</h2>

It is important that this manual stay 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 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 (888) 327-4236, by writing to NHTSA, U.S. Department of Transportation, Washington, DC 20590, by TTY at 1 (800) 424-9153, or visit their website at www.nhtsa.dot.gov.

Volvo Trucks North America

Greensboro, NC USA

Order number: PV776-21012002

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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 extremely important that this information is read and understood before the vehicle is operated.

IT IS IMPORTANT THAT THE FOLLOWING INFORMATION CONCERNING LABELS BE 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 proper operation of the vehicle.

 **DANGER**

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.

 **WARNING**

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.

 **CAUTION**

*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.*

Warning and Advisory Labels

Advisory, Danger, Warning and Caution labels are placed in various locations of the vehicle to alert drivers and service technicians about situations that may lead to personal injury or equipment damage. In the event that a label is damaged or missing the **label must be replaced**. Contact your authorized Volvo Truck dealer for assistance regarding Warning and Advisory labels.

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 manufacturers 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. There is also certain information regarding the Cummins engine. For detailed information on the Cummins engine or non-Volvo engines and/or drivetrains contact your nearest Volvo Truck dealer.

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.

<h3>NOTE</h3>

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

P. O. Box 26115

Greensboro, NC 27402-6115

United States of America

This Maintenance Manual covers all Volvo vehicles manufactured by Volvo Trucks North America, including the whole chassis and all Volvo manufactured components. For specific maintenance information on vendor components, manufactured by, for example: Cummins, 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.

NOTE

Illustrations are used for reference only and may differ slightly from the actual vehicle, however, key components addressed in this manual are represented as accurately as possible.

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

EXHAUST AND NOISE 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 delivery of the vehicle to the ultimate purchaser, and, in addition, no manufacturer or dealer may 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.

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.

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 SYSTEMS WARRANTY**NOTE**

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

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

Your emission control system may include parts such as the fuel-injection system, turbocharger assembly, electronic control module and other emission-related assemblies.

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

MANUFACTURER'S WARRANTY COVERAGE:

If an emission-related part of your engine is defective, the part will be repaired or replaced by Volvo Trucks North America. This is your emission control system DEFECTS WARRANTY.

OWNER'S WARRANTY RESPONSIBILITIES:

As the motor vehicle engine owner, you are responsible for the performance of the required maintenance listed in this manual. Volvo Trucks North America recommends that you retain all receipts covering maintenance of your vehicle, but Volvo Trucks North America cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance listed in other manuals which were supplied with your vehicle.

You are responsible for presenting your motor vehicle engine to a VOLVO 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 motor vehicle engine owner, you should also be aware that Volvo Trucks North America 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 the Volvo Trucks North America Warranty Department at P. O. Box 26115, Greensboro, NC 27402-6115, or the California Air Resources Board at 9480 Telstar Avenue, El Monte, California 91731.

(Applicable only to vehicles and/or engines certified for sale and registered in the State of California)

Volvo Trucks North America warrants the Emission Control Systems on each new VOLVO diesel engine in a new VOLVO truck to comply with all State of California emissions regulations applicable at the time of manufacture of the engine, and to be free from defects in material and workmanship under normal use and service up to 60 months, or 100,000 miles, or 3,000 engine operating hours, whichever occurs first, provided all Volvo Trucks North America maintenance requirements are followed as described in this manual. All warranty periods are calculated from the date-in-service of the new vehicle. The repair or replacement of defective parts will be made without charge for the cost of parts and, if repairs are made at an authorized Volvo Trucks North America dealership, there will be no charge for labor.

Volvo Trucks North America's obligation under this warranty is limited to the repair or replacement, at Volvo Trucks North America's option, of any part(s) of the Emission Control Systems of such engine and/or vehicle found to be defective upon examination by Volvo Trucks North America and provided that such part(s) were returned to Volvo Trucks North America or its nearest authorized Dealer within a reasonable period of time.

Qualifications and Limitations:

Not covered by the Emissions Control Systems Warranty:

- Malfunctions caused by misuse, improper adjustments, modification, alteration, tampering, disconnection, improper or inadequate maintenance and use of improper diesel fuel.
- Damage resulting from accident, acts of nature or other events beyond the control of Volvo Trucks North America.
- Inconvenience, loss of use of the vehicle, commercial loss of any kind including, but not limited to, consequential, incidental damages.
- Any vehicle in which the odometer has been altered or damaged so that mileage cannot be readily determined.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES AND REPRESENTATIONS OR CONDITIONS, STATUTORY OR OTHERWISE, EXPRESSED OR IMPLIED INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

PROCEDURES FOR HANDLING EMISSIONS CONTROL SYSTEM WARRANTY

The following engine components are covered by the supplemental emissions control system warranty policy as required by the California Code of Regulations.

- a. Turbocharger Assembly
- b. VGT Actuator Control Valve
- c. Charge Air Cooler
- d. Unit Injectors
- e. Engine Wiring Harness
- f. Electronic Control Module
- g. EGR Mixer
- h. EGR Cooler
- i. EGR Control Valve
- j. Crankcase Breather
- k. Diesel Particulate Filter (DPF) Assembly
- l. DPF Components:
 - Aftertreatment Fuel Injector (AFI)
 - AFI Shutoff Valve
 - Discharge Recirculation Valve
 - Pre-Catalyst Temp. Sensor
 - Post-Catalyst Temp. Sensor
 - Downstream DPF Temp. Sensor
 - Differential Pressure Sensor
- m. Sensors:
 - Engine Timing/Speed (flywheel)
 - Engine Position (camshaft)
 - Temperature — Coolant
 - Temperature — Inlet Manifold Air
 - Pressure — Boost Air
 - Humidity
 - EGR Temperature
 - EGR Differential Pressure

The emission warranty for the diesel particulate filter covers defects in workmanship only. Normal maintenance, such as cleaning ash from the filter at regular maintenance intervals, is not covered by the emission warranty.

NOTE

In response to customer requests, Volvo Trucks North America may build vehicles with engines supplied by other manufacturers, including, but not limited to, Cummins. In these cases, each engine manufacturer through its service organization, is responsible for emission control systems warranty on all parts of the engine assembly, as furnished.

CAUTION

Any unauthorized adjustments to the emission control components can cause severe damage to the engine.

1. Repairs by VOLVO Dealers, Sub-Dealers and Service Dealers

Repairs covered by the California Emission Control Systems Warranty will be performed by any authorized VOLVO repair facility at his place of business with no charge for parts and labor (including diagnosis), using VOLVO parts for any part of the emission control systems covered by this warranty and found defective.

2. In an Emergency

In an emergency, where an authorized VOLVO facility is not available, repairs may be performed at any available service establishment, or by the owner, using any replacement part, within the limitations of paragraphs 4 and 5 in this section. An emergency condition exists under this section if, after 30 days, repairs have not been completed or parts are not yet available. VOLVO will reimburse the owner for such repairs that are covered under this warranty, including diagnosis, not to exceed VOLVO's suggested retail price for parts replaced and labor charges based on VOLVO's recommended time allowance and geographically appropriate hourly labor rate. Replaced parts and paid invoices must be presented at a VOLVO facility as a condition of reimbursement for emergency repairs performed elsewhere.

⚠ CAUTION

In the event that damage results from unauthorized adjustments to any emission control system components, as evidenced by settings other than as specified, or broken fastener seals, the cost of repairing such damage WILL NOT BE COVERED under warranty.

3. Repairs by Non-VOLVO Facilities

Owners may elect to have maintenance, replacement, or repair of emission control systems performed by any repair facility, and may elect to use parts other than VOLVO parts without invalidating the warranty on other components, but the cost of such service or parts will not be covered by VOLVO under its warranty.

4. Use of Non-VOLVO Parts

Use of replacement parts which are not the equivalent of VOLVO parts may impair the effectiveness of emission control systems. If other than VOLVO parts are used, the owner should obtain assurances that such parts are warranted by their manufacturer to be the equivalent of VOLVO parts in performance and durability. VOLVO assumes no liability under this warranty with respect to parts other than VOLVO parts; however, the use of non-VOLVO parts does not invalidate the warranty on other components unless non-VOLVO parts cause damage to warranted parts.

5. Maintenance and Maintenance Records

The vehicle owner is responsible for the performance of all required maintenance specified in this manual.

VOLVO will not deny a warranty claim solely because there is no record of maintenance; however, VOLVO may deny a warranty claim if failure to perform required maintenance results in the failure of a warranted part. Receipts or other records covering the performance of scheduled maintenance should be retained to answer questions that may arise concerning maintenance. Maintenance records should be transferred to subsequent owners if the vehicle is sold.

6. Items Not Covered by the Emission Control Systems Warranty

- Malfunctions caused by misuse, improper adjustments, modification, alteration, tampering, disconnection, improper or inadequate maintenance.
- Damage resulting from accident, acts of nature or other events beyond the control of VOLVO.
- Inconvenience, loss of use of the vehicle, or commercial loss.
- Any vehicle on which the odometer has been changed so that mileage cannot be readily determined.

7. **Customer Assistance**

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

Volvo Trucks North America

Warranty Administration

(336) 393-2000

GASEOUS EMISSION CONTROL SYSTEMS WARRANTY

NOTE

For emission control systems information on engines other than VOLVO, refer to the engine vendor's publications.

Volvo Trucks North America warrants the Emission Control Systems on each new VOLVO diesel engine in a new VOLVO truck to comply with all United States Federal and Canadian emissions regulations applicable at the time of manufacture of the engine, and to be free from defects in material and workmanship under normal use and service up to 60 months, or 100,000 miles, whichever occurs first, provided all Volvo Trucks North America. maintenance requirements are followed as described in this manual. All warranty periods are calculated from the data-in-service of the new vehicle. The repair or replacement of defective parts will be made without charge for the cost of parts and, if repairs are made at an authorized Volvo Trucks North America. dealership, there will be no charge for labor.

Volvo Trucks North America's obligation under this warranty is limited to the repair or replacement, at Volvo Trucks North America's option, of any part(s) of the Emission Control Systems of such engine and/or vehicle found to be defective upon examination by Volvo Trucks North America and provided that such part(s) were returned to Volvo Trucks North America or its nearest authorized Dealer within a reasonable period of time.

Qualifications and Limitations:

Not covered by the Emissions Control Systems Warranty:

- Malfunctions caused by misuse, improper adjustments, modification, alteration, tampering, disconnection, improper or inadequate maintenance and use of improper diesel fuel.
- Damage resulting from accident, acts of nature or other events beyond the control of Volvo Trucks North America.
- Inconvenience, loss of use of the vehicle, commercial loss of any kind including, but not limited to, consequential, incidental damages.
- Any vehicle in which the odometer has been altered or damaged so that mileage cannot be readily determined.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES AND REPRESENTATIONS OR CONDITIONS, STATUTORY OR OTHERWISE, EXPRESSED OR IMPLIED INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

ENGINE GASEOUS EMISSIONS CONTROL SYSTEM WARRANTY***FEDERAL EMISSION REQUIREMENTS***

The following engine components are covered by the supplemental emissions control system warranty policy as required by the Federal emissions regulations.

- a. Turbocharger Assembly
- b. VGT Actuator Control Valve
- c. Charge Air Cooler
- d. Unit Injectors
- e. Engine Wiring Harness
- f. Electronic Control Module
- g. EGR Mixer
- h. EGR Cooler
- i. EGR Control Valve
- j. Crankcase Breather
- k. Diesel Particulate Filter (DPF) Assembly
- l. DPF Components:
 - Aftertreatment Fuel Injector (AFI)
 - AFI Shutoff Valve
 - Discharge Recirculation Valve
 - Pre-Catalyst Temp. Sensor
 - Post-Catalyst Temp. Sensor
 - Downstream DPF Temp. Sensor
 - Differential Pressure Sensor
- m. Sensors:
 - Engine Timing/Speed (flywheel)
 - Engine Position (camshaft)
 - Temperature — Coolant
 - Temperature — Inlet Manifold Air
 - Pressure — Boost Air
 - Humidity
 - EGR Temperature
 - EGR Differential Pressure

The emission warranty for the diesel particulate filter covers defects in workmanship only. Normal maintenance, such as cleaning ash from the filter at regular maintenance intervals, is not covered by the emission warranty.

NOTE

In response to customer requests, Volvo Trucks North America may build vehicles with engines supplied by other manufacturers, including, but not limited to, Cummins. In these cases, each engine manufacturer through its service organization, is responsible for emission control systems warranty on all parts of the engine assembly, as furnished.

FEDERAL EMISSION REQUIREMENTS

This section covers the requirement of the United States Clean Air Act which states:

“The manufacturer shall furnish with each new motor vehicle or motor vehicle engine such written instructions for the maintenance and use of the vehicle or engine by the ultimate purchaser as may be reasonable and necessary to assure the proper functioning of emission control devices and systems.”

This section also covers the requirements of the emissions regulations promulgated under the Motor Vehicle Safety Act in Canada.

TAMPERING WITH GASEOUS EMISSION CONTROL SYSTEMS PROHIBITED

The Federal Clean Air Act prohibits the removal or rendering inoperative of any device or element of design installed on or in a motor vehicle or motor vehicle engine in compliance with Federal Emission Regulations by:

1. Any person prior to its sale and delivery to the ultimate purchaser, or
2. Any manufacturer or distributor after its sale and delivery to the ultimate purchaser, or
3. Any person engaged in the business of repairing, servicing, selling, leasing, or trading motor vehicles or motor vehicle engines following its sale and delivery to the ultimate purchaser, or
4. Any person who operates a fleet of motor vehicles following its sale and delivery to the ultimate purchaser.

ENGINES OTHER THAN VOLVO

For specific information on engines other than VOLVO, refer to the engine vendor's publications.

Noise Emissions

Volvo Trucks North America 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 was designed, built and equipped to conform, at the time it left the control of Volvo Trucks North America, with all applicable U.S. EPA Noise Control Regulations.

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

Noise Control System, Operator Inspection and Maintenance Requirements

A Noise Control System Maintenance Log is located in this manual. 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.

The following elements make up the Noise Control System:

- Noise Shielding and Insulation Devices
- Cooling System
- Exhaust System/DPF System
- Air Intake/Air Induction System
- Engine Control, EGR and Fuel Systems

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 the acts that constitute tampering are the acts listed below:

- Removal, or rendering inoperative, of any exhaust components, including mufflers, heavy or double-wall exhaust tubing, flexible tubing or exhaust pipe clamping.
- Removal, or rendering inoperative, of the temperature-modulated cooling fan system.
- Removal of the cooling fan shroud.
- Removal, or rendering inoperative, of the air cleaner or air intake in-line silencer.
- Removal of the sound deadening material from the hood or cab tunnel.
- Removal, or rendering inoperative, of the engine speed governor so as to allow engine speed to exceed the manufacturer's specifications.
- Removal of splash shields located inside the wheel housings.
- Removal of engine block shields.
- Removal of engine crankcase shields or insulation.
- Removal of insulated rocker arm covers.
- Removal of transmission noise shields.

Noise Shielding and Insulation Devices

Maintenance

Ensure 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.

Regulatory Compliance

Acts that constitute tampering with the Noise Shielding and Insulation Devices:

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 vehicle body mounted sound insulation components and/or shields (cab or fender shields, skirts, wheel housing splash shields, etc.).

Cooling System

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.

Maintenance

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, belt tensioner 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.

Regulatory Compliance

Acts that constitute tampering with the 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

W A R N I N G

Hot engine! Avoid all movable parts or hot engine parts, exhaust gases, and/or fluids. A hot engine, exhaust, and/or fluids can cause burns.

Maintenance

Make sure the exhaust system is intact. Inspect for damage, misalignment and/or leakage. Primary system components requiring noise related inspection include 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.

Regulatory Compliance

Acts that constitute tampering with the Exhaust System:

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

Air Intake/Air Induction System

Maintenance

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.

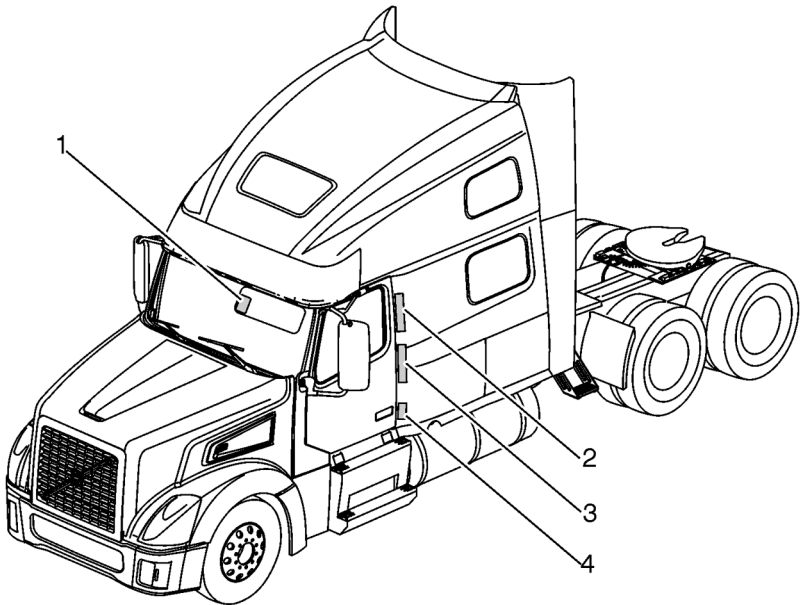
Inspect all intake system fasteners, brackets, and clamps for damage and tightness.

Regulatory Compliance

Acts that constitute tampering with the Air Intake/Air Induction System:

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

LABEL INFORMATION



VT Shown, VN and VHD Similar

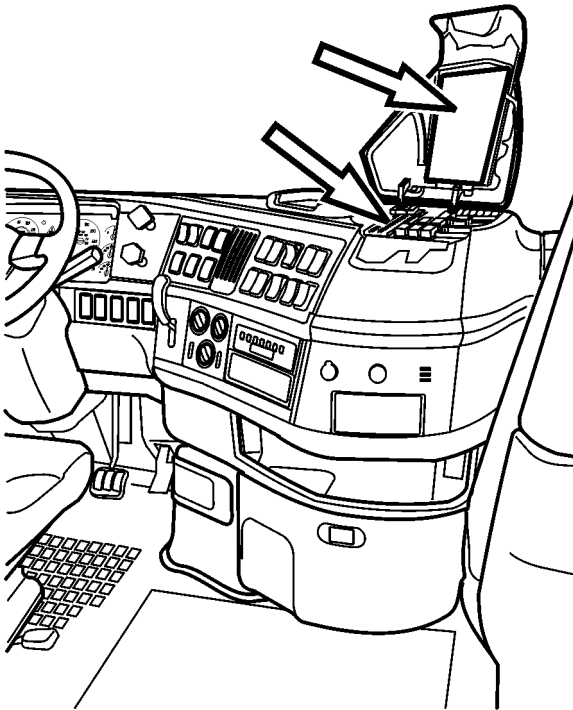
<p>1. Transmission Type and Gear Pattern This information is located in the visor.</p> <p>2. VIN/GAWR Located in the door frame “B” pillar.</p>	<p>3. VIN/Major Components Located in the door frame “B” pillar.</p> <p>4. Vehicle Noise Emission Located in the door frame “B” pillar.</p>
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FUSE AND RELAY LOCATION**⚠ WARNING**

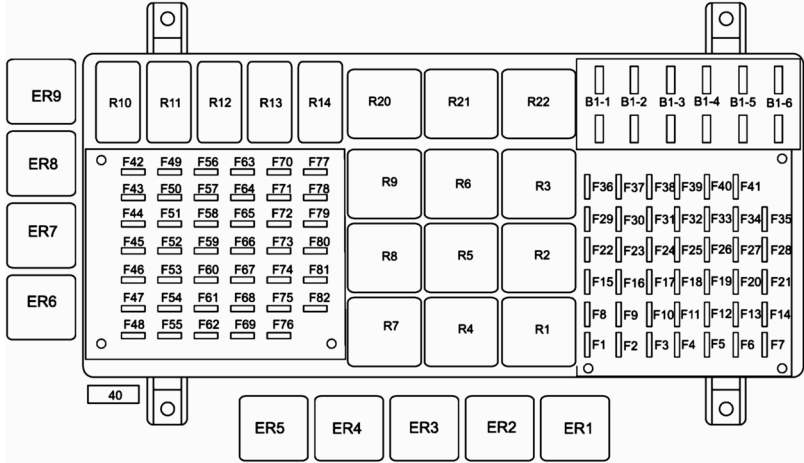
Always replace fuses and circuit breakers with the same current/ amperage. Increasing fuse or circuit breaker rating may result in electrical circuit overheating and possible fire.

⚠ CAUTION

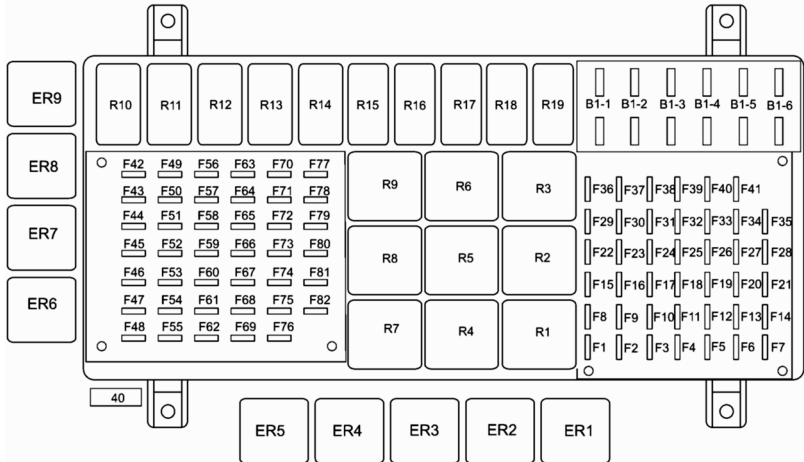
On sleeper models equipped with fluorescent lighting, there is a 3 AMP maximum fuse located in the lighting fixture.



The fuse relay panel is located under the top cover of the dash board. The vehicle has an electrical center located in the middle of the dash under the top cover. Since the function of some fuses or relays may change for the vehicle application, refer to the list of functions that is attached beneath each panel.



VN Fuse and Relay Center



VHD Fuse and Relay Center

PROPER MAINTENANCE PROCEDURE** DANGER**

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

 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.

 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 over speed the engine, causing severe engine damage and/or an explosion and fire. Serious personal injury or death could occur.

 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.

 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.

During Maintenance

Remove key from ignition while working on vehicle or engine.

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

- When operating the engine in an enclosed area, vent the exhaust to the outside.
- 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 any 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.
- 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 properly secured.
- Never put maintenance fluids into glass containers since glass containers can break.
- 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.
- Make sure protective locks and covers are in their proper place.
- 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. If you do not have the proper tools/knowledge to perform the repairs correctly, Volvo recommends contacting your nearest Volvo Truck dealer for all necessary repairs.
- 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 over speed 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 bypass the engine neutral-start system as well as causing damage to the electrical or electronic systems.

Compressed Air and Water

 **DANGER**

Compressed air can cause serious 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 200 kPa (30 psi) 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.

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.

W A R N I N G

DO NOT raise the engine hood 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.

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, which can cause personal injury and damage to engine components.



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.

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

Coolant

W A R N I N G

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



To prevent personal injury, do not climb up on the engine to remove the filler cap. Use a suitable, properly positioned ladder to reach 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 is stopped and cooled down. Remove the filler cap slowly to relieve pressure.

Oils

 W A R N I N G

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

 W A R N I N G

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

 W A R N I N G

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.

Speed Restrictive Tires

DANGER

Operating a vehicle equipped with speed restrictive tires in excess of their stated rating may result in tread separation and/or blowout resulting in the loss of steering control and possible collision. Serious personal injury or death could occur. Always maintain proper air pressure and never exceed the tire ratings.

When a vehicle is equipped with speed restrictive tires, DO NOT operate the vehicle in excess of the indicated speeds. If your vehicle is equipped with such tires, the speed restrictions will be stated on the sidewall of the tires. The operator of this vehicle is urged to check the tires of the vehicle to determine if there are any limitations.

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 over speed during start-up. Engine damage and severe injury and/or death from burns or explosion can occur.

DANGER

Excessive heat may cause the pressurized components of the air conditioned system to explode. Some mixtures of R134a refrigerant can become combustible at elevated pressures. 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.



! D A N G E R

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.

! W A R N I N G

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.



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 over speed with possible serious damage to the engine and bodily injury or property damage.

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

Contact your nearest Volvo Truck dealer for any necessary air conditioning testing or repairs.

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.

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.

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.

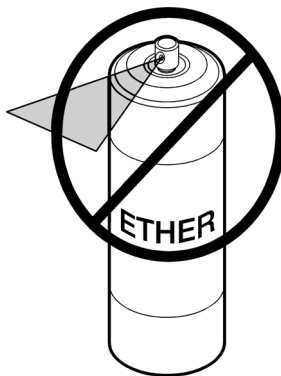
Provide adequate and proper waste oil disposal. Always dispose of waste liquids according to Federal and local regulations. Oil and fuel filters should be properly installed and housing covers tightened to the proper torque when being changed.

Starting Aids

DANGER

DO NOT use ether or other combustibile starting aids on any engine equipped with a preheater. If the engine is equipped with a preheater, introduction of ether or similar starting aids could cause a fire or explosion resulting in severe property damage, serious personal injury or death.

DO NOT use ether or other combustibile starting aids on engines that have a heater element or other heating devices installed in the intake manifold for heating the intake air during 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.

Respiratory Hazard Prevention

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.



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

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

⚠ WARNING

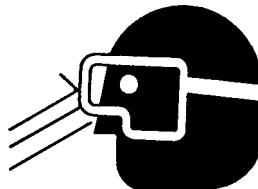
DO NOT work near the fan with the engine running or the ignition in the ON position. The engine fan can engage at any time without warning. Anyone near the fan when it turns on could be seriously injured.



Never attempt adjustments or repairs while the engine is running, see your authorized Volvo Truck dealer.

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

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.



Climbing Up and Down



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 on which you will be working or are around. Refer to the Operator's Manual for proper entry and exit procedures.

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

ENGINE DAMAGE PREVENTION

Before Starting the Engine



Before working on a vehicle, set the parking brakes, place the transmission in neutral and chock 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.

Only properly trained and authorized Volvo Service Technicians may attempt repairs on this vehicle.

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.

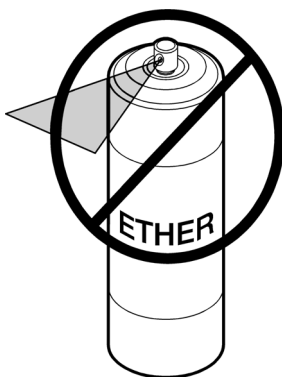
Diesel engine exhaust contains products of combustion which may be harmful to your health. Always start and operate the engine in a well-ventilated area, and if in an enclosed area, vent the exhaust to the outside.

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

 **DANGER**

DO NOT use ether or other combustibile starting aids on any engine equipped with a preheater. If the engine is equipped with a preheater, introduction of ether or similar starting aids could cause a fire or explosion resulting in severe property damage, serious personal injury or death.



ELECTRIC SYSTEM DAMAGE PREVENTION**Electric and Electronic Systems****⚠ WARNING**

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



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.

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.

Electronic Engine Control System

DANGER

The engine uses high voltage to the electronic unit injectors.

***DO NOT** come in contact with the unit injector terminals while the engine is running. An electric shock can cause an involuntary muscle spasm and cause loss of balance and falls leading to severe personal injury or death.*



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.

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 vehicle accident, injury or death.

Contact NHTSA by calling the Auto Safety Hotline at 1 (888) 327-4236, by writing to NHTSA, U.S. Department of Transportation, Washington, DC 20590, by TTY at 1 (800) 424-9153, or visit their website at www.nhtsa.dot.gov.

Canada

Refer customer complaints to Volvo Trucks Canada, Inc. or to Transport Canada, Defect Investigations and Recalls.

Canadian customers who wish to report a safety-related defect to Transport Canada, Defect Investigations and Recalls, may telephone the toll free hotline 1 (800) 333-0510 (within Canada only) or call 1 (613) 993-9851 (from Ottawa region or outside Canada). Contact Transport Canada by mail at: Transport Canada, ASFAD, Place de Ville Tower C, 330 Sparks Street, Ottawa ON K1A 0N5.

For additional road safety information, please visit the Road Safety website at: <http://www.tc.gc.ca/roadsafety/menu.htm>

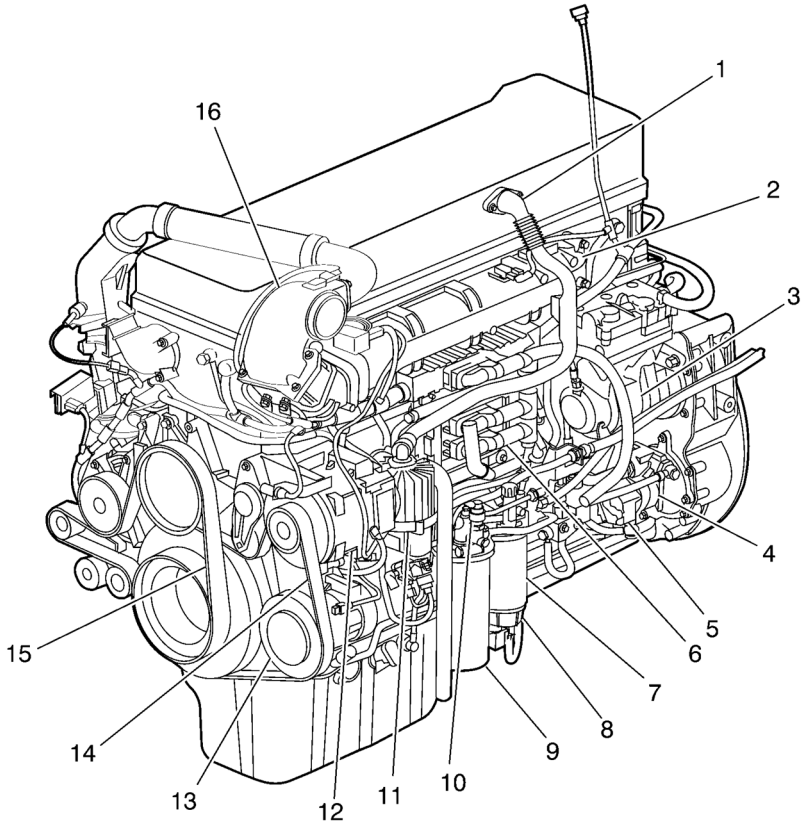
Mexico

Volvo Trucks de Mexico, S.A. de C.V. should be informed immediately if you believe the vehicle has a defect that could cause a vehicle accident, injury or death. Contact Volvo Trucks de Mexico by calling: 01 (800) 90 94 900 (within Mexico only) or 011-52-55-50-81-68-50, 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.

NOTE

For Roadside assistance information see “Service Assistance and Manuals” on page 122.

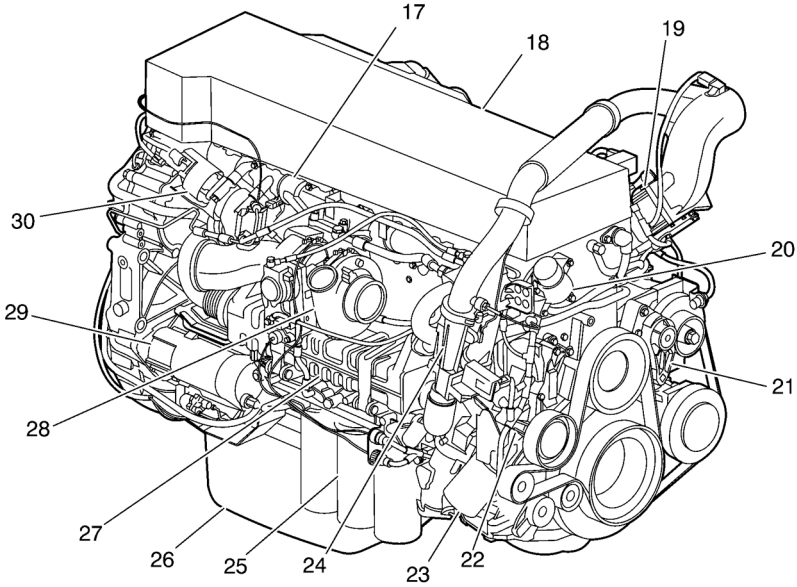
ENGINE OVERVIEW, D11F AND D13F LEFT SIDE VIEW



D13F Engine Shown, D11F Engine Similar

1. Breather Tube	9. Fuel Filter
2. Intake Manifold	10. Hand-Priming Pump
3. Air Compressor	11. Crankcase Ventilator
4. Power Steering Pump	12. Alternator
5. Fuel Pump	13. AC Compressor
6. Engine Electronic Control Unit (EECU)	14. Alternator/AC Compressor Belt
7. Fuel Filter	15. Fan/Coolant Pump Belt
8. Fuel/Water Separator	16. EGR Mixing Chamber

ENGINE OVERVIEW, D11F AND D13F RIGHT SIDE VIEW



D13F Engine Shown, D11F Engine Similar

17. Exhaust Manifold	24. Venturi Pipe
18. Valve Cover	25. Oil Filters
19. Engine Pre-Heater Element (Optional)	26. Oil Pan
20. Thermostat Housing	27. EGR Cooler
21. Belt Tensioner	28. Turbocharger
22. Coolant Pump	29. Starter Motor
23. Coolant Filter	30. EGR Valve

ENGINE STORAGE

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

1. Drain the engine 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 rpm. Shut the engine down. DO NOT drain the oil after this run.
5. Check the coolant for proper levels of antifreeze and inhibitor (SCA) protection. Service as necessary.
6. Seal all engine openings using protective covers.

To return to service an engine preserved in this manner, remove previously installed protective covers. Check all fluid levels and if necessary replace engine oil contaminated by condensation.

MAINTENANCE HAZARDS **DANGER**

Before working on or inspecting a vehicle, set the parking brakes, place the transmission in neutral and chock 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.

NOTE

Read all safety information before working on the vehicle. Refer to “Proper Maintenance Procedure” on page 24.

ENGINE COMPONENTS, SERVICE SCHEDULES

Component	Operation	Km (Miles)/Maximum Months/ Hours
Fuel Filter — All Engine Models	Change	Each oil change*
Water Separator — All Engine Models	Filter change	Each oil change*
Air Filter — US07	Change	Control lamp indication/24 months
Air Filter — Euro 4	Change	At maximum restriction as indicated on gauge, or 12 months
Coolant (Standard — All Engine Models)	Change	400 000(250,000)/24/4,000
Coolant (ELC) — All Engine Models	Change	1 000 000(600,000)/48/12,000
Coolant Filter — US07	Change	80 000(50,000) or 6 months
Coolant Conditioner — Euro 4	Change	Traditional coolants requiring Supplemental Coolant Additive (SCA) 80 000(50,000) or 6 months
Coolant Filter (ELC) — US07	Change	240 000(150,000)15/2,500
Coolant Filter (ELC) — Euro 4	Change	No SCA requirement 240 000(150,000) or 12 months
Valves/Injectors — All Engine Models**	Initial Adjust	200 000(125,000)/12/2,500
Valves/Injectors — All Engine Models**	Adjust	400 000(250,000)/24/5,000
Drive Belts VN — Euro 4 (Highway)	Change	500 000(300,000) or 36 months
Drive Belts VHD — Euro 4 (Vocational)	Change	240 000(150,000) or 12 months
DPF Filter — (If equipped)	Change	240 000(150,000) or 4,500 hours
AF Injector — (If equipped)	Clean	240 000(150,000) or 4,500 hours

* Under certain conditions (for example, irregular fuel quality), the fuel/water separator filters may require more frequent replacement.

** Valves must be adjusted whenever the rocker shaft has been removed and reinstalled for any reason.

COOLING SYSTEM**General Coolant Information**** 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.

 WARNING

DO NOT raise the engine hood 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.

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 and can cause personal injury.

 WARNING

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

 CAUTION

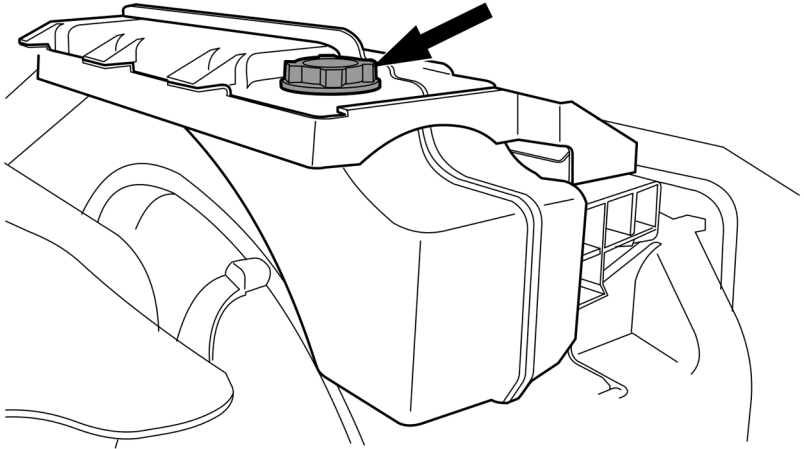
Volvo Trucks North America does not recommend using plain water in the cooling system. Water alone is corrosive at engine operating temperatures and does not provide adequate boiling protection. The engine may develop corrosion and cavitation problems in the engine and radiator, and the boiling point of the coolant is lowered compared to a proper antifreeze and water mixture. Failure to follow Volvo Truck North America's cooling system care/maintenance recommendations can render the warranty invalid.

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 cooling system.
- Maintain its liquid properties in cold climates.

Many engine failures can be traced back to a problem in the cooling system. 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.



NOTE

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

Coolant mixture 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.

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.

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

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 use quality products and service the system at the correct intervals. Please read this section carefully.

Keep the radiator (including charge air cooler) and the frontal area free from bugs, dirt, leaves, etc. (see “Cleaning Charge Air Cooler and Radiator Package” on page 68 for cleaning information).

Check the coolant level in the tank regularly. Fill the tank as necessary with the correct coolant.

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.



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.

 **CAUTION**

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

Additives

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 non-extended life 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.

Regular Coolant Change Interval

Replace the coolant every 400 000 km (250,000 miles), 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 at every engine oil change interval, every 1,000 hours or every 6 months (whichever comes first). For proper SCA levels, consult Service Manual.

Regular Coolant Filter Change Intervals **WARNING**

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

The charged coolant filter contains 8 units of SCA that are released slowly over time to maintain the recommended level during operation. Consult engine service manual for proper SCA level and change intervals.

Change the regular coolant filter every 80 500 km (50,000 miles).

Extended Life Coolant Change Interval** 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.

Replace coolant every 960 000 km (600,000 miles), 12,000 hours or every four years, whichever comes first.

An extender package must be added to the cooling system after 480 000 km (300,000 miles), 6,000 hours or two years, whichever comes first.

NOTE

DO NOT add supplement coolant additives (SCA) to extended life coolant.

Should the extended life coolant system become contaminated with regular coolant exceeding 10% of the system's total capacity or if SCA is added to extended life coolant, drain the system and refill with new extended life coolant or regular coolant.

Extended Life Coolant Filter Change Interval** WARNING**

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

 CAUTION

DO NOT use a filter that contains SCA. Damage to components can result.

Replace the extended life coolant filter every 240 000 km (150,000 miles), 2,500 hours or 15 months, whichever comes first, to prevent external rust damage to the filter walls.

FUEL SYSTEM

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 over speed during start-up. Engine damage, severe personal injury 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.

 **DANGER**

DO NOT remove the fuel tank cap near an open flame. Diesel fumes are combustible and can cause an explosion or fire resulting 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.

 **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.

Diesel Fuel Specification**Quality**** CAUTION**

Diesel engines for 2007 and later model year vehicles are designed to operate only with Ultra Low Sulfur Diesel (ULSD) fuel. Use of fuel other than ULSD will reduce the efficiency and durability of the engine, permanently damage the advanced emission control systems, reduce fuel economy and possibly prevent the engine from running at all. Manufacturer's warranties are likely to be rendered void by usage of improper or incorrect fuel, and usage of fuels other than ULSD fuel in diesel-powered vehicles is illegal and punishable with civil penalties. Use of fuel additives to compensate for the lower sulfur content is NOT recommended by Volvo Trucks North America.

The proper selection of fuel is essential for good economy, performance and engine life. No. 2D ULSD should be used when climatic conditions permit. No. 1D ULSD can be used during cold weather conditions. Blends of No. 1D and No. 2D ULSD fuels can be used to suit various climatic conditions.

NOTE

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

NOTE**Euro 4 Engines**

Ultra Low Sulfur Diesel (ULSD) fuel with a maximum sulfur content of 15 ppm is required to meet emission certification for Euro 4 emission engines. Using approved diesel fuel with a maximum sulfur content of 500 ppm in Euro 4 emission engines will meet all reliability standards.

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.

Fuel Sulfur Content

Fuel sold for use in diesel-powered engines for 2007 and later model year vehicles may only contain a maximum sulfur content of 0.0015% by weight. This was done to reduce particle emissions in the exhaust.

NOTE

The use of ultra-low sulfur diesel 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 43 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 0.05% of sediment and water.

Fuel Additives

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

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 1/2 liter per 450 liters (1 pint per 125 gallons) of fuel for winter freeze-up protection.
- Biocide — For treatment of microbe growth or “black slime.” Follow manufacturer's instruction for treatment.

Prohibited Additives** W A R N I N G**

The addition of gasoline to diesel fuel will create a serious fire hazard. Serious personal injury can result.

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

- 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.
- Used lubricating oil — Volvo Trucks North America 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.

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 diesel 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.

Fuel Storage

If fuel is stored on site:

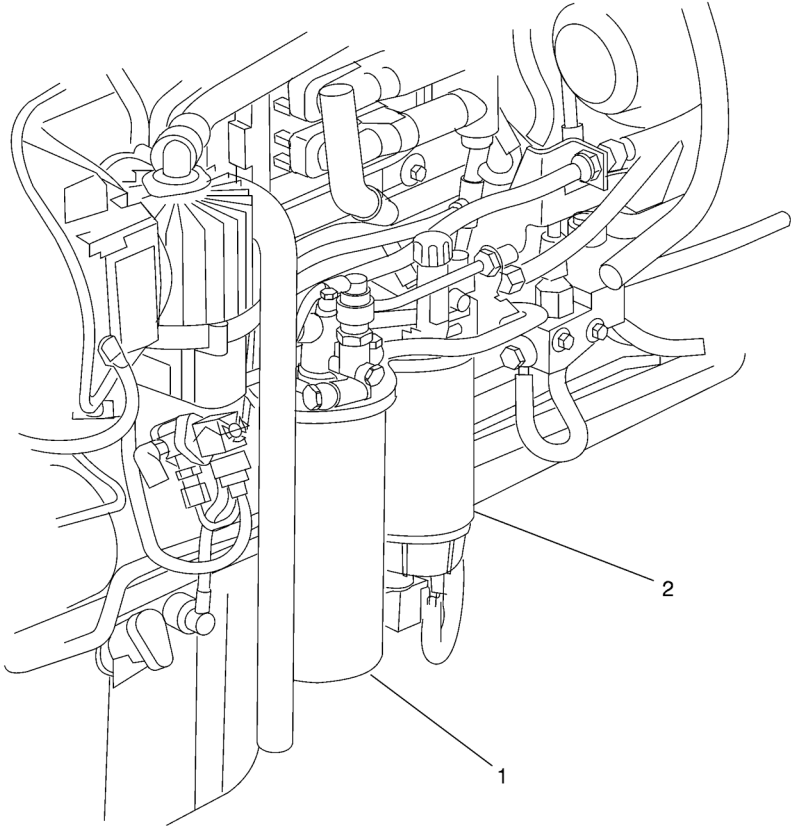
- Keep storage tank covered to prevent water entry.
- DO NOT use a tank made of galvanized metal or any galvanized piping for diesel oil storage. Diesel will react with the zinc, forming solids that can clog fuel filters and cause engine damage.
- Fuel stored for a long time may oxidize and form solids,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

Fuel Filters

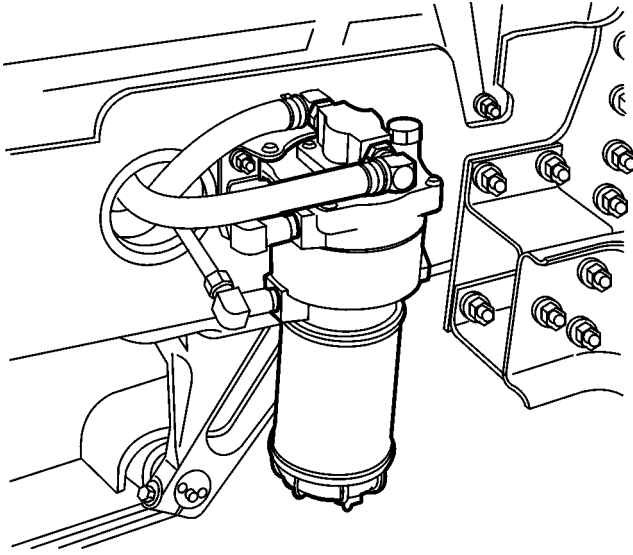
A primary fuel filter can be located on the engine or remote mounted on the frame rail. This filter consists of a filter cartridge, a water separation bowl and may have a fuel heater built in.

The secondary fuel filter is located on the left hand side, below the engine electronic control unit (EECU). The filter is a spin-on filter.



D11F and D13F Engine-Mounted Fuel Filters (D13F shown, D11F similar)

1. Secondary Fuel Filter	2. Primary Fuel Filter with Water Separator
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Chassis Mounted Primary Fuel Filter (Optional)

For priming the fuel system, see “Priming the Fuel System” on page 71.

Replacing Fuel Filters

<p>NOTE</p>

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

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.

Change the fuel filters at every oil change. Drain the primary filter water trap daily.

Maintenance

NOTE

When draining the fuel tank, collect the waste in a fuel safe 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 50 000 km (30,000 miles) or 300 hours, to drain off any water and/or sediment.

Yearly or at 200 000 km (120,000 miles), 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.

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.

Oil Quality

Volvo Trucks North America recognizes 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.

EO-O Premium Plus (or VDS-4) diesel engine oil is mandatory for use in all 2007 emission compliant Volvo engines. Chassis equipped with a 2007 emission compliant engine, which can be identified by the presence of a Diesel Particulate Filter (DPF), also require the use of Ultra Low Sulfur Diesel (ULSD) fuel. EO-O Premium Plus oils exceed the new API service category CJ-4.

⚠ CAUTION

DO NOT add extra oil additives. Additives such as break-in oils, top oils, graphitizers, and friction-reducing liquids are not necessary and can harm the engine.

Oil Change Intervals

The length of time an engine can operate before an oil change depends on the quality oil used, the type of fuel used, fuel consumption, engine oil consumption, vehicle application, level of dust in the air, and fuel consumption. The change intervals given in this manual are maximum intervals. If the vehicle is operating in heavy-duty operation, dusty or off-road conditions, etc., reduce the intervals for more frequent oil changes. For the correct oil change interval, see “Oil Capacity Tables and Viscosity Charts” on page 108.

For additional information about oil change intervals, see your Volvo Truck dealer. Also, refer to Bulletin 175-60, *Oil and Filters, Volvo Components*.

For a complete list of approved oils, see your Volvo Truck dealer. Also, refer to Bulletin 175-61, *Approved Oils, Volvo Components*.

NOTE

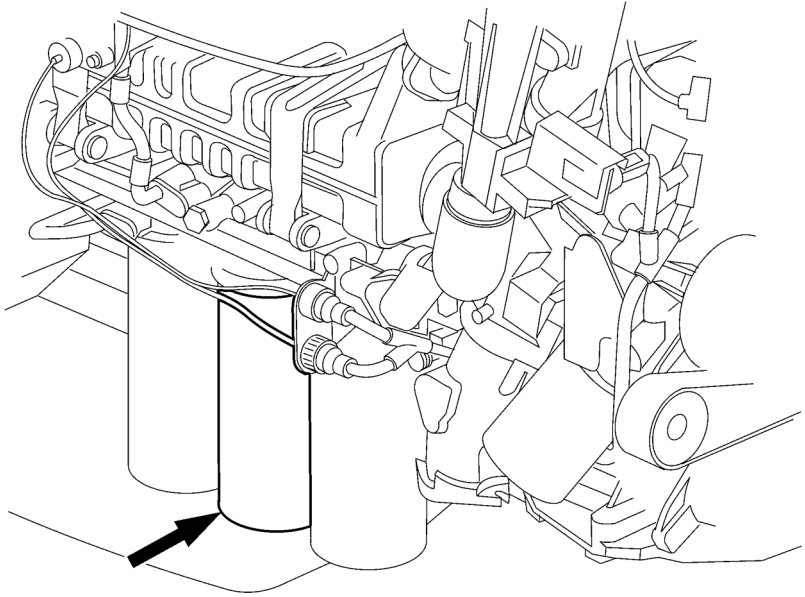
Oil filters should always be changed when changing oil.

Oil Filters

There are three filters on the engine, one of which is a bypass filter. This should be changed at the same time as the full-flow filter(s).

⚠ CAUTION

Volvo branded oil filters are designed to provide the proper level of filtration and protection for Volvo engines. Filters that do not meet the same stringent requirements may void engine warranty.



D11F and D13F Oil Filters (D13F shown, D11F similar)

Synthetic Lubrication

Synthetic oils are offered by some oil suppliers 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: both VDS-4 and EO-O Premium Plus.

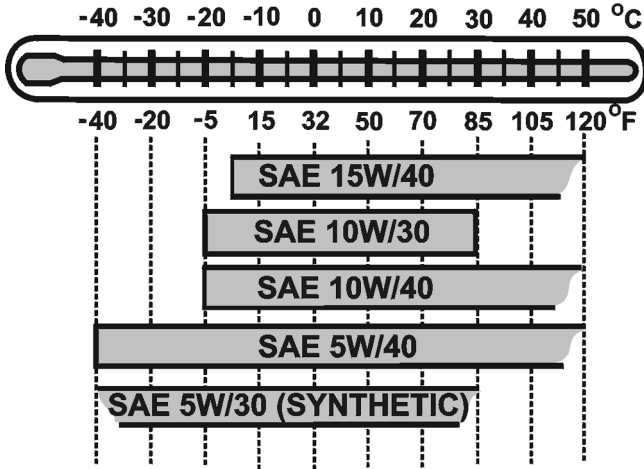
The use of synthetic oils does not permit the extension of the recommended oil change intervals.

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.

Volvo Trucks North America recommends the viscosities shown in the viscosity/temperature table for Volvo engines.



Oil Additives

⚠ CAUTION

Extra oil additives must never 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.

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.

Oil Consumption

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

NOTE

DO NOT overfill engine with oil.

All diesel engines are designed to consume some oil, so it is normal to add oil periodically. An engine used in heavy-duty operation will consume more oil than one in normal operation.

To assist you in measuring your oil usage please refer to the Fuel and Oil Record on “Fuel and Oil Record” on page 120.

Oil Change

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.

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 prevent oil running down the arm, causing burns.

CAUTION

Always dispose of all lubricants (motor oil, coolant, gear box oils, etc) and filters according to Federal or local regulations. Used oil disposed of in nature or waterways contaminates our drinking water and kills wildlife.

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.

For information on the type of oil recommended for your engine, see “Oil Quality” on page 57 and “Oil Capacity Tables and Viscosity Charts” on page 108 for quantities and viscosities, or refer to the engine manufacturer's operator's manual.

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.

Oil Filters Change

 **WARNING**

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

 **CAUTION**

Volvo-branded oil filters are designed to provide the proper level of filtration and protection for Volvo engines. Filters that do not meet the same stringent requirements may cause unsatisfactory results.

1. Coat the filter gasket with oil.
2. Install the filter and turn it by hand until the gasket makes contact with the sealing surface.
3. Manually turn the filter an additional 3/4 to one full turn.

Checking Oil Level

 **CAUTION**

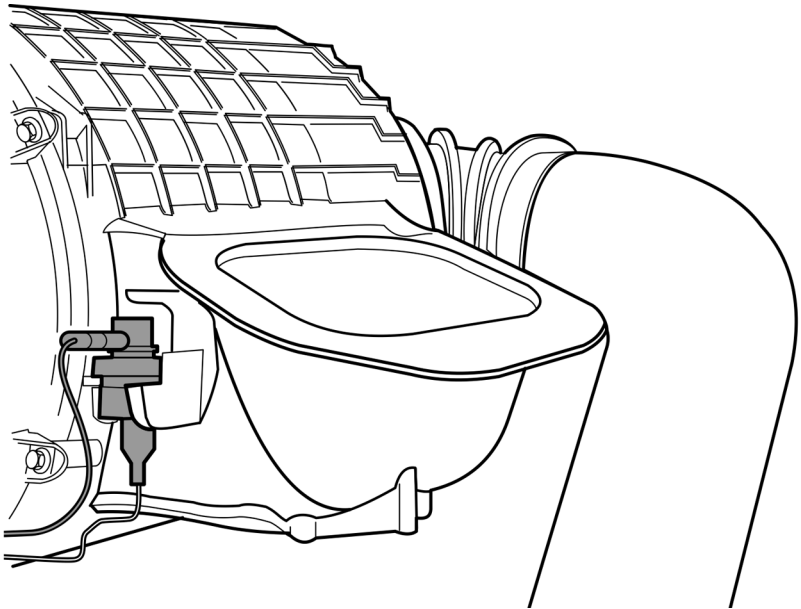
DO NOT let the oil level fall below the marking on the dipstick. DO NOT overfill so the level is above the upper marking on the dipstick. This could lead to excessive oil temperature and/or poor crankcase breather performance.

Ensure that the vehicle is parked on level ground before checking the oil level. Wait five minutes after shutting off the engine, then proceed with checking oil.

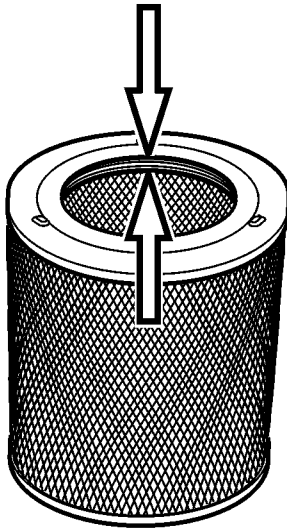
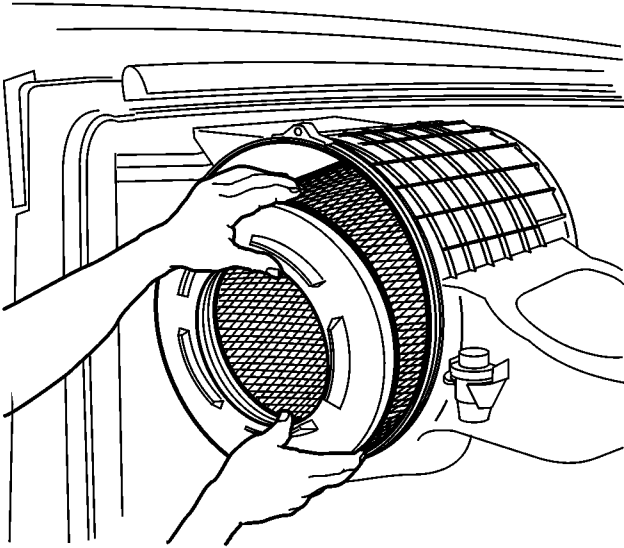
ENGINE AIR FILTER**⚠ CAUTION**

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.

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. Replace the filter according to the gauge or after a maximum of two years, whichever comes first. Optional extra filter insert should be changed with every third main air filter.



Pressure Restriction Gauge



DIESEL PARTICULATE FILTERS (IF EQUIPPED)

This vehicle is equipped with a 2007 emission compliant engine and may be equipped with an exhaust aftertreatment system which includes a Diesel Particulate Filter (DPF). The DPF reduces soot and particulate emissions into the atmosphere. Vehicles equipped with a DPF require the use of EO-O Premium Plus (or VDS-4) specification high performance diesel engine oil and Ultra Low Sulfur Diesel (ULSD) fuel.

CAUTION

Use of diesel fuel other than ULSD and engine oils other than EO-O Premium Plus (or VDS-4), will adversely affect performance, efficiency and durability of the DPF system and the engine, to the point where the engine may not run at all. Manufacturer's warranties can also be rendered void due to usage of improper fuel. Unapproved fuel additives (including engine oil) are NOT permitted. Blends of No. 1D and No. 2D grades of ULSD are recommended and allowable for cold weather operations.

The diesel particulate filter takes the place of the standard muffler. Soot and other particulate matter is collected by a filter where it is eventually oxidized using a regeneration process.

CAUTION

During the regeneration process, the temperature of the exhaust will be elevated. DO NOT park the vehicle with the exhaust outlet near flammable objects such as trees, awnings, etc. that could be damaged by elevated exhaust temperatures.

When regeneration occurs, an indicator lamp on the instrument panel will illuminate to alert the operator. The vehicle operator can stop or start regeneration. Certain conditions must be met before a regeneration can be manually started. Refer to the applicable vehicle operator's manual for a complete description of DPF indicator lamp and switch functions.

CAUTION

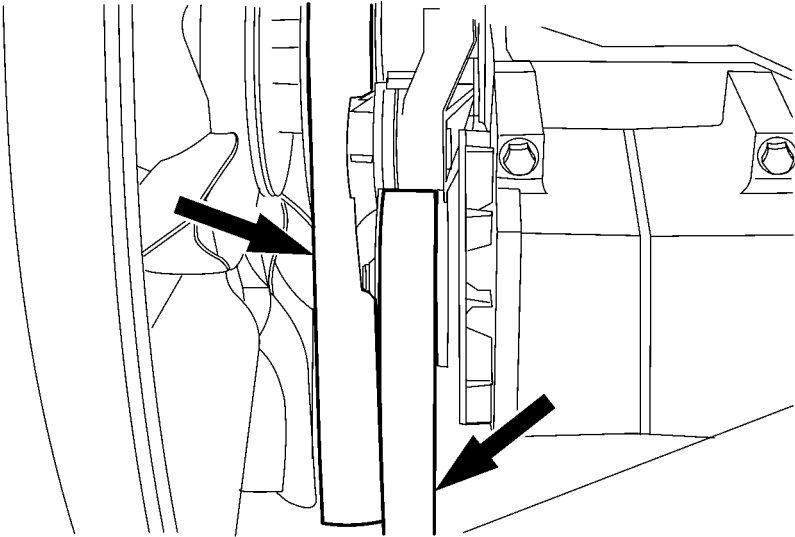
If the vehicle is in a location that may be hazardous when regeneration begins (i.e., in close proximity to flammable materials or gases, inside tunnels, parked under flammable objects, etc.), the regeneration should be stopped.

If regeneration is stopped by the vehicle operator, it should be initiated at a later time when the vehicle is in a safe location. Regenerations that are stopped and never restarted at a later time, however, will require that the vehicle be taken to an authorized Volvo Truck dealer to have the regeneration manually started.

FAN AND AUXILIARY DRIVE BELTS**! WARNING**

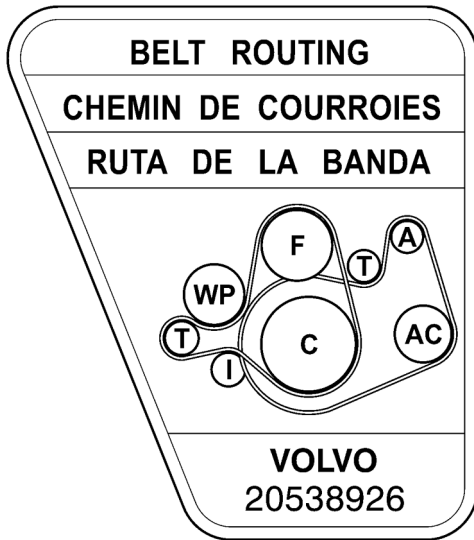
Hot engine. Keep yourself clear of all hot engine parts and/or fluids. A hot engine can cause serious burns.

All engine belts should be checked at each service point. Inspect for cracked or frayed material. All belts have automatic belt tensioners to keep the correct tension without adjustment.

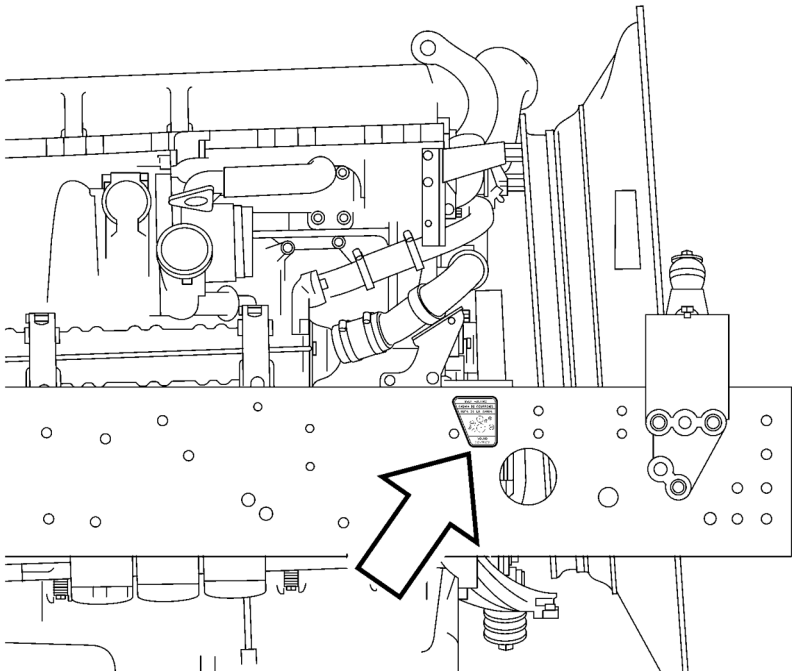


Drive Belts

A drive belt routing label is located on the vehicle frame rail.



Drive Belt Routing Label



Drive Belt Routing Label Location

TURBOCHARGER AND CHARGE AIR COOLER **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 over speed. Loss of control of vehicle may lead to an accident causing severe personal injury or death.

 **WARNING**

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 turbocharger 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.

Cleaning Charge Air Cooler and Radiator Package **WARNING**

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

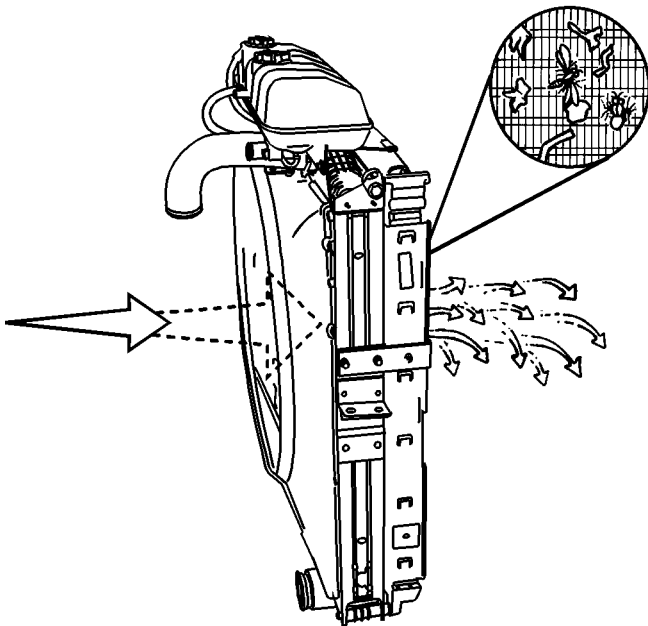
Periodically inspect the front of the radiator/charge-air-cooler package for buildup of dirt, mud, insects, etc. Over time, there may be a build-up of dirt, mud, insects, etc., between the radiator and charge air cooler. Inspect for build-up and contact your authorized Volvo Truck dealer, if necessary.

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.

⚠ CAUTION

When using a pressure washer to clean the vehicle, do not direct the spray at electrical components in the engine compartment such as the alternator, starter and compressors. Water spray from pressure washers can damage electrical components.

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 200 kPa (30 psi) 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 cannot be cleaned off with this procedure, consult your Volvo Truck dealer.

**Cleaning Charge Air Cooler and Radiator (typical radiator shown)**

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.

FUEL SYSTEM SERVICE**Changing the Primary Fuel Filter**** WARNING**

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.

 CAUTION

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

 CAUTION

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

Failure to change the primary fuel filter at the recommended intervals could result in reduced power.

1. Open the drain valve and drain off some fuel into a container. Remove the filter cartridge together with the bowl.
2. Separate the filter and the bowl. Clean and dry the bowl. Attach it to a new filter. Use new seals at both the bowl and filter head joint. Install both on the engine or vehicle.
3. Purge air from the filter by operating the primer pump to draw fuel and fill the filter. When using the hand primer, approximately 100 strokes will be required.
4. Start the engine and check for leaks. Correct any leaks with the engine stopped.

Priming the Fuel System

The fuel system will need to be bled if:

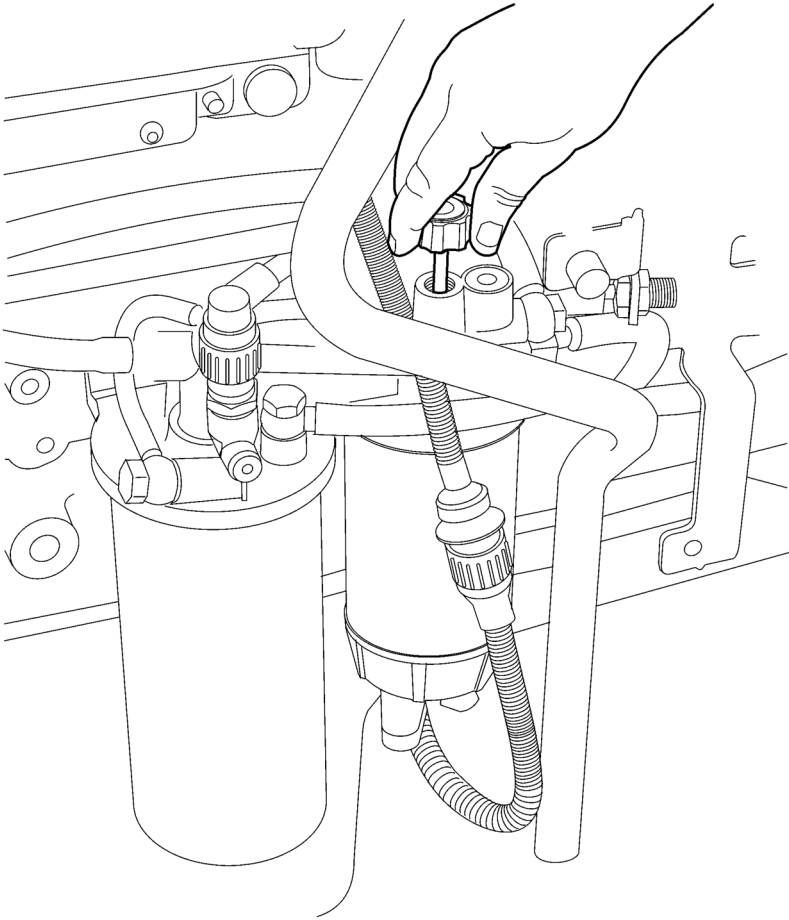
- The vehicle has run out of fuel.
- The engine has not been running for an extended period of time.
- Service work has been done on the fuel system, (tank, fuel lines, filters, valves, etc.) for example cleaning or replacing fuel filter elements.
- The engine is new or rebuilt.

 CAUTION
--

When priming the system, movement of the primer pump should be as up and down as possible. Avoid putting any side load on the pump or causing a binding condition. Failure to follow these instructions could prematurely damage the primer.

NOTE

When the fuel system is empty, 200 or more pump strokes may be needed to properly prime system. There are no bleed nipples to be opened to prime the fuel system.



D11F and D13F Primer Pump (D11F shown, D13F similar)

1. Unlock the hand pump by turning the handle counterclockwise.
2. Prime the system by moving the primer pump in an up and down pumping motion. Avoid putting any side load on the pump or causing a binding condition.
3. Lock the hand primer pump by retracting it into the housing and turning it clockwise.
4. Start the engine and run it at an increased idle speed for approximately 5 minutes to remove any remaining air in the system.
5. Check the fuel system for leaks.

Water In Fuel

You can only drain the water in the fuel when there is a high water level in the fuel filter housing, the engine is not running, the vehicle is stationary and the parking brake is applied. When the water in fuel indicator activates, the cluster displays the water in fuel icon and the message “Water in Fuel, Drain at next stop.”



When the operator chooses draining and the engine fulfills the conditions for priming, the icon shown below is displayed in the status icon bar.



When the operator chooses draining and the engine fulfills the conditions for draining, the icon shown below is displayed in the status icon bar.



TRANSMISSION, CLUTCH AND REAR AXLE MAINTENANCE

Transmission

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.

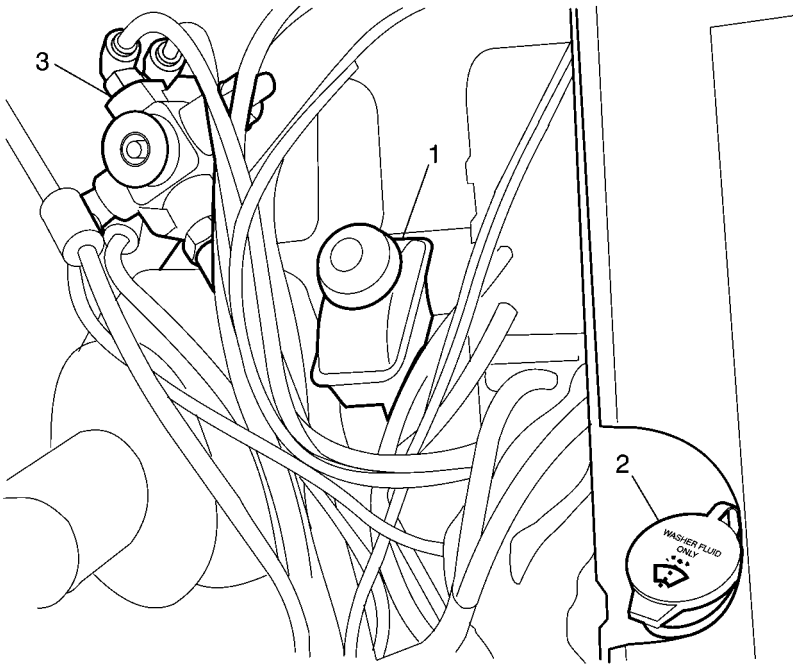
Transmissions should not be operated consistently at temperatures above 120° C (250° F). Operating temperatures above 120° C (250° F) increase the lubricant's rate of oxidation and shorten its effective life.

If the temperature reaches 140° C (285° F), stop the vehicle to let the temperature go down. See the vehicle Operator's Manual for information on the optional transmission temperature gauge.

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 2 000 m (6,000 feet) above sea level, more frequent oil changes will be necessary.

Clutch

Check the fluid level in the clutch fluid reservoir. The fluid level should be between the level marks on the reservoir. If fluid needs to be added, use brake fluid, DOT 4.



- | | |
|---------------------------------|----------------|
| 1. Clutch Fluid Reservoir | 3. Brake Valve |
| 2. Windshield Washer Fluid Fill | |

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.

Periodic inspection, lubrication, and maintenance of the driveshaft may be required. Contact your local authorized Volvo Truck dealer.

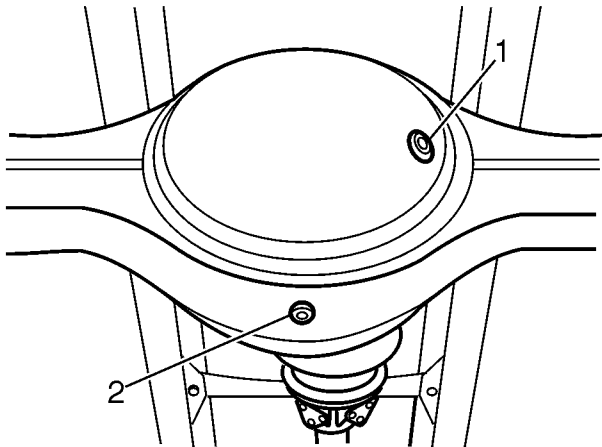
Rear Axle

Checking and Draining Differential Oil

Check the oil level through the top plug. 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.

Also check the rear axle ventilation for blockage. A blockage can cause overpressure in the axle and oil seal leakage.



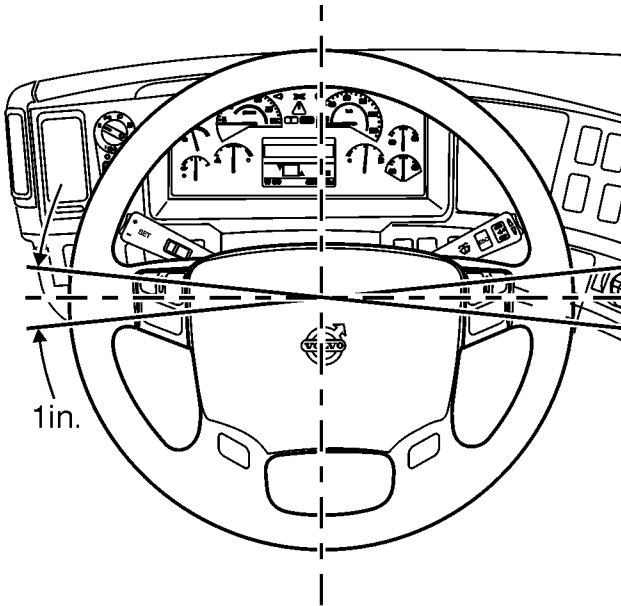
Rear Axle

1. Check and Fill Plug

2. Drain Plug

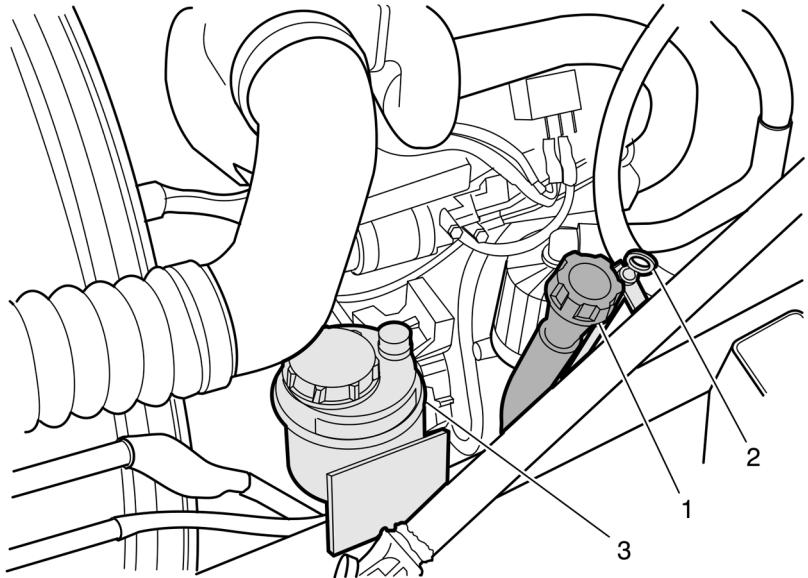
STEERING AND BRAKES MAINTENANCE**Steering System**

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. Play should not be more than 25 mm (1 inch) at the rim of the steering wheel. If the steering play is excessive, check the steering linkage for looseness, wear, etc. Make necessary repairs before driving the vehicle.



Power Steering Fluid Reservoir

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



- | | |
|-------------------------|-----------------------------------|
| 1. Engine Oil Fill Tube | 3. Power Steering Fluid Reservoir |
| 2. Engine Oil Dipstick | |

Brake System

 **DANGER**

DO NOT use replacement parts anywhere in the brake system unless it conforms exactly to original specifications. A nonconforming 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 690 kPa (100 psi). Failure to follow this procedure may lead to uncontrolled vehicle movement and cause severe personal injury or death.

 **DANGER**

Automatic slack adjusters MUST NOT be manually adjusted in an effort to correct excessive push rod stroke, as this condition indicates that a problem exists with the automatic adjuster, installation of the automatic slack adjuster or problems related to components of the foundation brakes. These conditions will not be corrected by manually adjusting the automatic slack adjusters.

Manual adjustment of automatic slack adjusters is a dangerous practice that could result in serious consequences. This practice gives the vehicle operator a false sense of security about the effectiveness of the brakes, and the brakes will likely soon be out of adjustment again.

NOTE

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.

Air Tanks

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.

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 lanyard or pull cord. 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. If sludge or oil is found in the drainage or an excessive amount of fluid is drained out of the tanks see your authorized Volvo Truck dealer.

Air Dryers

Air dryers have a regeneration system that cleans out the accumulated moisture but eventually the drying medium will be filled up. See your authorized Volvo Truck dealer

Dryer manufacturers recommend changing the cartridge every 2 to 3 years but the intervals need to be adjusted for vehicle application. In some climates, the cartridge may have to be changed every year. See your authorized Volvo dealer.

ELECTRICAL SYSTEM MAINTENANCE**Battery Care**** W A R N I N G**

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.

 W A R N I N G

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

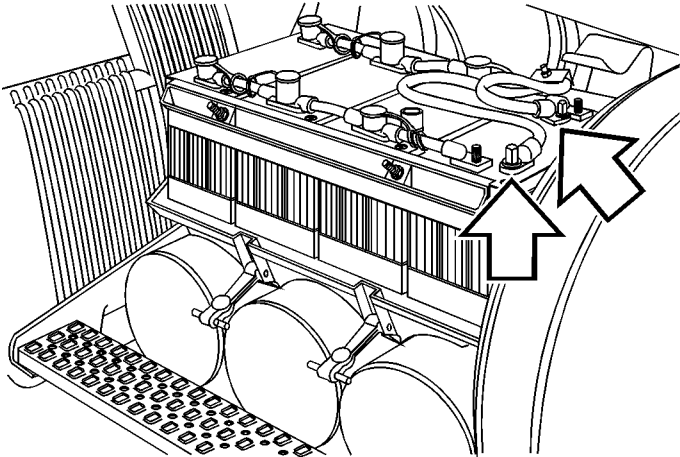
 C A U T I O N

Disconnecting battery cables when vehicle is equipped with power door locks will result in automatic locking of doors.

 C A U T I O N

When using a pressure washer to clean the vehicle, do not direct the spray at electrical components in the engine compartment such as the alternator, starter and compressors. Water spray from pressure washers can damage electrical components.

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.



Battery Terminals

When disconnecting battery terminals, always disconnect the ground terminal first. When reconnecting, always connect the ground terminal last. Disconnecting battery cables may result in a loss of preset radio controls, radio programming and require refreshing.

Lighting

! WARNING

Using incorrect bulbs or lamps may result in failures that could lead to a fire or a vehicle accident caused by improper lighting.

Check all lights on the vehicle daily for proper function. Replace burned out inserts and bulbs. Replace any broken or cracked side or rear reflectors. Headlights should be checked for aim at least once per year.

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

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 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 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.

 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 blowout and an accident and personal injury or death.

 **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 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 roadholding and can lead to an accident, and serious personal injury or death.

Wheels

 **DANGER**

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

 **DANGER**

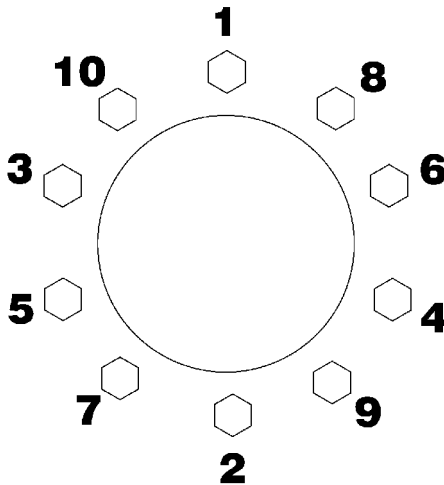
Wheels must be serviced only by a qualified technician. DO NOT do this work yourself. Inflated tires on wheels contain compressed air and if suddenly released, do so with an explosive force, resulting in serious personal injury or death.

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.

Wheel Nut Tightening

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

After the initial tightening, retightening must be made within the first 800 km (500 miles). 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 610 Nm (450 lb-ft). Tighten the nuts in the correct sequence. Inspect bolts and nuts for signs of wear or cracks. Make sure that the bolts are not bent. This tightening check 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.



10-Stud Wheel Nut Tightening Sequence

Tire Inflation and Wear

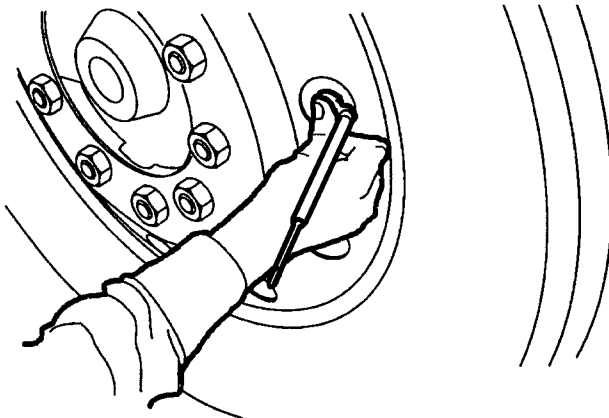
! WARNING

DO NOT operate the vehicle with under-inflated 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.

! 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 and vehicle accident.

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



Measure the tread depth. The depth should not be less than 4.8 mm (6/32-inch) on front tires and not less than 1.6 mm (2/32-inch) on drive tires. Most premium steer tires start with 14.2 mm (18/32-inch) tread depth when new. Usually remove steer tires at 4.8 mm (6/32-inch). Drive tires should be removed at not less than 1.58 mm (2/32-inch).

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.

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 6 mm [1/4 in.]).

Volvo Trucks North America is committed to repair procedure 642 (RP 642), American Tire Association (ATA) and The Maintenance Council (TMC).

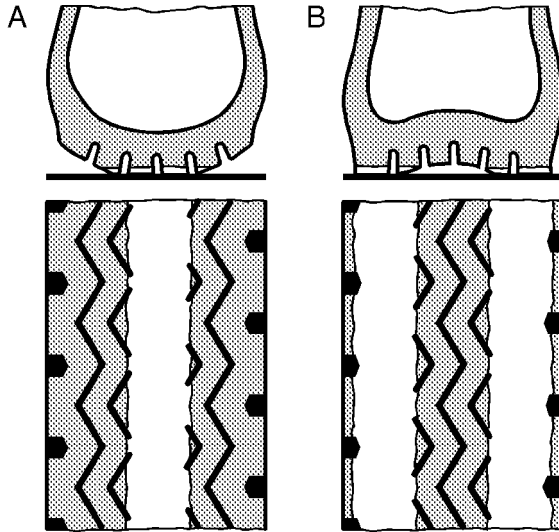
Representatives from Volvo Trucks North America actively participated, along with twenty-two companies, in developing recommended practice 642 entitled “Total Vehicle Alignment”: Recommendations for Maximizing Tire and Alignment related Component Life.” Recommended Practice 642 (RP 642) is published by the Maintenance Council, American Trucking Associations, Inc.

Companies that participated in the development of RP 642 are listed in the RP.

Typical Wear Patterns

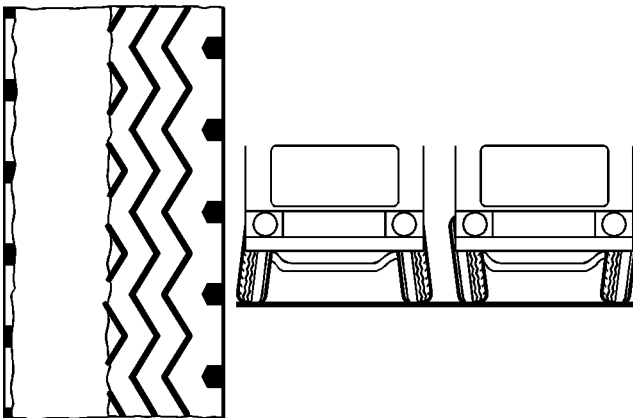
Incorrect Air Pressure

- A. Air pressure too high gives rapid wear in the middle.
- B. Air pressure too low gives rapid shoulder wear.



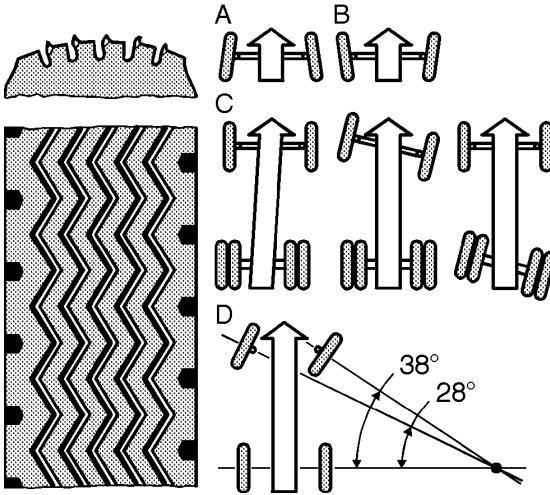
Incorrect Camber

Incorrect camber gives abnormal wear on one half of the tire.



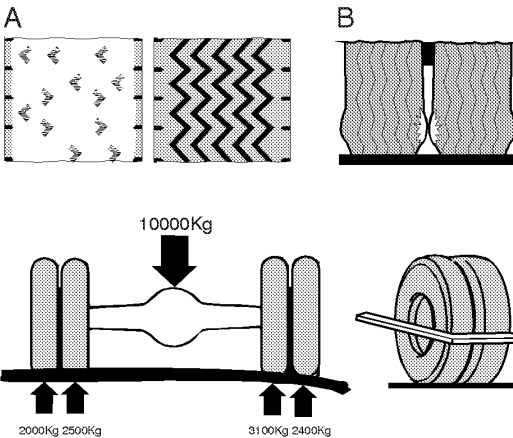
Incorrect Toe and Axle Alignment

- A. Incorrect toe-in
- B. Incorrect toe-out
- C. Out-of-line axle
- D. Steering arm defect



Dual Wheel Mounting

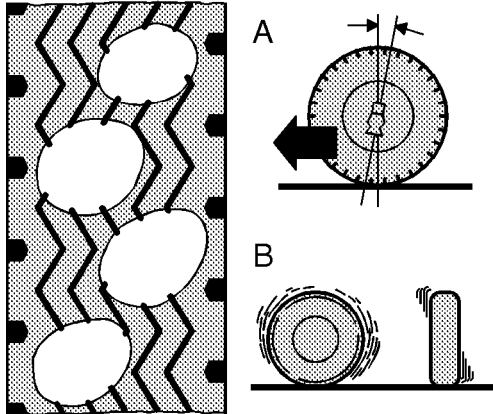
- A. Excessive road camber, different types of tire, different circumference or off-center loading give faster wear on one tire.
- B. Air pressure too low, mismatched rims for the tire type and dimension, excess flexing in tire wall, or different types of tires in inner and outer tires gives contact wear.



Incorrect Caster and Imbalance

- A. Caster angle
- B. Imbalance

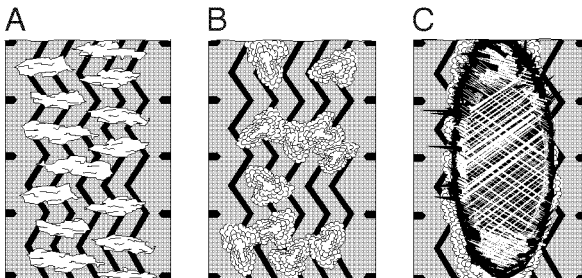
Also rapidly wears the mechanical parts of steering linkage, kingpin and wheel bearing.



Cuts in the Tire Tread

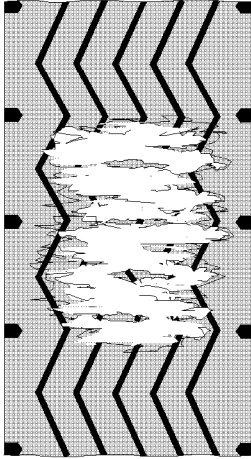
- A. Cuts
- B. Flaking cuts
- C. Rubber flaking

Cuts are due to poor roads, air pressure too high or incorrect tire type.

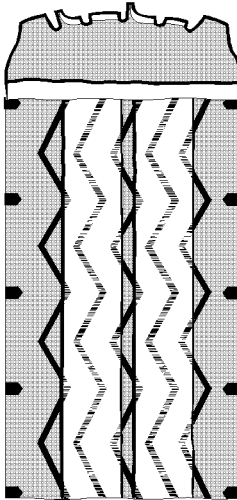


Spot Wear

Sudden braking, locking brakes or out-of-round brake drums give spot wear.

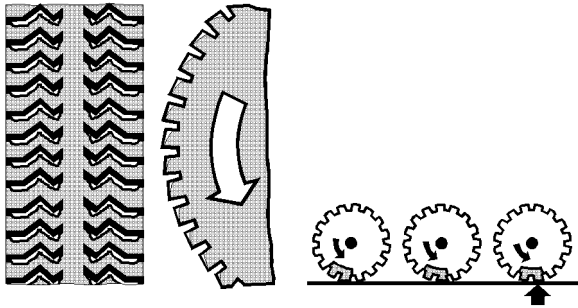
***Feathered Edges***

Normal occurrence on non-driving wheels on good roads and high mileage.



Cupping

Cupping is a normal occurrence that depends on the tread pattern; the higher the load, the greater the wear.

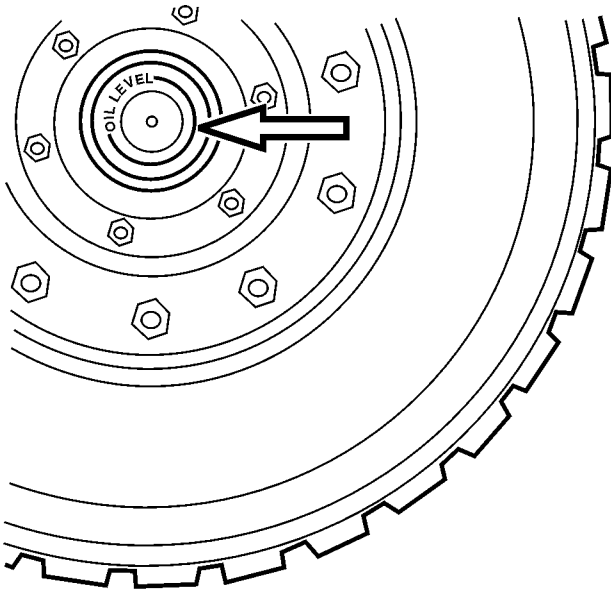


Front Wheel Hubs



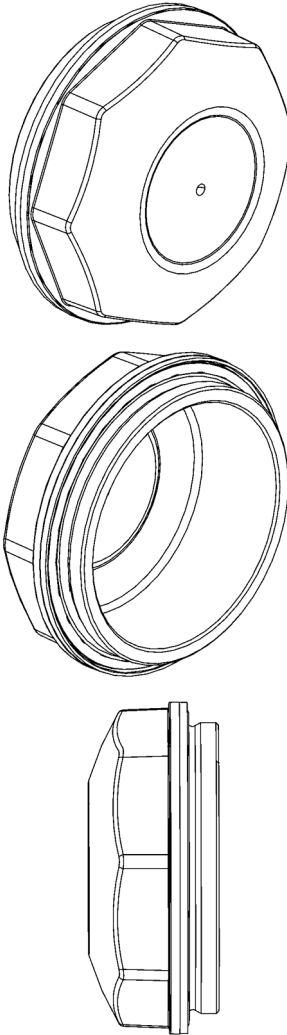
Failure to keep wheel bearings properly adjusted and lubricated may result in accelerated tire wear, poor handling and, in extreme cases, wheel separation from the hub or from the spindle resulting in loss of vehicle control and serious personal injury or death.

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.

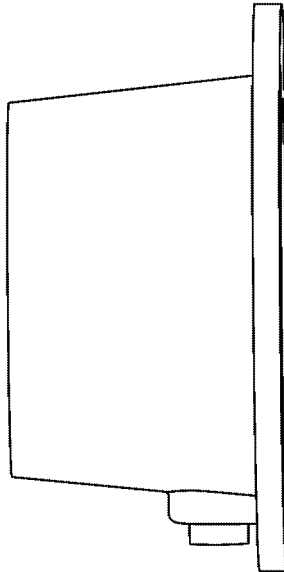
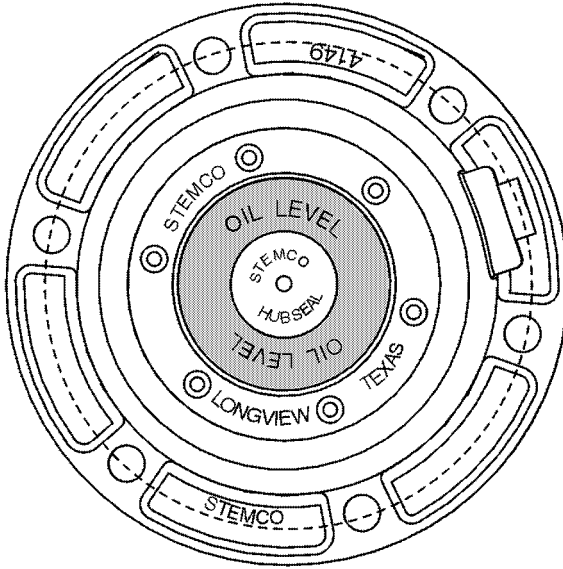


Unitized Front Hubs

The non-tapered axle hubs are sealed with lubricant inside the hub and do not require lubrication.



Unitized Hubs, Non-Tapered Axle End

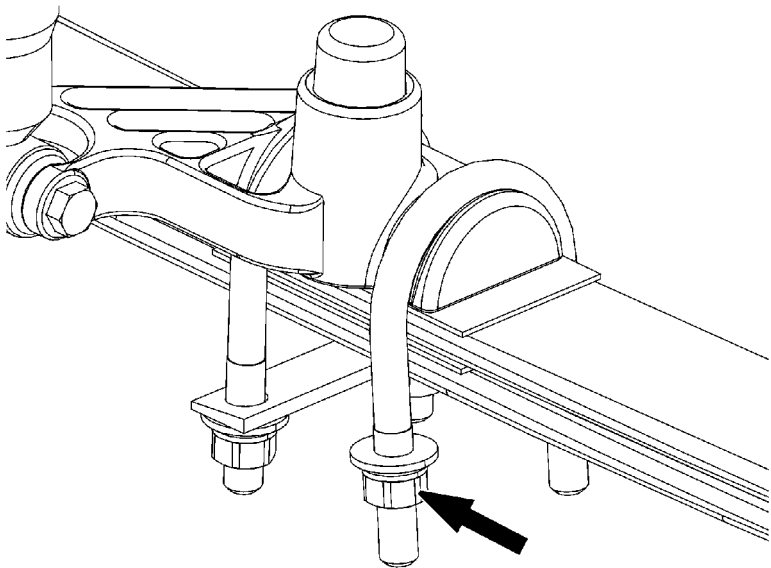


Tapered Axle End

CHASSIS MAINTENANCE**Springs****NOTE**

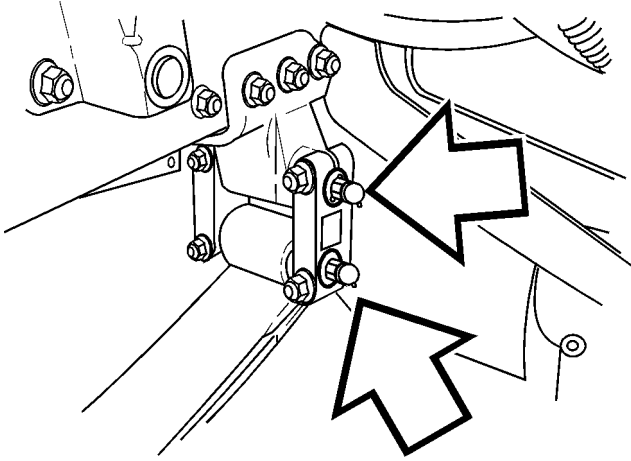
This work is best performed by a Volvo Truck dealer or other service outlet having the proper equipment.

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. Inspect the chassis for broken springs, shocks, loose or broken axle U-bolts. If any of these are found, contact your local Volvo dealer. The U-bolt nuts must be retightened to the proper torque specifications after the first 24 000 km (15,000 miles).

**U-Bolt Nuts**

Spring Bushings

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 grease is not able to reach 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.



Grease Fittings

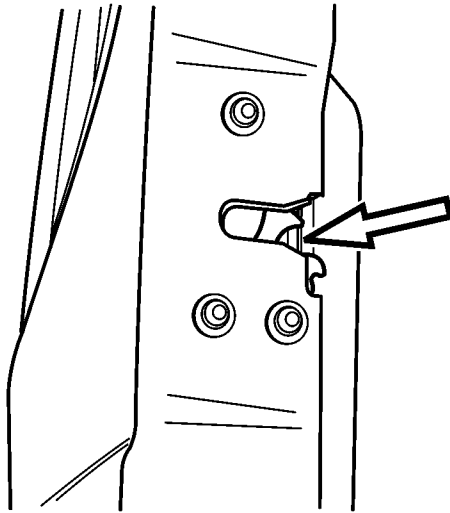
Rubber Bushings

Rubber bushings are used for extended service life. If your vehicle is equipped with rubber bushings **DO NOT** lubricate them. Replace the leaf spring if it is damaged or has premature or excessive wear.

CAB MAINTENANCE

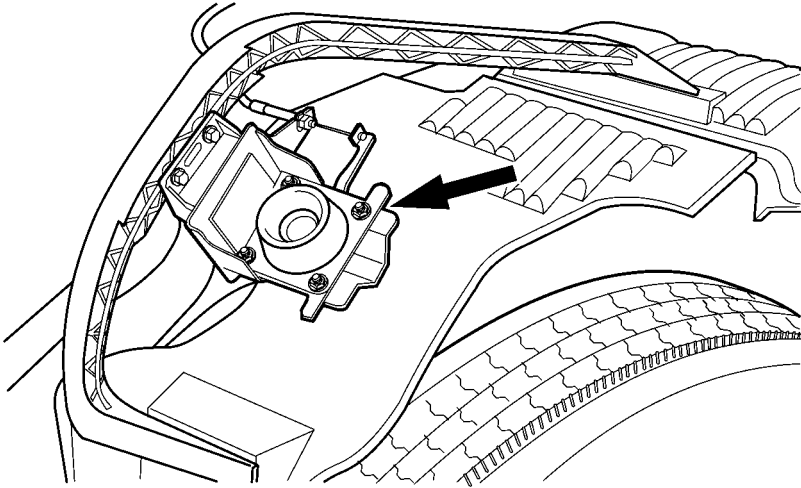
Doors

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, road spray 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.



Hood

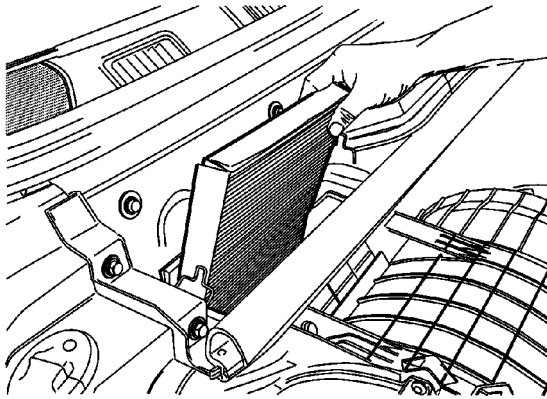
The hood latch mechanism should be greased with white grease yearly. If the mechanism is hard to work or binds, the latch should be cleaned before greasing.

**Rust Protection**

The rust protection applied when the cab was produced is adequate for normal use and service. If an extension of the cab rust protection 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 check it every 19 200 km (12,000 miles). The filter should not be cleaned and reused. Replace with a new filter as necessary. Change the filter more often if driving in dusty conditions. A clogged filter decreases the efficiency of the air conditioning system.



If the vehicle is equipped with a sleeper heater-A/C system, there is a filter for recirculating air. It is located behind the passenger seat on the bunk support. The filter should be checked after 19 200 km (12,000 miles), more often in dusty conditions. Replace the filter as necessary. To inspect or to change the filter, open the luggage storage lid and pull out the filter.

Paint and Brightwork Care

Cab

⚠ CAUTION

When using a pressure washer to clean the vehicle, do not direct the spray at electrical components in the engine compartment such as the alternator, starter and compressors. Water spray from pressure washers can damage electrical components.

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 approved for automotive cleaning 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.

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.

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 break off and can create rust stains on the surface.

Chrome

Chrome surfaces will rust if they are not cleaned and 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 break off and can create 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 and spots caused by oil, ice cream shoe polish, grease, etc., use a clothing fabric stain remover.

Plastic

The plastic in the upholstery can be cleaned with a soft cloth and mild soap solution.

Alcintera™ Suede-Like Material

Suede-like upholstery can be cleaned with a soft cloth and mild soap solution.

Leather Care

Volvo's Leather upholstery is manufactured with a protectant to repel soiling. Over time, sunlight, grease and dirt can break down the protection. Staining, cracking, scuffing, and fading can result.

 CAUTION

DO NOT use gasoline, naphtha or similar cleaning agents on the plastic or leather since these can cause damage. Take extra care when removing stains such as ink or lipstick since the coloring can spread. Use solvents sparingly. Too much solvent can damage the seat padding. Start from the outside of the stain and work toward the center. Sharp objects (e.g. pencils or pens in a pocket) or Velcro fasteners on clothing may damage the textile upholstery.

LUBRICATION

Chassis Lubrication



Before working on or servicing a vehicle, set the parking brakes, place the transmission in neutral and chock 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 24 000 km (15,000 miles). 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 16 000 km (10,000 miles) 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. 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.

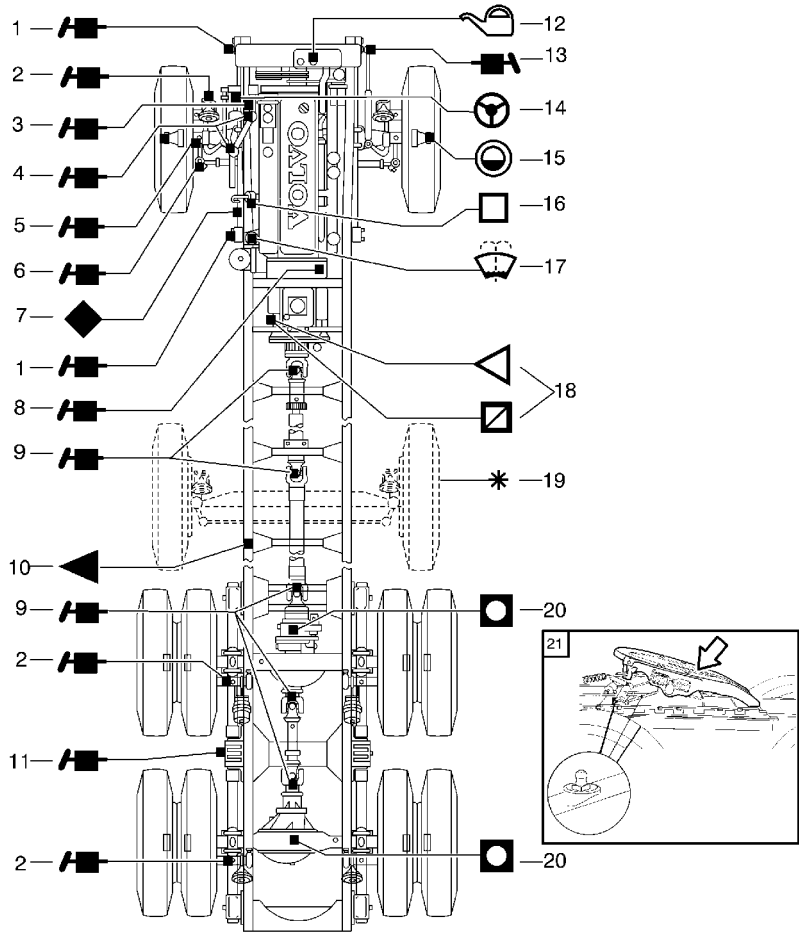
Lubrication Procedure

Make sure the grease fittings are cleaned off before greasing 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.

<h3>NOTE</h3>












Think of greasing the same way as an oil change. All old grease should come out and be replaced with new grease. Remove excess grease from fittings, shackles and other surfaces.

Lubrication Chart



NOTE

The numbers in the lubrication chart correspond with the numbered notes on "Lubrication Chart Notes" on page 104. Read these notes before selecting a lubricant.

	Grease		Automatic Transmission Fluid
	Hub Oil		Manual Transmission Oil
	Engine Oil		Rear Axle Oil
	Steering Fluid		Brake Fluid
*	Auxiliary Axle(s)		Coolant
	Hydraulic Oil		Windshield Washer Fluid

Lubrication Chart Notes

- Spring hanger:** Use a lithium-based grease with specification API NLGI No. 2. When lubricating the **left** and **right** sides of the **front** 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.
- Slack adjuster and brake cam:** Use a lithium-based grease with EP additives to specification API NLGI No. 2.

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.

- Steering gear:** 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.

- 4. Draglink and steering shaft:** Use a lithium-based grease with specification API NLGI No. 2.
- 5. Kingpin, upper and lower:** 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

Non-Volvo axles are typically greased with the wheels on the ground. Consult with the axle manufacturer for the latest recommendation.

- 6. Tie-rod:** Use a lithium-based grease with specification API NLGI No. 2.

NOTE

Volvo axles may use a greased-for-life tie-rod. No provisions for adding grease are available.

- 7. Brake fluid and clutch reservoir:** Check the fluid level in the reservoir. Add brake fluid if necessary. Use only DOT 4 brake fluid in the clutch release system. Mixing DOT 4 brake fluid with petroleum-based oil will cause seal damage which will cause leakage.
- 8. Clutch bearing linkage:** Use a lithium-based grease with EP additives to specification API NLGI No. 2.

NOTE

Inspection cover removal is necessary. Lubricate according to Eaton's lubrication document and reinstall the inspection cover.

- 9. U-Joints:** Use a lithium-based grease with EP additives to specification API NLGI No. 2.

NOTE

Ensure that grease purges out of all four seals of the U-joints.

- 10. PTO/Hydraulic reservoir:** If equipped, consult with the PTO manufacturer for the latest recommendation.
- 11. T-Ride bogie beam (48k-70k suspension):** If equipped, 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.

NOTE

Some vehicles are equipped with newer versions of the T-Ride suspension that use conical bushings. These vehicles do not require lubrication.

- 12. Coolant:** Add coolant if necessary. Only use pre-mixed clean water and antifreeze in a 50/50 mix. Add only the same type antifreeze: extended life or standard.
- 13. Steering assist cylinder:** If equipped, use a lithium-based grease with EP additives to specification API NLGI No. 2 to grease both ball joints.
- 14. Power steering fluid:** Check the fluid in the reservoir with the dipstick. Add oil if necessary. Use ATF Dexron[®] III. Change fluid every 240 000 km (150,000 miles). Change filter every year.
- 15. Front oil-lubricated wheel bearings (if applicable):** 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. Lubricate both the right and the left wheel bearings.
- 16. Engine oil and filter:** For oil and filter change see “Oil Capacity Tables and Viscosity Charts” on page 108.
- 17. Windshield washer fluid:** Add fluid as necessary.

18. Automatic and manual transmission:

- Automatic transmission: Use Dexron® III automatic transmission fluid. See the manufacturer's operator manual for intervals and quantity.
- Manual transmission: Use a mineral or synthetic oil. Check oil level periodically. Level should be to the bottom of the inspection hole.

19. Auxiliary axle(s): If equipped, use a lithium-based grease with specification API NLGI No. 2. Also, lubricate the brake, cams, slack adjuster and tie-rod ends.

20. Rear axle: Check the oil level in the differential by removing the fill/level plug in the housing. The oil should be level with the bottom of the fill/level plug hole. Add oil if necessary.

⚠ CAUTION

Most rear differentials have a large screw and nut protruding from the housing. The screw and nut hold the thrust plate shoe against the ring gear and are not to be confused with the fill/level plug.

21. Fifth wheel: The fifth wheel and slider assemblies should always be re-lubricated after steam cleaning or at least every 24 000 km (15,000 miles).

NOTE

A heavy coating of grease is recommended on the fifth wheel plate by using the grease fitting under the fifth wheel top plate or by direct application to the top of the plate. The fifth wheel can be greased with the trailer connected, by using the grease fittings under the top plate.

Grease the support brackets trunnions through the fittings over the bracket pins.

Grease the fittings at the saddle plate (1 each side) and the saddle plate lock pockets (1 each side).

NOTE

See “Oil Capacity Tables and Viscosity Charts” on page 108 for oil types.

OIL CAPACITY TABLES AND VISCOSITY CHARTS

NOTE

Use the information in the table below to determine the operating condition and usage applicable to your vehicle.

D11F and D13F Engine Oil and Filter Change Intervals

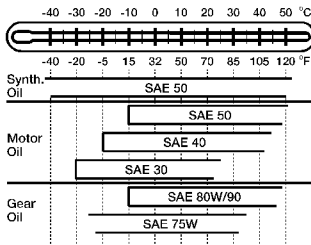
Engine Operating Condition	Medium	Heavy	Severe	Very Severe
Fuel Consumption (mpg)	more than 6.0	more than 4.7	more than 3.7	more than 2.0
Fuel Consumption (L/100 KM)	less than 39	less than 50	less than 64	less than 120
Engine Oil and Filter Change Interval, km (miles)	50 000 (31,000)	40 000 (25,000)	30 000 (18,000)	15 000 (9,000)

Clutch Hydraulic System

Clutch system fluid	DOT 4 brake fluid according to (SAE J 1703)
Replacement interval	Every 24 months

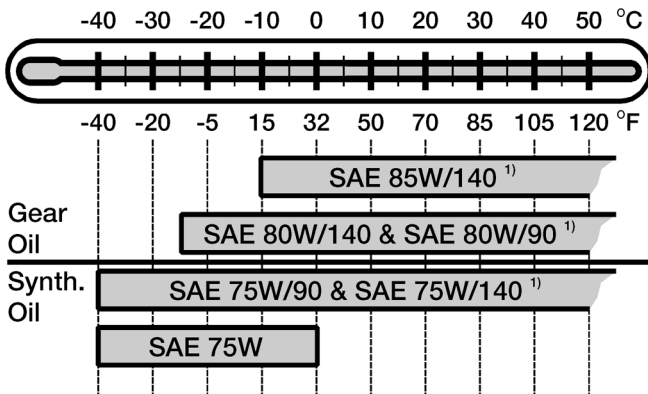
Eaton Fuller Transmission 9,10, 13, 15 and 18-speed

For oil quality and oil change intervals, see the manufacturer's operator's manual.	
Capacity	
9-speed	12.0 liters (13.5 quarts)
10, 13, 15 and 18-speed	13.0 liters (14.0 quarts)



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

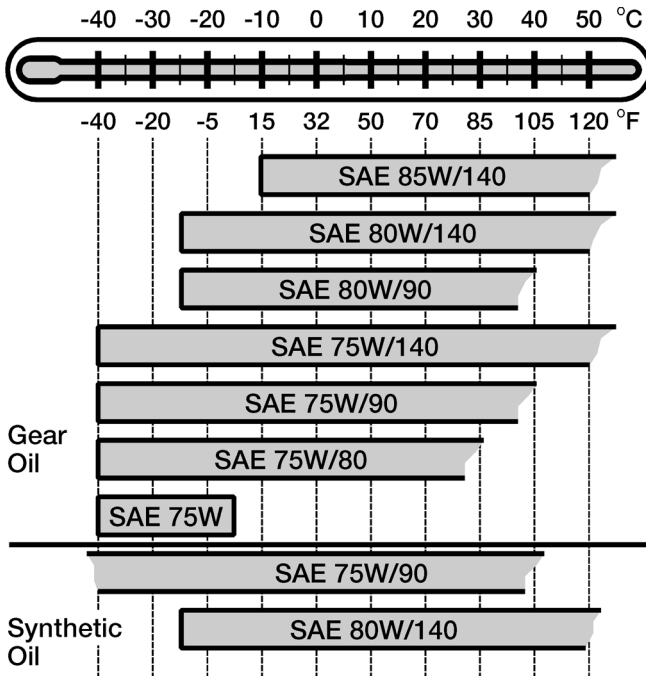
For oil change intervals, see the manufacturer's operator's manual	
Capacity	
RS23-160	19 liters (20 quarts)
RS23-185	22.5 liters (23.5 quarts)
RT40-145/160, front tandem	14 liters (15 quarts)
RT40-145/160, rear tandem	12 liters (13 quarts)
RT 46–160 front RT 46–160 rear	approximately 18 liters (19 quarts) approximately 16 liters (17 quarts)



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 120° C (250° F)**.

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



Steering Hydraulic System

Fluid type	Automatic Transmission Fluid (ATF) Dexron® III
Change interval	Every 240 000 km (150,000 miles) or every 12 months

Hubs

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

PREVENTIVE MAINTENANCE**NOTE**

Once you determine the applicable operating condition for your vehicle, use the information in the table below to perform preventive maintenance.

TYPE OF OPERATION	CHECK / CHANGE BASIC (4 MONTHS)	CHECK / CHANGE ANNUAL (12 MONTHS)	ADDITIONAL SERVICE
Check Warning and Control Lamps	X	X	
Check Fault Codes displayed in the vehicle Instrument Cluster	X	X	
Check Air Compressor's Function and Condition	X	X	
Check Hinges, Doorstops, Locks and Sealing Strips	X	X	
Check External Lamps	X	X	
Check Rear View Mirrors and Reflectors	X	X	
Function Check of Wipers and Washers	X	X	
Check Headlamps	X	X	
Check Hood Attachment and Locking Devices	X	X	

TYPE OF OPERATION	CHECK / CHANGE BASIC (4 MONTHS)	CHECK / CHANGE ANNUAL (12 MONTHS)	ADDITIONAL SERVICE
Check Batteries-Dirt, Leakage, Attachment, Specific Gravity of Battery Acid, Fluid Level Connections and Battery Box	X	X	
Check Fuel Tank, Hoses, Pipes Venting and Mounting	X	X	
Check Fuel Water Separator for the Fuel system, Draining of Condensation.	X	X	
Check Tire Wear	X	X	
Chassis Lubrication	X	X	
Cab Lubrication	X	X	
Check Oil Level in hubs for Oil Lubricated Wheel Bearings	X	X	
Check Oil in Front Drive Axle	X	X	
Check Exhaust Leakage	X	X	
Check Air Dryer	X	X	
Check Steering Linkage	X	X	
Check Front Shock Absorbers	X	X	
Check Front Wheels and Bearings	X	X	
Check Rear Spring Bolts	X	X	

TYPE OF OPERATION	CHECK / CHANGE BASIC (4 MONTHS)	CHECK / CHANGE ANNUAL (12 MONTHS)	ADDITIONAL SERVICE
Check Mounting for Front and Rear Axle	X	X	
Check Chassis Frame and Crossmembers	X	X	
Check Rear Wheels and Bearings	X	X	
Check Brake Linings	X	X	
Check Brake Cylinders, Levers and Forks	X	X	
Check Oil Level in Manual Transmission (If Applicable)	X	X	
Check Oil in Retarder	X	X	
Check Oil Level in Power Steering	X	X	
Check Air Cleaner	X	X	
Check Fluid Level in Clutch Fluid Reservoir	X	X	
Check Coolant Level	X	X	
Check Fluid Levels in Windshield Wiper Reservoirs	X	X	
Check Transmission Oil Cooler hoses and Connections for leaks	X	X	

TYPE OF OPERATION	CHECK / CHANGE BASIC (4 MONTHS)	CHECK / CHANGE ANNUAL (12 MONTHS)	ADDITIONAL SERVICE
Valve Adjustment		X	REQUIRED: Once a year, every 209 000 km (130,000 miles) or every 2,500 hours, (whichever comes first)
Check Drive Belts	X	X	
Check Radiator Fan, Bearing Tolerance, Bolt Unions, Fan Cover and Fan Ring with Rubber Seal	X	X	
Check Turbocharger	X	X	
Check Discharge Lines and Hoses	X	X	

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 Truck 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 Volvo Truck dealer, ask for outstanding safety related recalls that relate to the vehicle. This service is available only at an authorized Volvo Truck 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 a Volvo Truck dealer who has the proper equipment and trained technicians.

ENGINE DATA

Consult your authorized Volvo Truck dealer.

Fill in the blanks for future reference

Vehicle Identification Number (VIN)

Engine Model

Engine Serial Number

Engine Power Rating

Primary Fuel Filter Part Number

Secondary Fuel Filter Part Number

Oil Filter Part Number, Full Flow

Oil Filter Part Number, By-pass

Air Cleaner Element Part Number

Coolant Filter Part Number

Fan Drive Belt Part Number

Accessory Drive Belt Part Number

Diesel Particulate Filter Part Number (If Equipped)

Diesel Oxidation Catalyst Part Number (If Equipped)

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 for technical help, parts or service information.

Volvo Action Service (VAS), provides on-call assistance. For help, contact VAS directly: 24 hours a day at 1 (800) 528-6586 or 1 (800) 52-VOLVO. Also on the internet: www.vas.Volvo.com.

VAS offers:

- **Delivery Assurance** — If you need roadside assistance, 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.

To order a single service manual or a service manual set for your vehicle, contact your authorized Volvo Truck dealer.

In order to process the request correctly, please give the model, year and VIN (**last six digits of VIN**). For VIN location, refer to “Label Information” on page 21.

A

Air Dryer Maintenance	79
Air Filter, Cab	99
Air Filter, Engine	63
Air Tank Draining	79
Alternative Fuels	53

B

Battery Maintenance	80
Burn Prevention	26

C

Canadian Consumer Complaints	38
Climbing Up or Down	34
Coolant Additives	47
Coolant Change Interval, Extended	48
Coolant Change Interval, Regular	47
Coolant System	44
Coolant Water Specification	44
Crushing Prevention	33
Cutting Prevention	33

D

Diesel Particulate Filters	65
Driveshaft Maintenance	75

E

Electric Grounding Practices	36
Electric System, Precautions	36
Electronic System Precautions	37
Emissions Control Compliance	5
Engine Air Filter	63
Engine Components, Service Schedules	43
Engine Damage Prevention	34
Engine Data Notes	121
Engine Monitoring Systems	37
Engine Oil Change	61
Engine Oil Filters	58
Engine Oil, General	57

Engine Overview, D11F	39, 40
Engine Overview, D13F	39, 40
Engine Shut-Down System	37
Engine Storage	41
Engine, Before Starting	35
Ether Start	31, 35
Explosion Prevention	29

F

Fan Drive Belts	66
Fire Prevention	29
Fuel Additives	51
Fuel Cetane Number	51
Fuel Enhancers	52
Fuel Filter Replacement	56
Fuel Filter Replacement, Primary	70
Fuel Filters	55
Fuel Quality	50
Fuel Safety Information	49
Fuel Storage	54
Fuel Sulfur Content	51
Fuel System, Priming	71
Fuel, Alternative	53
Fuses	22

H

Hubs, Front	92
-----------------------	----

I

Injury Prevention	26
-----------------------------	----

L

Lubrication Chart	102
-----------------------------	-----

M

Maintenance Hazards	42
Maintenance Safety Precautions	24

N

Noise Emissions 16

O

Oil Additives 60

Oil Capacity 108

Oil Change Intervals 58

Oil Consumption 60

Oil Filters Change, Engine 62

Oil Quality 57

Oil Viscosity 59

Oil, Synthetic 59

Owner Information, General 3

Owner's Information Package 4

P

Power Steering Fluid Reservoir 77

R

Radiator Package, Cleaning 68

Relay Center 22

Respiratory Hazard Prevention 32

Roadside Assistance 122

Rubber Bushings 96

S

Safety Defects, Reporting 38

Safety Information, Brakes 78

Selling Vehicle 3

Service Assistance 122

Service Charts 116

Service Manuals 122

Speed Restrictive Tires 29

Spring Bushings 96

Spring Maintenance 95

Steering System Maintenance 76

T

Tires, Wheels and Hubs Maintenance82
Transmission Oil73
Turbocharger and Charge Air Cooler68

U

U-bolts95
Unitized Front Hubs93

V

Vendor Component Information3
Volvo Action Service122

W

Water In Fuel73

1-800-52-VOLVO

Volvo Action Service (VAS) Support Center

- If you need assistance on the road or if you need service repairs, contact the VAS support center. VAS is available 24 hours per day, 7 days per week at **1-800-528-6586**.
- Please report the specific nature of the service problem to the Volvo Customer Support Specialist, who will answer your questions and arrange for the assistance you need.

Truck Model & Serial _____

Engine Model & Serial _____

Transmission Model & Serial _____

Rear Axle Model & Serial _____

Your Truck Was Delivered By:

VOLVO

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