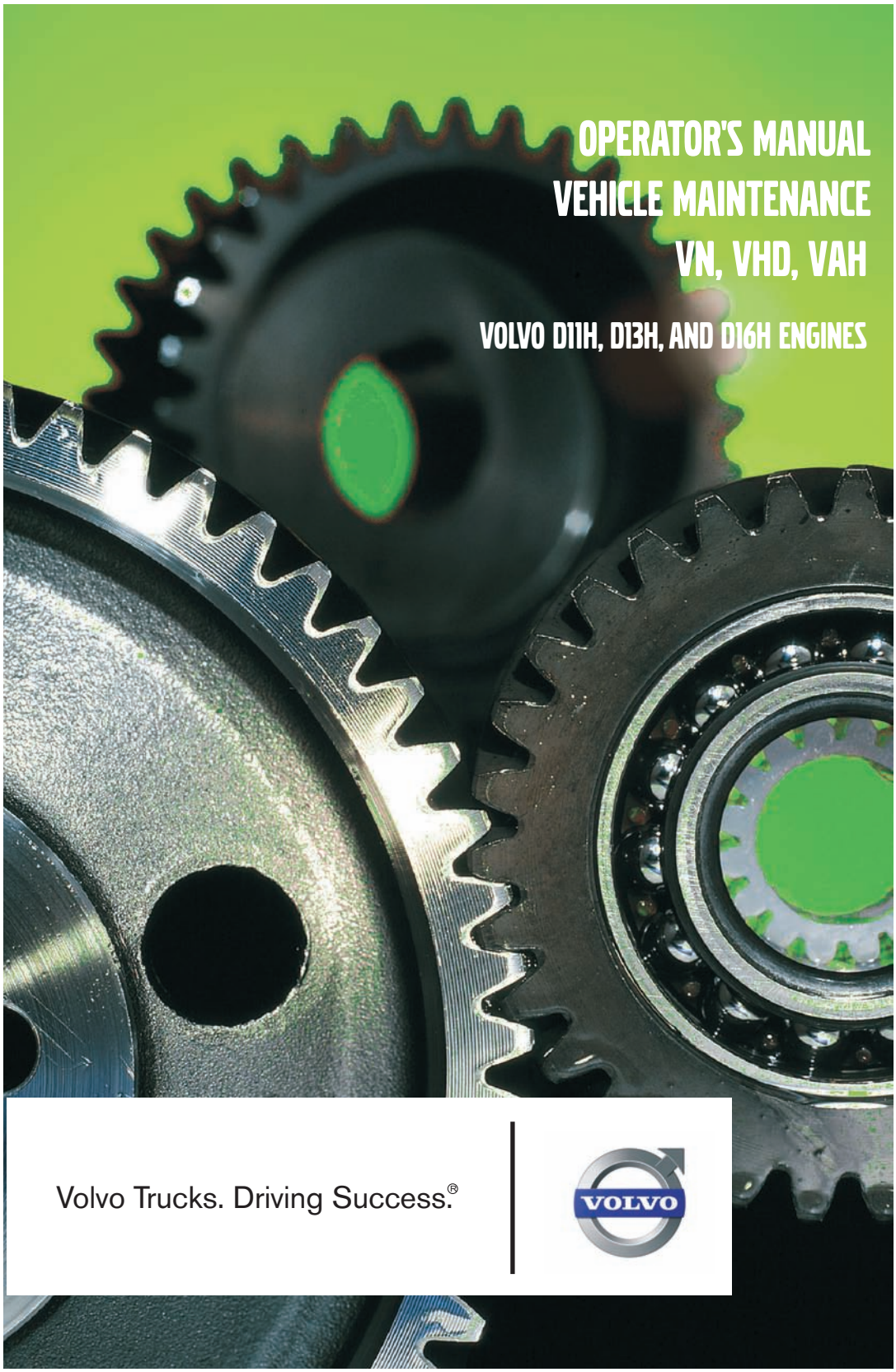


OPERATOR'S MANUAL
VEHICLE MAINTENANCE
VN, VHD, VAH

VOLVO D11H, D13H, AND D16H ENGINES

Volvo Trucks. Driving Success.®

VOLVO

Contents

Foreword

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 Owners Package.

Note: 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 Group North America, LLC 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 Group North America, LLC

Greensboro, NC USA

Order number: PV776-22171527

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 Operators 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 operators 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 operators 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 operators 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.

General Information

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/operators manuals supplied by component manufacturers. These manuals are placed in the Owners 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. For information regarding the Cummins engine contact Cummins directly. For detailed information on 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.

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

VOLVO Trucks North America

P. O. Box 26115

Greensboro, NC 27402-6115

United States of America

4 Operator's Manual Vehicle Maintenance VN, VHD

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 manufacturers 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.

General

USA

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:
CAA, Section (a) (3) (A) prohibits any person from removing or rendering inoperative any emission control device or element of design installed on or in a motor vehicle or motor vehicle engine in compliance with federal regulations under the Clean Air Act prior to the sale and delivery of the vehicle to the ultimate purchaser. The statute also prohibits any person from knowingly removing or rendering inoperative any emission control device or element of design after sale and delivery of a vehicle or engine to the ultimate purchaser. Any person who violates these provisions either by removing or rendering inoperative emissions control devices prior to the sale or delivery of an engine or vehicle to an ultimate purchaser, or by knowingly removing or rending inoperative such devices after the sale and delivery of an engine or vehicle to an ultimate purchaser, can be subject to penalties of up to $3,750 per incident. Any dealer or manufacturer who violates these provisions can be subject to penalties of up to $37, 500 per incident.

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.

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.

Note: For specifics of the prohibited vehicle/engine modifications refer to the VOLVO Bodybuilder documentation.

Engines Other than VOLVO

For specific information on engines other than VOLVO, refer to the engine vendors publications.

Engine Gaseous Emission Control Systems

Warranty Maintenance

Note: For emission control systems information on engines other than VOLVO, refer to the engine vendor’s publication

Gaseous Emission Control Systems Warranty

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 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:

Note: 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 or DEF.
- 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 or 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.

Emissions Control System Warranty

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

1 Turbocharger Assembly
- VGT Actuator

2 Charge Air Cooler
- CAC Pipes (Air inlet to/from CAC)
- CAC Hoses

3 Engine Control Module (ECM)

4 Injectors

5 Engine and Vehicle Wire harness (repair to circuits related to Emissions Warrantable Components)

6 Exhaust Gas Recirculation (EGR) Mixer

7 EGR Cooler

8 EGR Valve and EGR Valve Control

9 EGR Pipes - Engine Exhaust Manifold to EGR Cooler

10 EGR Pipes - EGR Cooler to Inlet Manifold

11 Crankcase Breather

12 Crankcase Separator

13 Crankcase Tubing and Hoses before Separator

14 Aftertreatment Wiring Harness

15 After treatment Control Module (ACM)

16 Aftertreatment Diesel Particulate Filter (DPF) Assembly

A. Aftertreatment DPF Assembly with Aftertreatment Diesel Oxidation Catalyst (DOC)
- Aftertreatment Doser
- Diffuser Pipe (Aftertreatment Doser Mounting)
- Fuel lines to Aftertreatment Doser
- Aftertreatment Fuel Shutoff Valve
- Aftertreatment Fuel Pressure Sensor
- Discharge Recirculation Valve (DRV) (Heat Mode)
- Discharge Recirculation Valve (DRV) Solenoid
- Engine Turbocharger Compressor Bypass Actuator (Heat Mode)
- Engine Turbocharger Compressor Bypass Actuator Solenoid
- Engine Exhaust Gas Temperature (EGT) Sensor
- Aftertreatment DPF Intake Temperature Sensor
- Aftertreatment DPF Outlet Temperature Sensor
- Aftertreatment DPF Differential Pressure Sensor
- Aftertreament Doser Air Supply Regulator (if applicable), Supply Lines, and Fittings
- Engine Exhaust Gas Temperature (EGT) Sensor
- Aftertreatment DPF Intake Temperature Sensor
- Aftertreatment DPF Outlet Temperature Sensor
- Aftertreatment DPF Differential Pressure Sensor

17 Sensors:
- Crankshaft Position (CKP)
- Camshaft Position (CMP)
- Engine Coolant Temperature (ECT)
- Intake Manifold Air Temperature
- Intake Manifold Pressure (IMP)
- EGR Temperature
- Aftertreatment Outlet NOx
- Aftertreatment Intake NOx

- EGR Differential Pressure
- Ambient Air Temperature (AAT)

18 SCR

- Aftertreatment Selective Catalytic Reduction (SCR) Catalyst
- Aftertreatment Diesel Exhaust Fluid (DEF) Pump
  - Aftertreatment DEF Dosing Absolute Pressure Sensor
  - Aftertreatment DEF Return Valve
- Aftertreatment DEF Dosing Valve
- Aftertreatment DEF Tank
- Aftertreatment DEF Tank Heater/Sender
- Aftertreatment DEF Tank Heater
- Aftertreatment DEF Tank Heater Valve
- Aftertreatment DEF Tank Temperature Sensor
- Aftertreatment DEF Level Sensor
- Aftertreatment DEF Heated Lines

19. Instrument Cluster (Repair of microprocessor , OBD MIL, Real Time Clock, Aftertreatment DEF Tank Gauge and, Aftertreatment DEF Tank Low Level Indicator)

20. Exhaust Gas Piping (from Turbocharger to Aftertreatment System)

21. Data Link Connector (DLC)

Engine Gaseous Emissions Control System Warranty

The emission warranty for the diesel particulate filter and SCR Systems covers defects in workmanship only. Normal maintenance, such as cleaning ash from the filter at regular maintenance intervals and cleaning the Aftertreatment fuel injector on Diesel Oxidation Catalyst (DOC) DPF systems, is not covered by the emission warranty. With the Thermal Regeneration DPF system, cleaning the ignition electrodes and fuel injection nozzle at the regular maintenance intervals is considered normal maintenance and 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. 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 and Canadian Emission Control System Warranty

Federal and Canadian Warranty 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 Canadian Environmental Protection Act, 1999.

Manufacturer’s Warranty Coverage

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 160934 km (100,000 miles), whichever occurs first, provided that all 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 dealership, there will be no charge for labor.
VOLVO’s obligation under this warranty is limited to the repair or replacement, at VOLVO’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 and provided that such part(s) were returned to VOLVO or its nearest authorized Dealer within a reasonable period of time.

Note: For emission control systems information on engines other than VOLVO, refer to the engine vendor’s publication

Tampering with 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.

Note: For specifics of the prohibited vehicle/engine modifications refer to the VOLVO Body Builders documentation.

California Emission Control Warranty Statement

Your Warranty Rights and Obligations

The California Air Resources Board and VOLVO Trucks North America are pleased to Explain the emission control system warranty on your 2013 / 2014 vehicle. In California, new motor vehicle engines must be designed, built and equipped to meet the State's stringent anti-smog standards. VOLVO 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.
If an emission-related part of your engine is defective, the part will be repaired or replaced by VOLVO. This is your emission control system DEFECTS WARRANTY.

Manufacturer's Warranty Coverage

(Applicable only to vehicles and/or engines certified for sale and registered in the State of California)
VOLVO 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, whichever occurs first, provided all VOLVO 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 dealership, there will be no charge for labor.
VOLVO's obligation under this warranty is limited to the repair or replacement, at VOLVO's option, of any part(s) of Emission Control Systems of such engine and/or vehicle found to be defective upon examination by VOLVO and provided that such part(s) were returned to VOLVO or its nearest authorized Dealer within a reasonable period of time.

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 recommends that you retain all receipts covering maintenance of your vehicle, but VOLVO 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 may deny you warranty coverage if your vehicle or a part has failed due to abuse, neglect, improper maintenance, or unapproved modifications. If you have any questions regarding your warranty rights and responsibilities, you should contact VOLVO Trucks North America Warranty Activities P.O. Box 26259, Greensboro, NC 27402, or the California Air Resources Board at 9480 Telstar Avenue, El Monte, California 91731.

Federal, Canadian, and California Emission Control Warranty Statement

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.

Emission Control System Warranty

The following engine components are covered by the supplemental emissions control system warranty policy as required by the Code of Federal Regulations, California Code of Regulations, and the regulations under the Canadian Environmental Protection Act, 1999.

1 Engine Turbocharger Assembly
- VGT Actuator

2 Charge Air Cooler
- CAC Pipes (Air inlet to/from CAC)
- CAC Hoses

3 Engine Control Module (ECM)

4 Injectors

5 Engine and Vehicle Wire harness (repair to circuits related to Emissions Warrantable Components)

6 Exhaust Gas Recirculation (EGR) Mixer

7 EGR Cooler

8 EGR Valve and EGR Valve Control

9 EGR Pipes - Engine Exhaust Manifold to EGR Cooler

10 EGR Pipes - EGR Cooler to Inlet Manifold

11 Crankcase Breather

12 Crankcase Separator

13 Crankcase Tubing and Hoses before Separator

14 Aftertreatment Wiring Harness

15 After treatment Control Module (ACM)

16 Aftertreatment Diesel Particulate Filter (DPF) with Aftertreatment Diesel Oxidation Catalyst (DOC)
- Aftertreatment Doser
- Diffuser Pipe (Aftertreatment Fuel Doser Mounting)
- Fuel lines to Aftertreatment Fuel Doser
- Aftertreatment Fuel Doser Air Supply Regulator
- Aftertreatment Fuel Shutoff Valve
- Aftertreatment Fuel Pressure Sensor
- Engine Exhaust Gas Temperature (EGT) Sensor
- Aftertreatment DPF Intake Temperature Sensor
- Aftertreatment DPF Outlet Temperature Sensor
- Aftertreatment DPF Differential Pressure Sensor

17 Sensors:
- Crankshaft Position (CKP) Sensor
- Camshaft Position (CMP) Sensor
- Engine Coolant Temperature (ECT) Sensor
- Intake Manifold Air Temperature/Pressure Sensor
- Exhaust Gas Recirculation (EGR) Temperature Sensor
- Aftertreatment Outlet NOx Sensor
- Aftertreatment Intake NOx Sensor
- Engine Exhaust Gas Recirculation Differential Pressure Sensor
- Ambient Air Temperature (AAT) Sensor

18 SCR
- Aftertreatment Selective Catalytic Reduction (SCR) Catalyst
- Aftertreatment Diesel Exhaust Fluid (DEF) Pump
  - Aftertreatment DEF Dosing Absolute Pressure Sensor
  - Aftertreatment DEF Return Valve
- Aftertreatment DEF Dosing Valve
- Aftertreatment DEF Tank

- Aftertreatment DEF Tank Heater/Sender
- Aftertreatment DEF Tank Heater
- Aftertreatment DEF Tank Heater Valve
- Aftertreatment DEF Tank Temperature Sensor
- Aftertreatment DEF Level Sensor
- Aftertreatment DEF Heated Lines
- Aftertreatment DEF Quality Sensor

19. Instrument Cluster (Repair of microprocessor , OBD MIL, Real Time Clock, Aftertreatment DEF Tank Gauge and, Aftertreatment DEF Tank Low Level Indicator)

20. Exhaust Gas Piping (from Turbocharger to Aftertreatment System)

21. Data Link Connector (DLC)

Emission Control System Warranty (Cont.)

The emission warranty for the diesel particulate filter (DPF) and SCR System covers defects in workmanship only. Normal maintenance, such as cleaning ash from the filter at regular maintenance intervals and cleaning the aftertreatment fuel injector on Diesel oxidation catalyst (DOC) DPF systems, 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. 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 Emission Control Systems Warranty will be performed by any authorized VOLVO repair facility 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 3 and 4 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.

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.

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

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 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 or incidental damages.
- Any vehicle in which the odometer has been altered or damaged so that mileage cannot be readily determined.

7. **Customer Assistance** VOLVO wishes to assure that the 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 Federal, Canadian, or California Emission Control Systems Warranty, they should contact the nearest VOLVO Regional Office for assistance. The address and telephone number for each Regional Office are in the VOLVO Directory of Sales, Parts and Service Centers. Owners in need of additional assistance or information concerning the Emission Control Systems Warranty may also contact:
VOLVO Trucks North America
Warranty Activities
P.O. Box 26259
Greensboro, NC 27402

Emission Green House Gas Component Warranty (If Equipped)

VOLVO Trucks LLC warrants certain individual greenhouse gas (GHG) components and controls of each new VOLVO vehicle certified to the requirements of Chapter 40 of the United States Code of Federal Regulations, Part 1037. VOLVO GHG certified vehicles are warranted to be designed, built, and equipped so they conform at the time of sale to the ultimate purchaser to the requirements of the Part and to be free from defects in material and workmanship which, under normal use and service, would cause the vehicle to fail to conform to the requirements of the Part up to the periods specified, provided all VOLVO Trucks LLC maintenance and inspection requirements are followed. See your local authorized VOLVO Trucks dealer for recommended maintenance and inspection procedures. All warranty periods are calculated from the date in service of the vehicle. All coverage is 100% for parts and labor subject to the qualifications, limitations and exclusions as noted.

LIMITATIONS AND EXCLUSIONS TO THIS WARRANTY APPEAR ON THE FOLLOWING PAGES.
THESE LIMITATIONS AND EXCLUSIONS ARE IMPORTANT AND MUST BE READ AND UNDERSTOOD.

This warranty applies to new VOLVO vehicles certified to the requirements of 40 CFR part 1037. VOLVO Trucks LLC reserves the right to make any changes in design, or make additions to or upon its products, without incurring any obligations to install the same changes on vehicles previously built.

Emissions Components Coverage, Vehicle:

Not Covered by the Emissions Control System Warranty:

- Malfunctions caused by misuse, improper adjustment, modification alteration, tampering, disconnection, improper or inadequate maintenance and use of improper diesel fuel or DEF.
- Damage resulting from accident, act of nature or other events beyond the control of VOLVO Trucks LLC
- Inconvenience, loss of use of the vehicle, commercial loss of any kind including, but not limited to consequential or 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.

Tires, Drive and Steer Only: The first 24 months or 38624 km (24,000 miles) of vehicle operation, whichever occurs first, and applying only to the first set of tires on the vehicle when delivered to the ultimate purchaser. Subject to the terms and conditions of the tire manufacturer's warranty, excluding retreads. Emissions related warranty coverage only, refer to the specific tire manufacturer's warranty policy for other term lengths.

Source of parts and repair A repair shop or person of the owner's choosing may maintain, replace, or repair emission control devices and systems.

Replacement of tires that are GHG certified The original equipment tires installed on this vehicle at the factory were certified to the U.S. EPA Greenhouse Gas (GHG) and NHTSA Fuel Efficiency regulations. Replacement of these tires should be with a tire of equal or lower rolling resistance levels (TRRL or Crr). Please consult your tire supplier(s) for appropriate replacement tires.

Maintaining a GHG certified tire In order to maintain the certified rolling resistance of the tires which optimize fuel economy, the maintenance procedures provide by the tire manufacturer must be followed.

All other Vehicle emission controls are warranted to 60 months or 160934 km (100,000 miles), whichever occurs first.

Other vehicle components: 60 months or 160934 km (100,000 miles), whichever occurs first.

Emission Control System Warranty
Vehicles sold for use in California must have the Operator's Manual in the vehicle which contains the California Emission System Warranty.

Covered Emission Components List: 60 Months or 160934 km (100,000 Miles)	**Qualifications and Limitations**
Electronic Control Module	Engine, vehicle and transmission ECMs where they are part of the certified emissions control. See your VOLVO Dealer for coverage identification.
Engine & Vehicle Wire Harness	Only circuits specifically connected to other emission related components.
Instrument Cluster Repair of microprocessor Real Time Clock	Only where they are part of the certified emission controls. See your VOLVO Dealer for coverage identification.
Sensors Ambient Air Temperature Sensor Engine Coolant Temperature Sensor Engine Speed Sensor Transmission Speed Sensor	Only where they are part of the certified emission controls. See your VOLVO Dealer for coverage identification.

Covered Emission Components List:	Qualifications and Limitations
Tires	Drive and Steer Only: The first 24 months or 38624 km (24,000 miles) of vehicle operation, whichever occurs first, and applying only to the first set of tires on the vehicle when delivered to the ultimate purchaser. Subject to the terms and conditions of the tire manufacturer's warranty, excluding retreads. Emissions related warranty coverage only, refer to the specific tire manufacturer's warranty policy for other term lengths.
Exterior Components: Highway Tractors Only Chassis Fairings Ground Effect Extensions Roof Deflectors Cab Side Deflectors Adjustable Roof Extensions Side Deflector Extensions Bumper Deflectors A-pillar Deflectors	60 Months or 160934 km (100,000 Miles), whichever occurs first.
Air Conditioning Components: Only those vehicles certified as "Tractors" according to the requirements of Chapter 40 of the Code of Federal Regulations, Part 1037. Hoses, Compressor to Condenser Hoses, Condenser to Drier Hoses, Drier to Climate Unit Hoses, Climate Unit to Compressor Hoses, Bunk Climate Unit Receiver Drier, Spring Loaded, 12 cubic in. A/C Compressor A/C Condenser A/C Pressure Switches & Transducers Main Climate Unit Bunk Climate Unit	60 Months or 160934 km (100,000 Miles), whichever occurs first.

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.

Note: To track all maintenance to the Noise Control System utilize the “Noise Control Log”, page 163.

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
- Selective Catalytic Reduction (SCR)

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 manufacturers 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

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.

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

> **WARNING**
>
> 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:

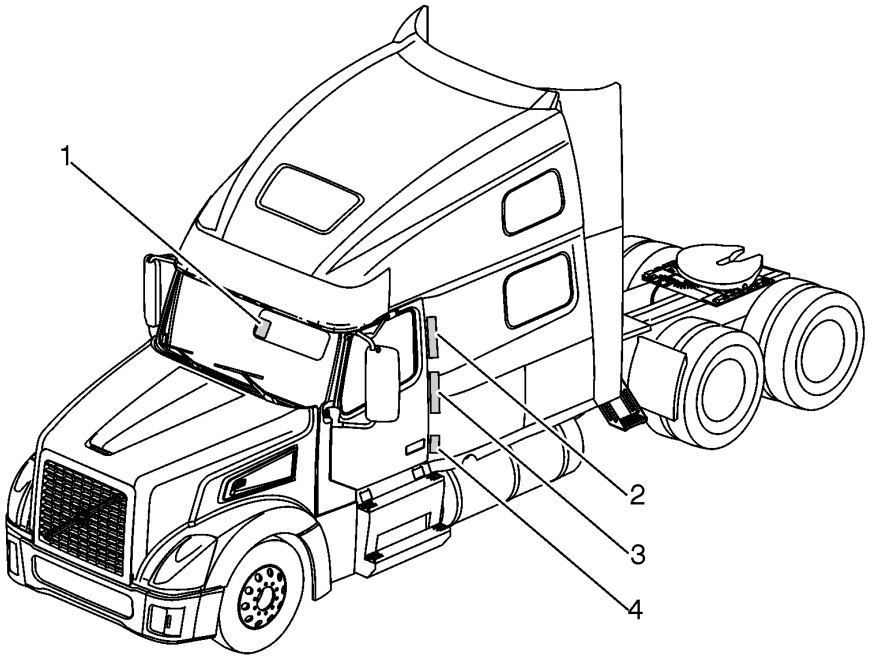
Removing or rendering inoperative air intake/induction system components (filter, filter housings, ducts, etc.).

Engine Control, EGR and Fuel Systems

Acts that constitute tampering with Engine Control, EGR and Fuel Systems:

Removing rendering inoperative, or modifying the engine control system such as the ECU, EGR system components, or fuel system components, in order to allow the engine to operate outside of the manufacturers specifications is not allowed and violates both warranty and legislation.

Label Information



W1000211

VT Shown, VN and VHD Similar

1. **Transmission Type and Gear Pattern, and Exhaust Aftertreatment Systems (EATS)** This information is located in the visor.	3. **VIN/Major Components** Located in the door frame B pillar.
2. **VIN/GAWR** Located in the door frame B pillar.	4. **Vehicle Noise Emission** Located in the door frame B pillar.

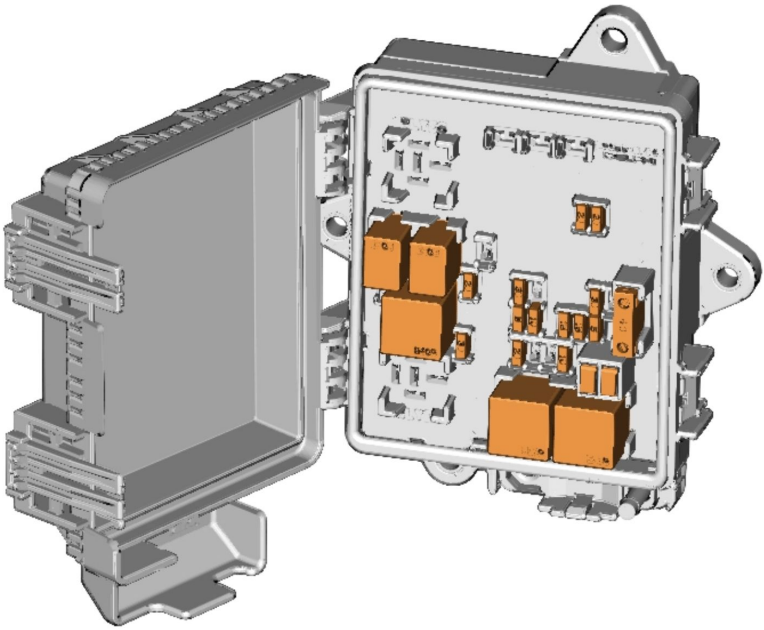
Fuse and Relay Location

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.

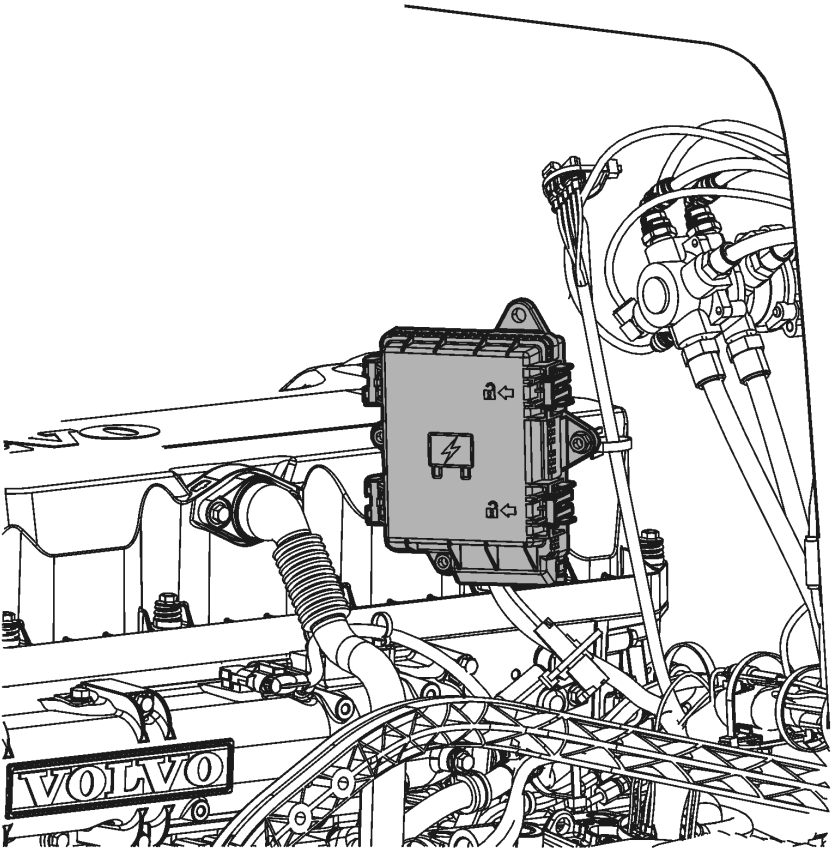
CAUTION

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



W3035176

The fuse relay panel is located under the hood of the vehicle. The vehicle has an electrical center located under the hood, on the driver's side of the vehicle, near the steering shaft. 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.



W3032984

Safety Information

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 30 psi (200 kPa) for cleaning purposes.

Asbestos Information

Note: The VOLVO engine and replacement parts for it shipped from the factory are asbestos free. VOLVO recommends the use of only genuine VOLVO spare parts. Never use any parts that contain or are thought to contain asbestos. Exposure to asbestos fibers can create serious health risks, including death.

Fluid Penetration

DANGER

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

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.

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 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.

W0001525

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

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

Coolant

WARNING

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

W0001527

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

WARNING

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

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

Batteries

WARNING

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

WARNING

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

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

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.

W0001526

DANGER

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

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.

W0001527

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.

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.

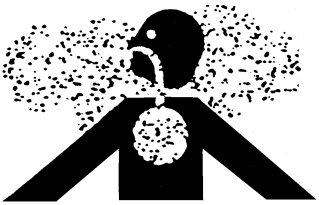
Respiratory Hazard Prevention

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.

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.



W0001523

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

Poisonous Substances

DANGER

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

Cooling system supplemental additive contains alkali. To prevent personal injury, avoid contact with the skin and eyes.

DO NOT drink coolant of any concentration.

Crushing or Cutting Prevention

DANGER

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

WARNING

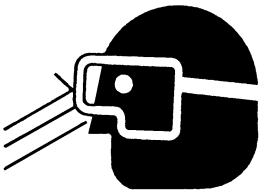
DO NOT work near the fan with the engine running or the ignition in the ON position. The engine fan can engage at any time without warning. Anyone near the fan when it turns on could be seriously injured.

W0001524

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.



W0001528

Climbing Up and Down

DANGER

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

DO NOT climb up on or jump off from the engine or stand on components that cannot support your weight. Use an adequate ladder or scaffolding, suitably situated.

DO NOT use top of engine or cowling ledge as foothold when reaching on top of cab. Clean steps, handholds and areas of the vehicle on which you will be working or are around. Refer to the Operators 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

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.

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.

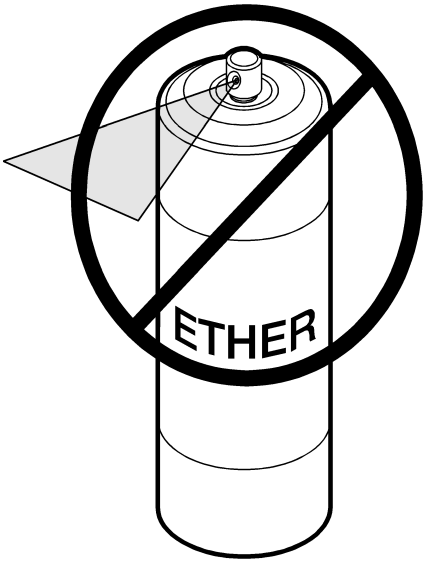
Diesel engine exhaust contains products of combustion which may be harmful to your health. Always start and operate the engine in a well-ventilated area, and if in an enclosed area, vent the exhaust to the outside.

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 operators manual to prevent major engine component damage and personal injury.

Starting Aids

DANGER

DO NOT use ether or other combustible 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.



W0001484

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.

W0001526

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 engines 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.

W0001522

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

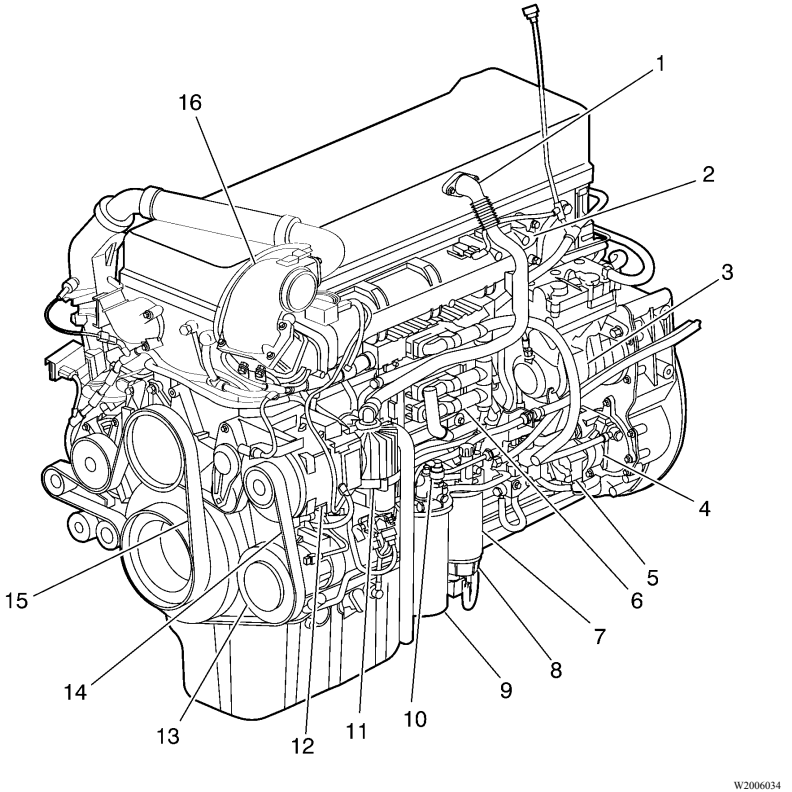
Mexico

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 Pea Blanca, C.P. 01210, Mexico, D.F.

Note: For Roadside assistance information see “Service Assistance and Manuals”, page 168.

General Engine Information

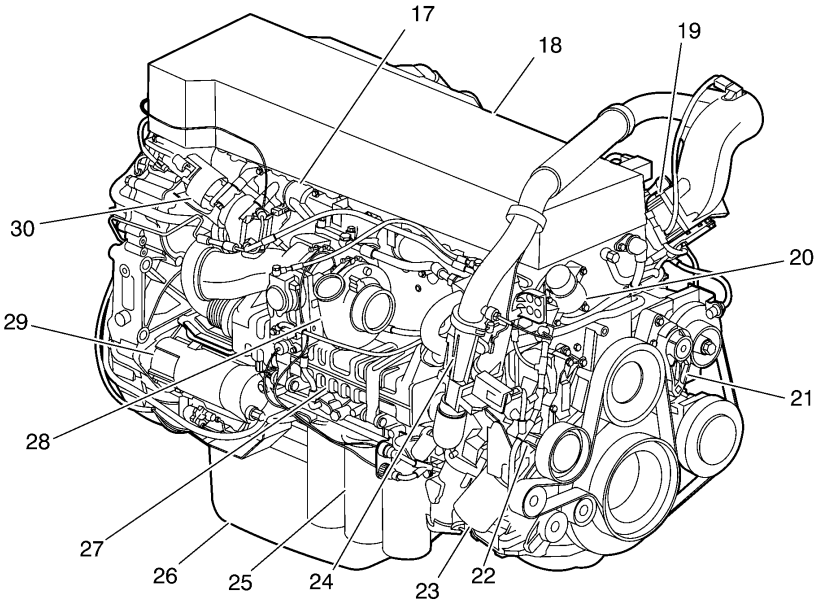
Engine Overview, D11H and D13H Left Side View



D13H Engine Shown, D11H 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 Control Module (ECM)	14. Alternator/AC Compressor Belt
7. Fuel Filter	15. Fan/Coolant Pump Belt
8. Fuel/Water Separator	16. EGR Mixing Chamber

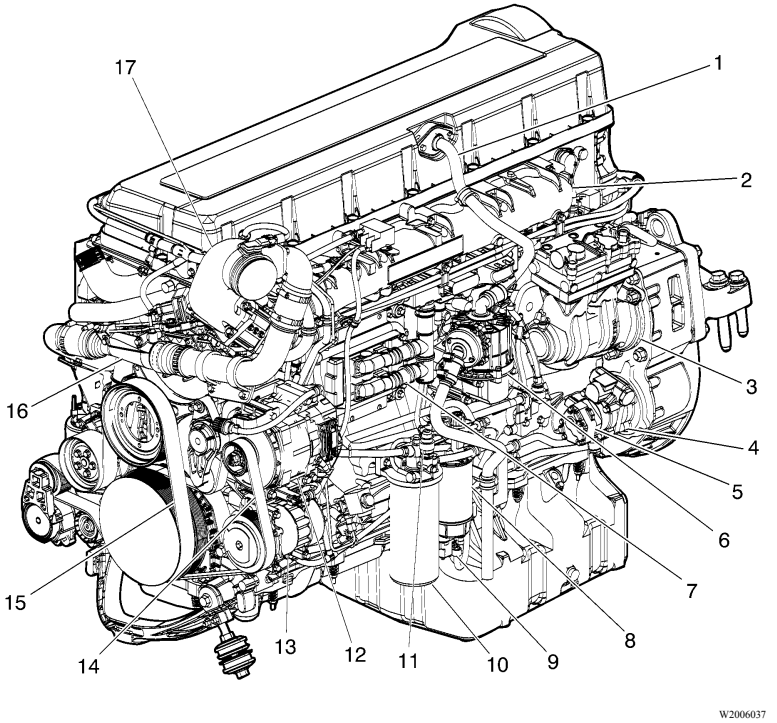
Engine Overview, D11H and D13H Right Side View



D13H Engine Shown, D11H Engine Similar

17. Exhaust Manifold	24. Venturi Pipe
18. Valve Cover	25. Oil Filters
19. Intake Air Heater (IAH) optional	26. Oil Pan
20. Thermostat	27. EGR Cooler
21. Belt Tensioner	28. Turbocharger
22. Coolant Pump	29. Starter Motor
23. Coolant Filter	30. EGR Valve

Engine Overview, D16H Left Side View



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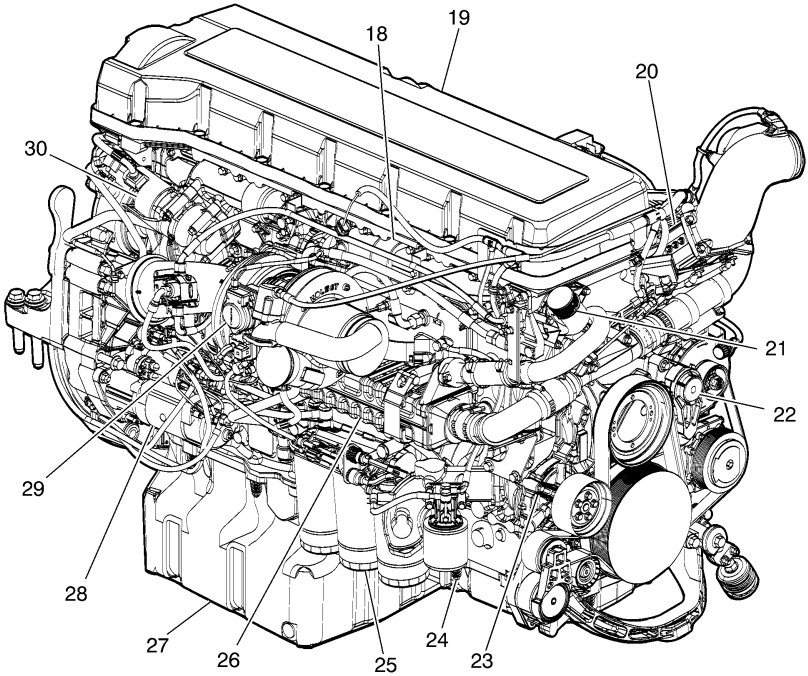
1. Breather Tube	9. Fuel/Water Separator
2. Intake Manifold	10. Fuel Filter
3. Air Compressor	11. Hand-Priming Pump
4. Power Steering Pump	12. Alternator
5. Fuel Pump	13. AC Compressor
6. Crankcase Ventilator	14. Alternator/AC Compressor Belt
7. Engine Control Module (ECM)	15. Fan/Coolant Pump Belt
8.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

Engine Overview, D16H Right Side View



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18. Exhaust Manifold	24. Coolant Filter
19. Valve Cover	25. Oil Filters
20. Intake Air Heater (IAH)	26. EGR Cooler
21. Thermostat	27. Oil Pan
22. Belt Tensioner	28. Starter Motor
23. Coolant Pump	29. Turbocharger
	30. EGR Valve

Engine Storage

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 and Service

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", page 29.

Engine Components, Service Schedules

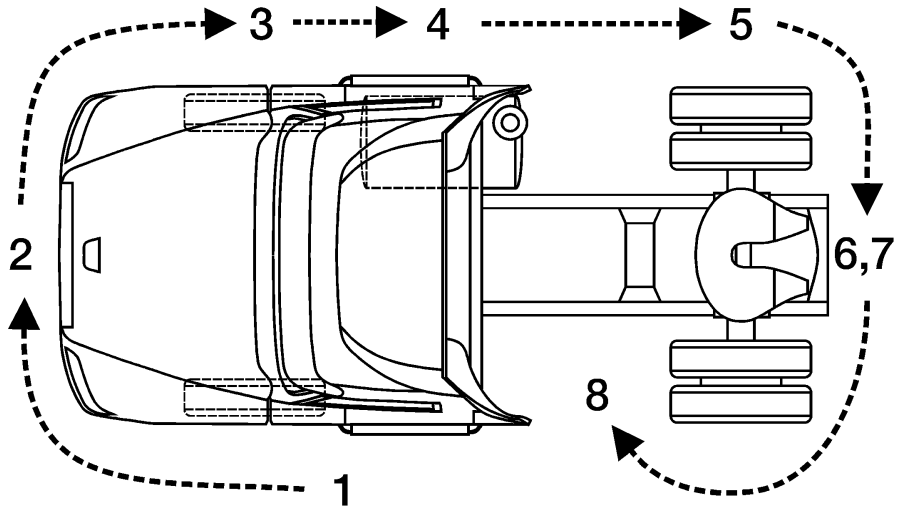
Component	Operation	Km (Miles)/Maximum Months/Hours
Fuel Filter (D11, D13 and D16)	Change	Each oil change*
Water Separator (D11, D13 and D16)	Filter change	Each oil change*
Air Filter US2010	Change	At maximum restriction as indicated on gauge, or 12 months
Fuel Tank Ventilation Filter	Change	Every 12 months
Air Filter Euro 4	Change	Every 12 months
Coolant (D11, D13 and D16)	Change	500 000 (300, 000) or 24 months whichever comes first
Coolant (D11, D13 and D16)	Change	Vocational Application 250 000 (150, 000) or 12 months whichever comes first
Coolant, Extended Life (ELC) (D11, D13 and D16)	Change	1 000 000 (600,000) or 48 months, whichever comes first

Component	Operation	Km (Miles)/Maximum Months/Hours
Coolant Filter (D11, D13 and D16)	Change	80 000 (50,000) or 6 months, whichever comes first
Coolant Filter, Extended Life (ELC) (D11, D13 and D16)	Change	240 000 (150,000) or 12 months, whichever comes first
Coolant Conditioner Euro 4	Change	Traditional coolants requiring Supplemental Coolant Additive (SCA) 80 000 (50,000) or 6 months
Valves/Injectors (D11 and D13)**	Initial Adjust	200 000 (125,000) or 12 months, whichever comes first
Valves/Injectors (D11 and D13) **	Adjust	400 000 (250,000) or 24 months, whichever comes first
Valves/Injectors (D16) **	Initial Adjust	100 000 (60,000) or 6 months, whichever comes first
Valves/Injectors (D16) **	Adjust	200 000 (125,000) or 12 months, whichever comes first
Drive Belts Pinnacle (Highway)	Change	500 000 (300,000) or 36 months, whichever comes first
Drive Belts VHD Euro 4 (Vocational)	Change	240 000 (150,000) or 12 months, whichever comes first
Accessory Drive Belt Pinnacle (Highway)	Change	500 000 (300,000) or 36 months, whichever comes first
Accessory Drive Belt VHD Euro 4 (Vocational)	Change	240 000 (150,000) or 12 months, whichever comes first
Aftertreatment Diesel Particulate Filter (DPF)	Clean	400 000 (250,000) or 4,500 hours, whichever comes first
Aftertreatment Diesel Exhaust Fluid (DEF) Pump Filter (D11, D13 and D16)	Change	First Change; 161 000 (100,000) or 3200 hours, or 3 years whichever comes first. After: 240 000 (150,000) or 4800 hours or three (3) years, whichever comes first
Aftertreatment Diesel Exhaust Fluid (DEF) Tank Filler Neck Filter Cleaning (D11, D13 and D16)	Clean	280 000 (175,000) or 12 months, whichever comes first

Component	Operation	Km (Miles)/Maximum Months/Hours
Aftertreatment Hydrocarbon Doser Service	Clean	240 000 Km (150,000 miles) or 4,500 hours, whichever comes first
Aftertreatment DPF Ignition Electrode and nozzle(DPF Spark Assisted System only)	Clean	Vocational Application 240 000 (150,000 miles) or 4,500 hours, whichever comes first
Aftertreatment Hydrocarbon Doser (If equipped) (D11, D13 and D16)	Clean	240 000 (150,000) or 4,500 hours, whichever comes first
*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.		

Pre-Trip Inspection Quick List

Take your time going through the pre-trip inspection. Remember that a careful pre-trip inspection saves time by eliminating unscheduled stops for correcting a faulty item. The following information has been provided by the American Trucking Association as developed by the D.O.T. Office of Motor Carriers (BMCS).



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Inspect the vehicle in a circular manner.

Approaching the Vehicle

• Check under the vehicle for oil, fuel, coolant leaks or other signs of damage.

• Check body surfaces for signs of breaks or damage.

Preparation

• Open drain cocks on air tanks to let the tanks drain.

• Chock wheels on vehicle and, if hooked up, trailer.

• Close air tank drain cocks.

• Start the engine and let the air pressure build up to normal. Stop engine check for air leaks.

• Switch on parking lights and hazard lights.

• Release parking brakes. Listen for air leaks

• Raise hood so belts can be checked

Step 1: Left Side of the Cab

Left Front Wheel

• Check condition of wheel rim. Especially look for cracks, missing lock rings, bent or broken studs, missing clamps or lug nuts.

• Check condition of tire: properly inflated, no serious cuts, bulges, tread wear or any signs of misalignment; valve stem not touching wheel, rim or brake drum; valve cap in place.

• Check wheel bearing and hub: no obvious leaking on outside or inside wheel. Verify correct oil level in hub.

Left Front Suspension

• Check condition of the springs (leaf or air), spring hangers, shackles, U-bolts: no cracks, breaks or shifting.

• Check shock absorber condition.

Left Front Brake

• Condition of brake drum. With brakes released, look for a noticeable gap between lining and drum. (This check cannot be made if dust covers are in place.) For additional information on the disc brake check refer to “Disc Brake Check”, page 121.

• Condition of brake air hose.

• Check brake chamber mounting bolts and bracket.

• Check slack adjuster and chamber pushrod travel for proper brake adjustment.

Condition of Front Axle and Steering System, Left Side

• No loose, worn, bent, damaged or missing parts.

Engine Compartment, Left Side

• Check coolant hose condition.

• Check condition of fan drive belts.

• Check engine and surrounding areas for coolant, oil and fuel leaks.

• Check wiring harnesses for signs of damage.

Engine Compartment, Right Side

• Check condition of coolant and heater hoses.

• Check condition of fan drive belts.

• Check engine and surrounding areas for coolant, oil and fuel leaks.

• Check fuel separator sight glass and drain if necessary. Check for leaks.

• Check wiring harnesses for signs of damage.

• Check air filter with brackets and hoses for loose connections or damage. Check filter gauge, if mounted on the filter.

Step 2: Front of Cab Area

Condition of Windshield

• Check for damage and clean if dirty.

• Check windshield wiper arms for proper spring tension.

• Check wiper blades for any damage, "dead" rubber and attachment to arm.

Lights and Reflectors

• Lower cab and inspect parking, clearance and identification lights on cab. They should be clean, operating and of the proper color.

• Reflectors clean and proper color.

• Turn on headlights. High and low beams should be operating and lenses clean. If equipped, check daytime running lights.

• Left and right front turn signal lights clean, operating and proper color.

Grille

• Check that charge air cooler and radiator or bugscreens are clean and undamaged.

Step 3: Right Side of Cab Area

Right Front Wheel

• Check condition of wheel rim. Especially look for cracks, missing lock rings, bent or broken studs, missing clamps or lug nuts.

• Check condition of tire: properly inflated, no serious cuts, bulges, tread wear or any signs of misalignment; valve stem not touching wheel, rim or brake drum; valve cap in place.

• Check wheel bearing and hub: no obvious leaking on outside or inside wheel. Verify correct oil level in hub.

Right Front Suspension

• Check condition of the springs (leaf or air), spring hangers, shackles, U-bolts: no cracks, breaks or shifting.

• Shock absorber condition.

Right Front Brake

• Condition of brake drum. With brakes released, look for a noticeable gap between lining and drum. (This check cannot be made if dust covers are in place.) For additional information on the disc brake check refer to “Disc Brake Check”, page 121.

• Condition of brake air hose: check for any chafing.

• Check brake chamber mounting bolts and bracket.

• Check slack adjuster and chamber pushrod travel. With brakes applied or released, look for conspicuously different positions of the slack adjusters for proper brake adjustment..

Condition of Front Axle and Steering System, Right Side

• No loose, worn, bent, damaged or missing parts.

Step 4: Right Saddle Tank Area

Right Fuel Tank(s)

• Securely mounted Diesel and Diesel Exhaust Fluid are not damaged or leaking.

• Fuel lines secure and not leaking. Check that shut-off valves are open.

• Tank(s) full of fuel. Cap on and secure.

Condition of Visible Components

• Rear of engine: not leaking.

• Transmission: not leaking. If equipped with oil cooler, check cooler, hoses and fittings for leaks.

• Check drive shaft.

• Exhaust system: secure, not leaking, not touching wires, fuel or air tubing.

• Frame and cross members: no bends, cracks or breaks.

DPF/SCR check hoses and fittings for leaks.

• Air tubing and electrical wiring: secured against snagging and chafing.

Step 5: Right Rear Vehicle Area

Dual Wheels, One or Two Axles

• Check condition of wheels and rims. Especially look for cracks, missing lock rings, bent or broken spacers, studs, missing clamps or lug nuts.

• Check condition of tires: properly inflated, no serious cuts, bulges, tread wear or any signs of misalignment; valve stems not touching wheels, rims or brake drums; valve caps in place and no objects stuck between the wheels.

• Check that both tires are of same type, for example, not mixed radial and bias type and that their circumferences are matched.

• Check wheel bearing and hub: no obvious leaking on outside or inside wheel.

Suspension

• Check condition of springs (leaf), spring hangers, shackles and U-bolts.

• Axle alignment.

Brakes

• Condition of brake drums. With brakes released, look for a noticeable gap between lining and drum. (This check cannot be made if dust covers are in place.) For additional information on the disc brake check refer to “Disc Brake Check”, page 121.

• Condition of brake hoses: check for any chafing.

• Check brake chamber mounting bolts and brackets.

• Check slack adjusters and chamber push rod travel. With brakes applied or released, look for conspicuously different positions of the slack adjusters for proper adjustment.

• Check spring brakes.

Step 6: Rear of Vehicle Area

Frame Area

• Frame or cross members not bent, cracked or otherwise damaged or missing.

• Check that air tubing and electrical lines are properly secured to the frame with no damage or chafing.

Lights and Reflectors

• Tail lights, brake lights and turn signal lights: operating, clean and proper color.

Step 7: Coupling System Area

Fifth Wheel

• Securely mounted to the frame.

• No missing or damaged parts.

• Check that trunnion and plate are properly lubricated.

Sliding Fifth Wheel

• Mechanism not worn, bent, damaged or parts missing.

• Properly lubricated.

• All locking pins present and locked in place.

• If air operated: no air leaks.

Air Tubing and Electric Lines Visible From This Point

• Should be secure from dangling.

• Both air lines and electric line should be free from damage, oil and grease.

Step 8: Left Saddle Tank and Left Rear Vehicle Wheels Area

Dual Wheels, One or Two Axles

• Check condition of wheels and rims. Especially look for cracks, missing lock rings, bent or broken spacers, studs, missing clamps or lug nuts.

• Check condition of tires: properly inflated, no serious cuts, bulges, tread wear or any signs of misalignment; valve stems not touching wheels, rims or brake drums; valve caps in place and no objects stuck between the wheels.

• Check that both tires are of same type, for example, not mixed radial and bias type and that their circumferences are matched.

• Check wheel bearing and hub: no obvious leaking on outside or inside wheel.

Suspension

• Check condition of springs (leaf or air), spring hangers, shackles and U-bolts, no cracks, breaks or shifting.

Brakes

• Condition of brake drums. With brakes released, look for a noticeable gap between lining and drum. (This check cannot be made if dust covers are in place.) For additional information on the disc brake check refer to “Disc Brake Check”, page 121.

• Condition of brake hoses: check for any chafing.

• Check brake chamber mounting bolts and brackets.

• Check slack adjusters and chamber push rod travel. With brakes applied or released, look for conspicuously different positions of the slack adjusters for proper brake adjustment..

• Check spring brakes.

Condition of Visible Components

• Transmission: No visible leaks, excessive wear or damage.

• Drive shaft: Appears servicable without excessive wear or damage.

• Exhaust system: secure, not leaking, not touching wires, fuel or air tubing.

• Frame and cross members: no bends, cracks or breaks.

• Air tubing and electrical wiring: secured against snagging and chafing.

Left Fuel Tank(s)

• Securely mounted and not damaged or leaking.

• Fuel lines secure and not leaking. Check that shut-off valves are open.

• Tank(s) full of fuel. Cap on and secure.

Battery Area

• Open the battery box. Battery box securely mounted to vehicle.

• Batteries secured against movement.

• Battery cases not broken or leaking. Battery cables free from damage.

• Tops of batteries and terminals clean and free from foreign material.

• If equipped, replace battery lid and make sure it is securely fastened.

In the Cab

• Check steps and grab handles for looseness or breakage. Also, clean them if there is any substance that makes them slippery, which makes cab entry/exit hazardous.

• Start the engine. If equipped, check that exhaust rain cap opens when accelerating engine.

• Check gauges and tell-tale light function. See the Instruments and Controls section.

• Check function of low air warning.

• Check clutch function. If equipped, check for clutch brake function.

• Check windshield wipers and washers and horns, including back-up alarm, if equipped.

• Clean inside windshield, door windows and instruments. Clean mirrors.

• Check temperature control and defroster. If equipped, check mirror heater.

• Check condition of warning triangles, fire extinguisher and flares.

• Adjust the seat. Check mirror adjustment.

• Check safety belts for function and damage.

• Apply service brakes. After initial drop, pressure should hold steady, or increase slightly, with engine at idle.

• Check steering wheel for excessive free play.

• Check for loose items in the cab. Secure them if necessary.

Hooking Up To Trailer

Hook-Up Preparation

• Check kingpin and mounting plate on trailer, free from wear, bends or damage.

• Chock trailer wheels.

Fifth Wheel or Trailer Hitch

• No visible space between fifth wheel and trailer.

• Locking jaws around the shank and not the head of kingpin.

• Release lever properly seated and safety latch/lock engaged.

• Check all connections to dolly or trailer hitch and safety chains are secured.

• Check function of trailer air supply valve and trailer brakes.

Sliding Fifth Wheel

• Check that fifth wheel is not so far forward that the tractor frame will strike the landing gear during turns.

Note: Refer to the trailer manufacturer's manual for specific information on the trailer checks.

Step 9: Trailer Front Area

Air and Electrical Connections

• Glad hands properly mounted, free from damage and not leaking.

• Trailer cord receptacle properly mounted, free of damage; plug properly seated and safety catch engaged to prevent accidental disconnect.

• Air and electrical lines properly secured against tangling, snagging and chafing with sufficient slack for turns.

Step 10: Right Side of Trailer Area

Landing Gear or Dolly Area

• Fully raised; no missing or damaged parts.

• Crank handle present and secured.

• If power operated, no air/hydraulic leaks.

Spare Wheel(s)

• Carrier or rack not damaged.

• Spare wheel securely mounted in rack.

• Tire and wheel condition adequate for a spare: proper size, properly inflated.

Lights and Reflectors

• Trailer side clearance lights: clean, operating and proper color.

• Reflectors clean and proper color.

Frame and Body

• Frame and crossmembers not bent, cracked, damaged or missing.

• Proper placarding.

• Body parts not damaged or missing.

Step 11: Right Rear Trailer Wheel

Dual Wheels, One or Two Axles

• Check condition of wheels and rims. Especially look for cracks, missing lock rings, bent or broken spacers, studs, missing clamps or lug nuts.

• Check condition of tires: properly inflated, no serious cuts, bulges, tread wear or any signs of misalignment; valve stems not touching wheels, rims or brake drums; valve caps in place and no objects stuck between the wheels.

• Check that both tires are of same type, for example, not mixed radial and bias type and that their circumferences are matched.

• Check wheel bearing and hub: no obvious leaking on outside or inside wheel.

Suspension

• Condition of springs (leaf or air), spring hangers, shackles and U-bolts.

• Axle alignment.

• Condition of torque rod arms.

• If equipped with sliding axles, check position and alignment. Look for damaged, worn or missing parts, all locks present, fully in place and locked.

• Flexible air tubing not cracked, cut, crimped or otherwise damaged. Secured against tangling, dragging and chafing.

Brakes

• Condition of brake drums. With brakes released, look for a noticeable gap between lining and drum. (This check cannot be made if dust covers are in place.) For additional information on the disc brake check refer to “Disc Brake Check”, page 121.

• Condition of brake hoses: check for any chafing.

• Check brake chamber mounting bolts and brackets.

• Check slack adjusters and chamber push rod travel. With brakes applied or released, look for conspicuously different positions of the slack adjusters for proper brake adjustment..

• Check spring brakes.

Step 12: Rear of Trailer Area

Lights and Reflectors

• Rear clearance, identification and tail lights clean, operating and proper color.

• Reflectors clean and proper color.

Cargo Securement

• Cargo properly blocked, braced, tied, chained, etc.

• Tailboard up and properly secured. End gates free from damage, properly secured in stake pockets.

• Canvas or tarp (if required) properly latched down to prevent water damage, tearing, billowing or blockage of either mirrors or tail lights.

• Rear doors securely closed, latched or locked; required security seals in place.

• Underside guard in place: not cracked, bent or broken.

Step 13: Left Rear Trailer Wheels Area

Dual Wheels, One or Two Axles

• Check condition of wheels and rims. Especially look for cracks, lock rings missing, bent or broken spacers, studs, missing clamps or lug nuts.

• Check condition of tires: properly inflated, no serious cuts, bulges, tread wear or any signs of misalignment; valve stems not touching wheels, rims or brake drums; valve caps in place and no objects stuck between the wheels.

• Check that both tires are of same type, for example, not mixed radial and bias type and that their circumferences are matched.

• Check wheel bearing and hub: no obvious leaking on outside or inside wheel.

Suspension

• Condition of springs (leaf or air), spring hangers, shackles and U-bolts.

• Axle alignment.

• Condition of torque rod arms.

• If equipped with sliding axles, check position and alignment. Look for damaged, worn or missing parts, all locks present, fully in place and locked.

• Flexible air tubing not cracked, cut, crimped or otherwise damaged. It should be secured against tangling, dragging and chafing.

Brakes

• Condition of brake drums. With brakes released, look for a noticeable gap between lining and drum. (This check can not be made if dust covers are in place.) For additional information on the disc brake check refer to “Disc Brake Check”, page 121.

• Condition of brake hoses: check for any chafing.

• Check brake chamber mounting bolts and brackets.

• Check slack adjusters and chamber push rod travel. With brakes applied or released, look for conspicuously different positions of the slack adjusters.

• Check spring brakes.

Step 14: Left Side of Trailer Area

Landing Gear or Dolly Area

• Fully raised; no missing or damaged parts.

• Crank handle present and secured.

• If power operated, no air/hydraulic leaks.

Spare Wheel(s)

• Spare wheel securely mounted in rack with no damage to rack.

• Tire and wheel condition adequate for a spare: proper size, properly inflated.

Lights and Reflectors

• Trailer side clearance lights: clean, operating and proper color.

• Reflectors clean and proper color.

Frame and Body

• Frame and crossmembers not bent, cracked, damaged or missing.

• Proper placarding.

• Body parts not damaged or missing.

Before Leaving the Parking Area

• Remove chocks from the wheels.

• Test trailer hook-up by slowly pulling while applying the trailer brakes with the trailer brake hand control valve.

• Test the service brakes before leaving the parking area.

• Test parking brakes by stopping on a 20% grade and applying the parking brakes. The parking brakes shall hold the combined vehicle and trailer without moving.

New Vehicle Break-In

To ensure many years of reliable, trouble-free operation, the following break-in procedures are recommended:

Note: Oil change, filter change and chassis lubrication are no longer required at the 3,000-mile vehicle break-in interval.

Refer to the preventive maintenance schedules outlined in the *Maintenance and Lubrication Manual (21394653)* for recommended lubrication change intervals for the following items:

- Gear oils (transmission, rear axle carrier[s], front drive axle carrier, transfer case, flywheel PTO)
- Engine oil
- Oil filters
- Fuel filters
- Coolant conditioner

Note: It is important that components be filled with lubricants meeting the specifications as given in the *Maintenance and Lubrication Manual (21394653)*

Note: When checking oil levels, the vehicle must be parked on level ground, and the units at normal operating temperature. Components must be filled to the correct level. DO NOT OVERFILL.

Note: Oil and filter change intervals in this manual pertain to components built by VOLVO Truck. For information concerning oil and oil filter change intervals for vendor components, refer to the specific vendor component service literature.

During the First 5000 Kilometers (3000 Miles)

- After the first 200 Km (125 miles), retorque the wheel nuts using an accurately calibrated torque wrench. Recheck this torque again after 800 Km (500 miles).
- Check oil and coolant levels frequently.
- Check brake and clutch adjustments per recommended maintenance schedule, and adjust as needed.
- Observe the instruments often, and shut down the engine at the first sign of any abnormal readings.
- Report all leaks, loose fasteners, unusual noises, etc., to the service representative at the nearest VOLVO dealership so they can be checked and corrected.
- Check the spring clip torque (U-bolts).
- On chassis equipped with AIRTEK™ front axle air suspensions, retorque the U-bolts.

• Check the U-bolt torque on the VOLVO air suspension at the end of the first 1600 Km (1000 miles).

After the First 5000 Kilometers (3000 Miles) or Before 6400 Kilometers (4000 Miles) or Before 3 to 4 Months

• Retorque the spring clip (U-bolts).

Note: On chassis equipped with AIRTEK™ front axle air suspensions, check the torque of the front axle U-bolts at 24 000 kilometers (15,000 miles).

At the First A Inspection Interval

• Check front and rear axle alignment and adjust if the alignment is out of specifications.

• Check steering knuckle to axle beam clearance.

Although this quality-built vehicle has been inspected, lubricated and adjusted at the VOLVO Trucks Assembly Plant, an occasional air, oil or coolant leak may develop. Quick action to correct these minor items will prevent a major repair later. Take the vehicle to the nearest VOLVO service center as soon as any abnormal condition becomes evident.

Initial Valve Adjustment Intervals

Refer to the *Maintenance and Lubrication Manual* for detailed information concerning the Initial Valve Adjustment Interval also see “Engine Components, Service Schedules”, page 51.

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

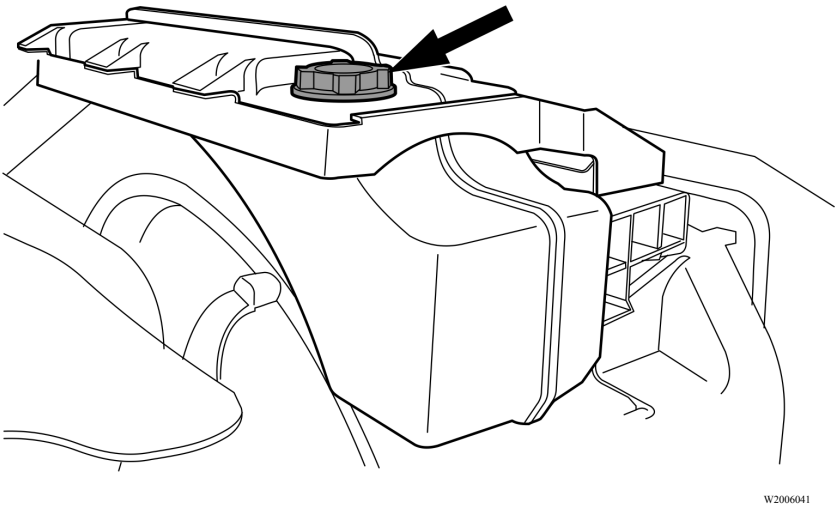
VOLVO Trucks North America does not recommend using plain water in the cooling system. Water alone is corrosive at engine operating temperatures and does not provide adequate boiling protection. The engine may develop corrosion and cavitation problems in the engine and radiator, and the boiling point of the coolant is lowered compared to a proper antifreeze and water mixture. Failure to follow VOLVO Truck North Americas 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 operators manual for more information on the warning functions.



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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”, page 108 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.

DANGER

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

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

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.

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.

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 systems 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.

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. Manufacturers 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 manufacturers instruction for treatment.

Prohibited Additives

WARNING

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.

Use of Biodiesel for VOLVO US2010 Certified Products

VOLVO engines are certified to comply with U.S. EPA and California emissions standards based upon the use of test fuels with specifications established by these regulatory agencies. Alternative fuels, including biodiesel, that are not substantially similar to the required test fuels may adversely affect engine emissions compliance and may impact the performance of certain emissions aftertreatment components. As a result, VOLVO does not warrant the engine will conform to applicable Federal or California emissions limits when operated on, or having been operated on, biodiesel or other alternative fuels that are not substantially similar to specified test fuels used for certification.
The use of biodiesel up to a maximum of 20% (B20) in and of itself, will not affect the manufacturer's mechanical warranty as to engine or emissions system, provided the bio fuel used in the blend conforms to ASTM D6751, and B1 to B5 blends conform to ASTM D975, and B6 to B20 blends conform to ASTM D7467.

Customers will need to utilize oil sampling to establish appropriate drain interval(s) for their application(s).

Fuel Storage

If fuel is stored on site:

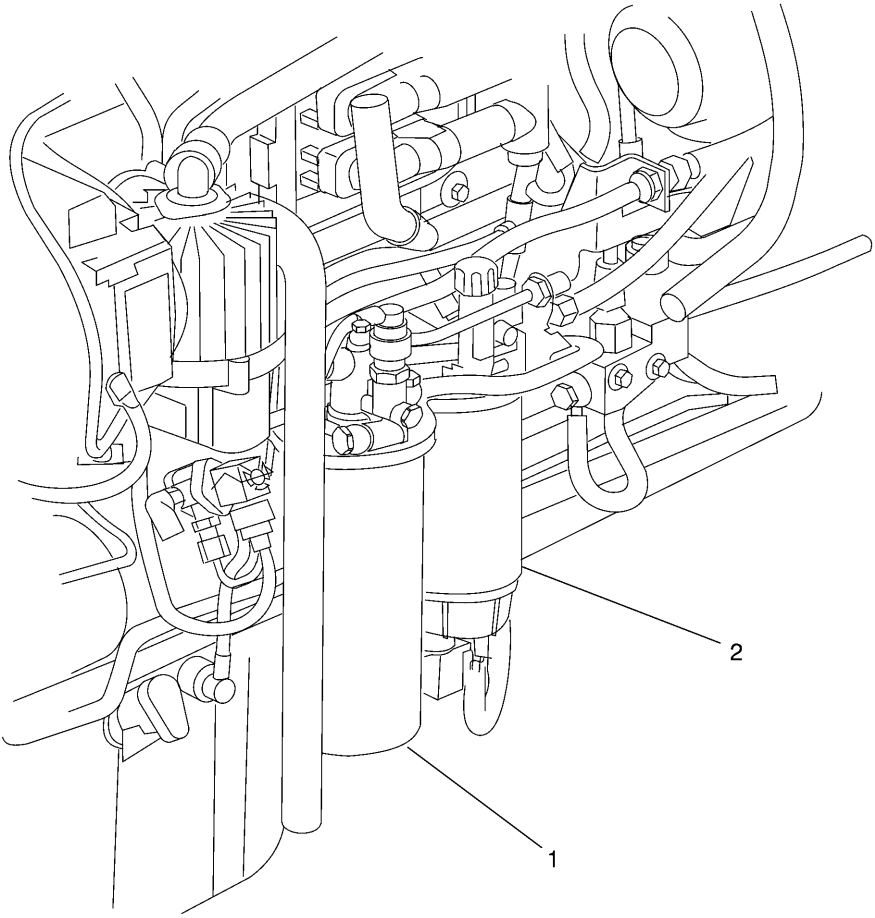
- Keep storage tank covered to prevent water entry.
- DO NOT use a tank made of galvanized metal or any galvanized piping for diesel oil storage. Diesel will react with the zinc, forming solids that can clog fuel filters and cause engine damage.
- Fuel stored for a long time may oxidize and form solids, 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 control module (ECM). The filter is a spin-on filter.



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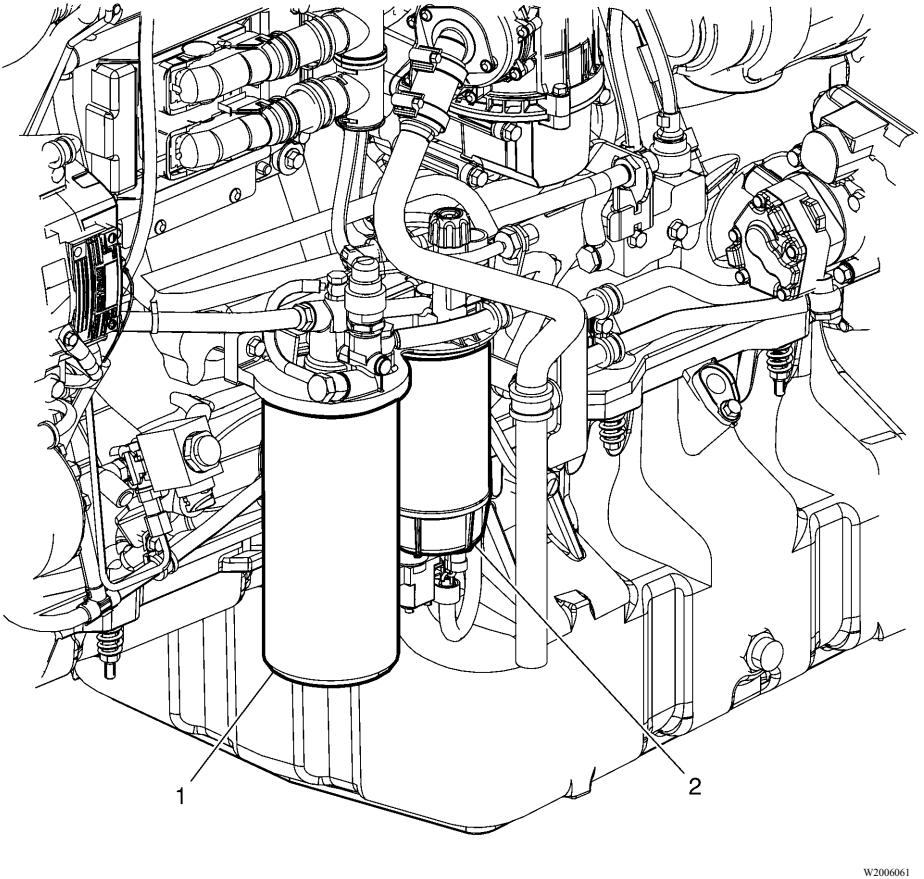
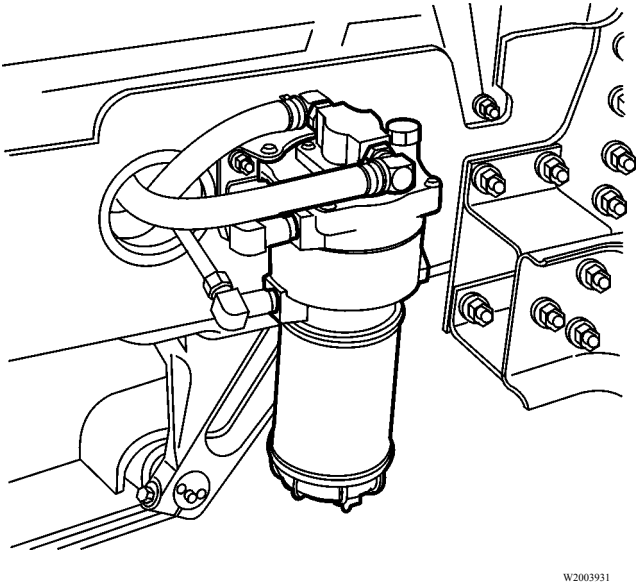
D11H and D13H Engine-Mounted Fuel Filters (D13H shown, D11H similar)



D16H Engine-Mounted Fuel Filters



Chassis Mounted Primary Fuel Filter
(Optional)

For priming the fuel system, see “Priming the Fuel System”, page 111.

Replacing Fuel Filters

Note: 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 mi) or 300 hours, to drain off any water and/or sediment.

Yearly or at 200 000 Km (120,000 mi), 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.

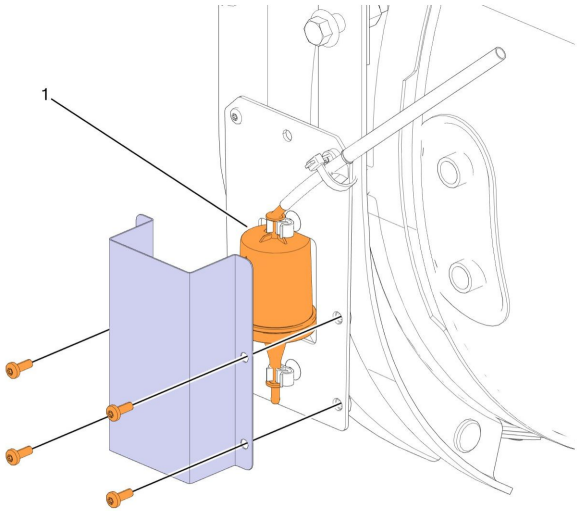
Fuel/Water Separator Chassis Mounted

Fuel Tank Ventilation Filter

There are two different ventilation filters available tank mounted or stanchion exhaust bracket mounted.

Attached to the fuel tank support bracket is the fuel tank ventilation filter. The purpose of this component is to filter out contaminants that can enter the fuel tank from the vent lines.

This filter should be replaced in conjunction with the vehicle air filter, every 12 months.

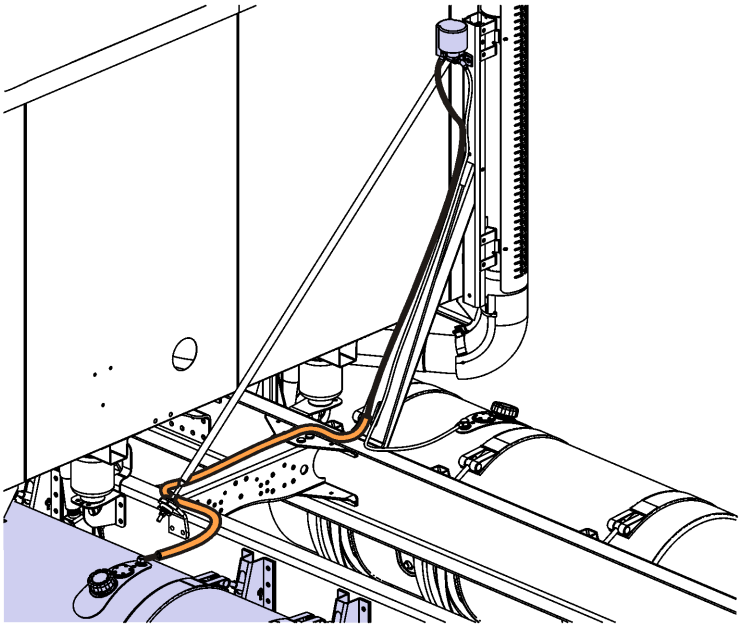


1 – Fuel Tank Ventilation Filter

Exhaust Stanchion Mounted – Fuel Tank Ventilation Filter

The fuel tank ventilation filter is added to the fuel tank vent lines and mounted on the stanchion exhaust bracket at the right side of the truck. This is for extremely dusty applications. For both single or dual tank applications, the vent-lines will run from the tank vent fittings to the fuel tank ventilation filter.

This filter should be replaced in conjunction with the vehicle air filter, every 12 months.



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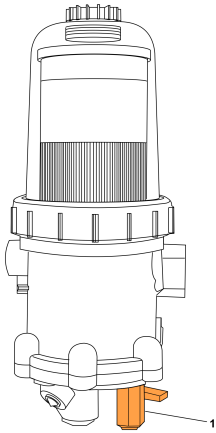
Fuel/Water Separator Chassis Mounted

Water and large contaminants fall to the bottom of the body and can be drained away. Dispose of the drained water/fuel in an environmentally safe manner.

Note: DO NOT drain the water separator bowl while the engine is running.

Note: Drain the filter water trap daily. Change the fuel/water separator filter at every oil change or when the fuel reaches the top of the filter.

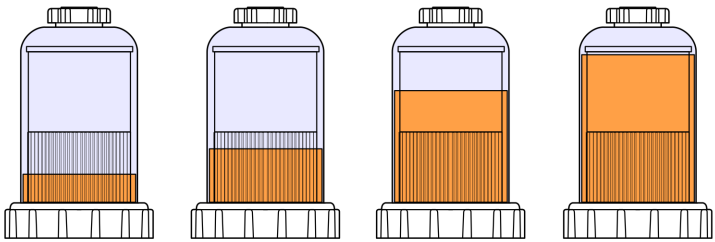


W2080277

1. Drain Valve

ELEMAX® Filter

“SEEING IS BELIEVING” ®
The patented clear cover allows the user to know when **not to change the filter**. Fuel level rises as the filter media becomes contaminated, the fuel filter doesn’t need replacement until the fuel level is at the **Top Of The Filter.**



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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 2010 emission compliant VOLVO engines. Chassis equipped with a 2010 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”, page 153.

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

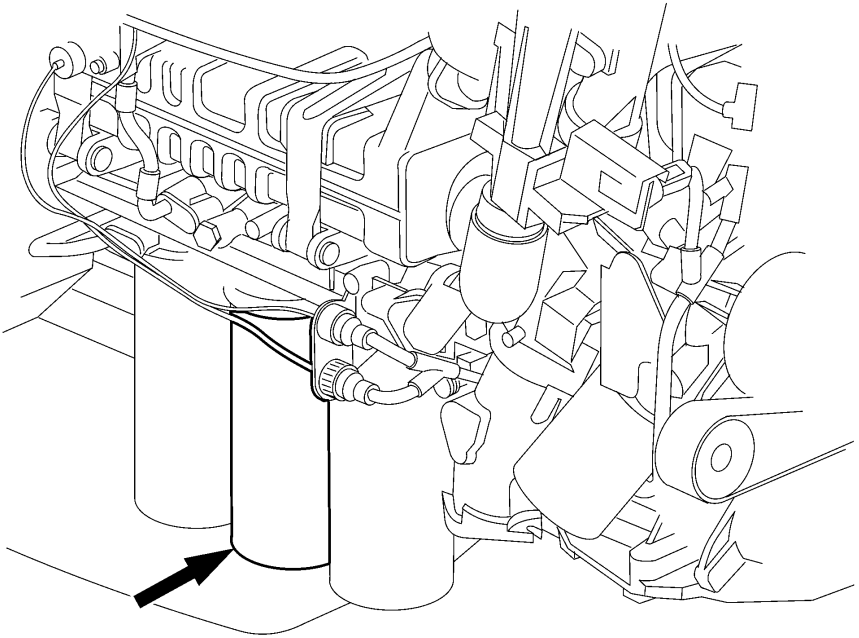
For a complete list of approved oils, see your VOLVO Truck dealer. Also, refer to Bulletin 175-61, *Approved Oils, VOLVO Components*.

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.



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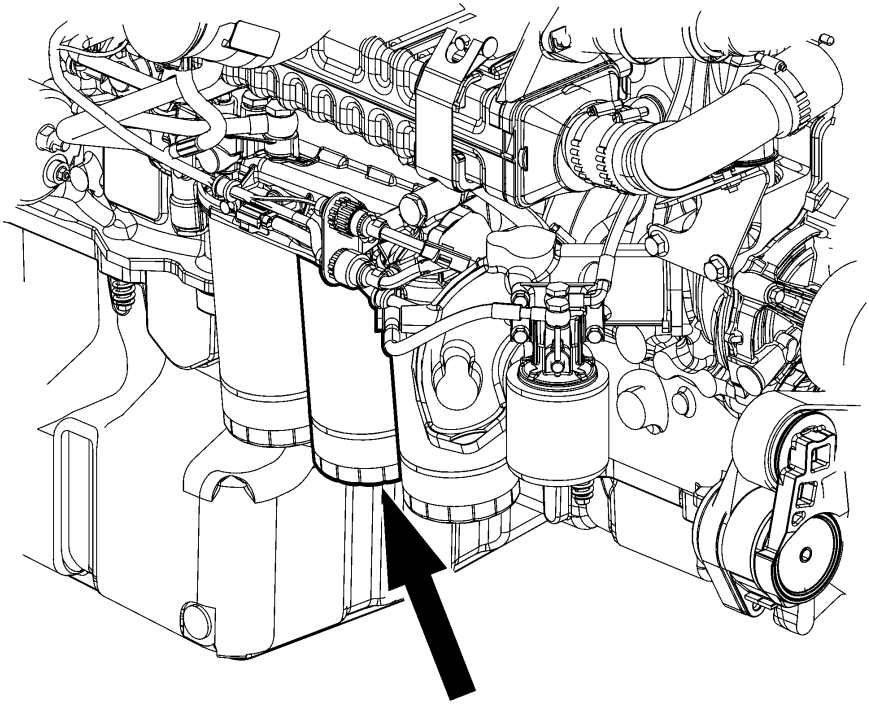
D11H and D13H Oil Filters (D13H shown, D11H similar)



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D16H Oil Filters

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.

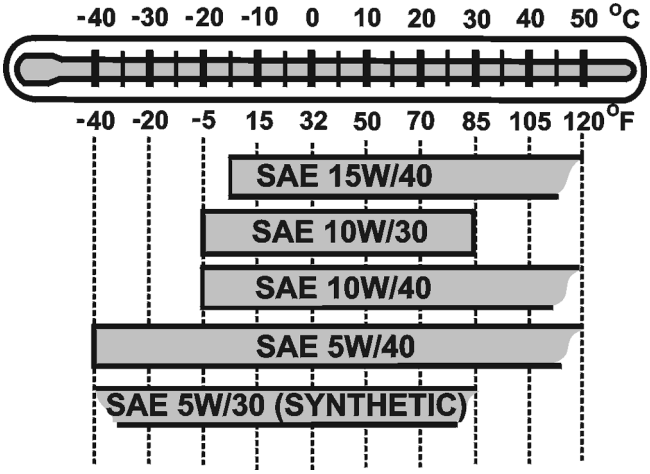
The use of synthetic oils does not permit the extension of the recommended oil change intervals. It is the contamination rate, i.e., soot, and the depletion of additives, rather than base oil quality that determines the useful engine oil life and therefore the oil change intervals.

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. The standard oil weight for VOLVO engines is 10W/30.

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



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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”, page 166.

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”, page 86 and “Oil Capacity Tables and Viscosity Charts”, page 153 for quantities and viscosities, or refer to the engine manufacturers operators 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.

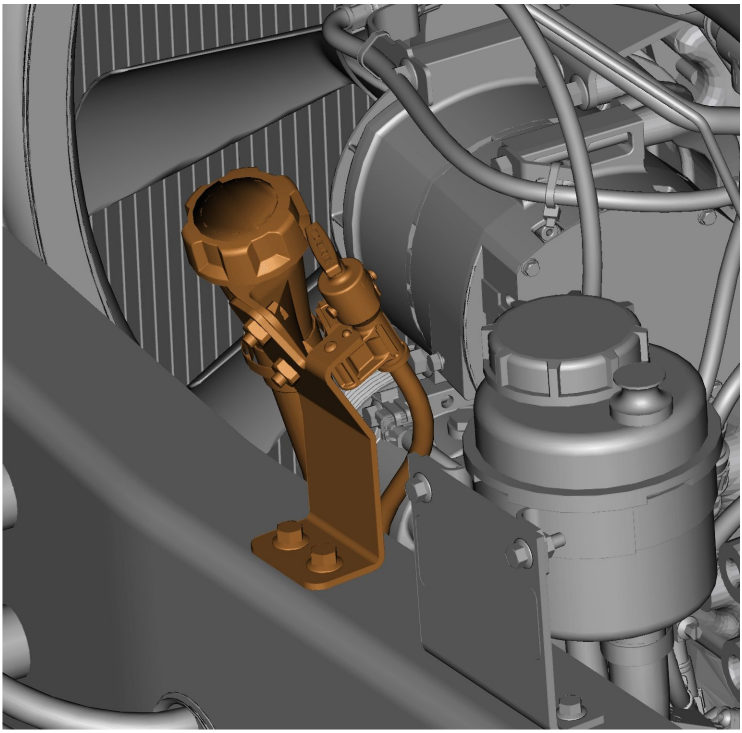
3 Manually turn the filter an additional 3/4 to one full turn.

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.



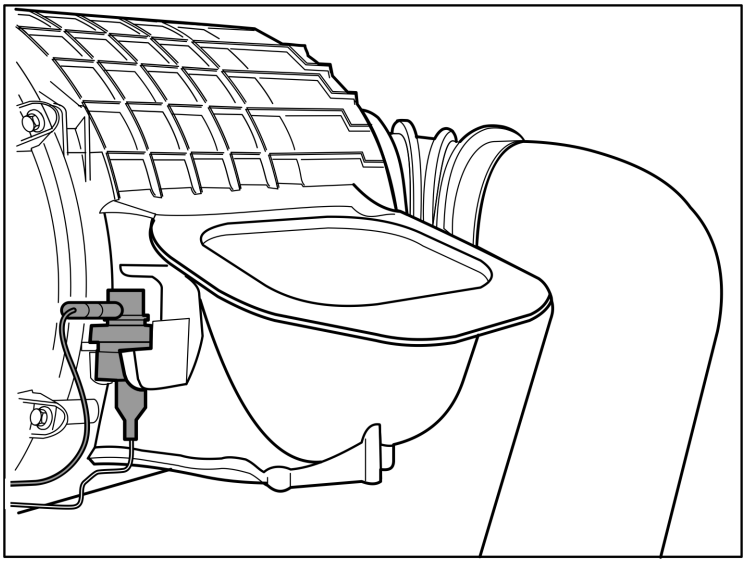
W2056443

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 Operators 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.



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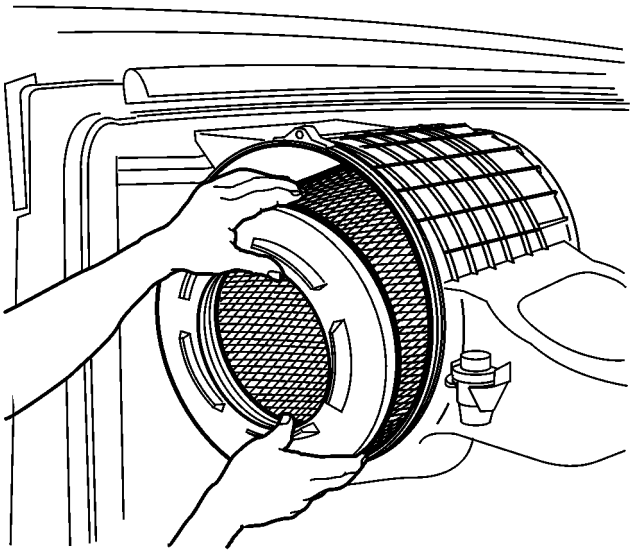
Pressure Restriction Gauge



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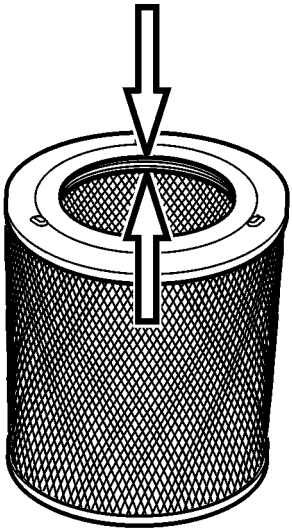


W2003945

Exhaust Aftertreatment System

⚠ DANGER

The SCR/DPF shield should not be removed while the vehicle is in use. Also, only remove the shield, once the vehicle is out of use and the SCR/DPF is sufficiently cooled. Failure to follow these instructions can result in fire, which can cause component damage, personal injury or death.

⚠ CAUTION

The Diesel particulate filters and their components, **can not** be moved or altered from the OEM installation in any fashion. Any alterations may cause component damage and is prohibited by the law.

Check if the vehicle is equipped with a Diesel Particulate Filter (DPF) or a DPF and Selective Catalytic Reduction unit (SCR). These components are part of the overall vehicle emissions control system. In normal operation, these components can experience surface temperatures as high as 350° C (662° F). It is important to verify the temperature at which the material or substance in, or associated with, the body can ignite. If it is possible for the material or substance to fall or leak from the body, take steps to prevent them from contacting or collecting on the DPF or SCR. Failure to do so may result in fire.

It is important to note that additional shielding may, depending upon conditions and the material or substance, trap flammable substances between the additional shield and the DPF/SCR. If this condition can develop, advise the user of the vehicle to periodically check to ensure there are no trapped substances.

Note: The DPF/SCR and associated components are part of a U.S. EPA and California Air Resources Board (CARB) certified engine emissions system. These components must not be moved, altered or modified in any way. Tampering with these systems render the emissions warranty void and may result in possible tampering charges by the EPA or CARB.

New stringent standards for exhaust emission control begin with the 2010 model year. The Diesel Particulate Filter (DPF) system has been developed to act in combination with Ultra Low Sulphur Diesel (ULSD) fuel to reduce particulate emissions to meet the requirement. The Exhaust After-Treatment System (EATS) includes all the engine and exhaust emissions control components that are required to meet the stringent 2010 standard.

Particulate matter consists of soot and ash in the exhaust that engines with an EGR system alone, are not equipped to handle. The particulate matter is considered a contaminant that contains undesirable elements. The DPF system reduces the unwanted elements to a more acceptable level defined in the regulations. There are multiple methods of reducing these emissions. VOLVO has selected to use a Diesel Oxidation Catalyst (DOC) with a catalyzed diesel particulate filter. The other uses a diesel particulate filter of a different kind without a DOC and in its place uses a combustion chamber to heat the exhaust mixture thus causing active regeneration.

The particulate matter removed from the exhaust collects on the filter surfaces. To avoid eventual blockage, which would increase exhaust back pressure and affect power and fuel economy, the filter must be cleaned. The DPF is cleaned automatically. The soot breaks down to safer substances before being released to the atmosphere. Some of the ash remains, but takes a long time to reach the point where ash clogs the filter.

Cleaning a filter so it can continue to function is called “regeneration.” Either system uses high heat to break down the chemical properties. Depending on vehicle usage, the engine is equipped with a passive or active regeneration system.

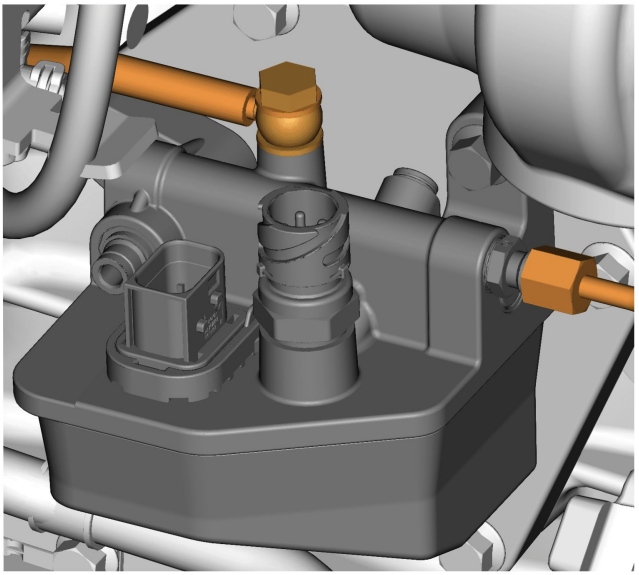
In “passive regeneration,” the exhaust produces enough heat continuously to convert the soot, with approximately 260 °C (500 °F) being required. The process is slow and continues indefinitely. Passive regeneration is possible only in vehicle applications where the temperature is likely to remain at or above the required temperature level, making active regeneration unnecessary.

Active regeneration occurs when the vehicle is parked and is initiated automatically by the aftertreatment system. During an active regeneration, the temperature of the filter must be raised to 500 °C (932 °F). To produce this temperature, the system uses a hydrocarbon injector or Aftertreatment Fuel (AF) injector to introduce fuel into the exhaust stream as it leaves the turbocharger. The hot exhaust ignites the fuel which produces the regeneration temperature. When the DPF becomes restricted to a minimum volume, the engine ECU starts the fuel injection into the exhaust. When the air flow rate returns to normal through the DPF, the engine ECU turns the injector off.

⚠ WARNING

Prior to ever working on the exhaust, allow time for the entire exhaust system to cool. Failure to do so may result in personal injury. Severe burns can occur.

Aftertreatment Hydrocarbon Dosing System



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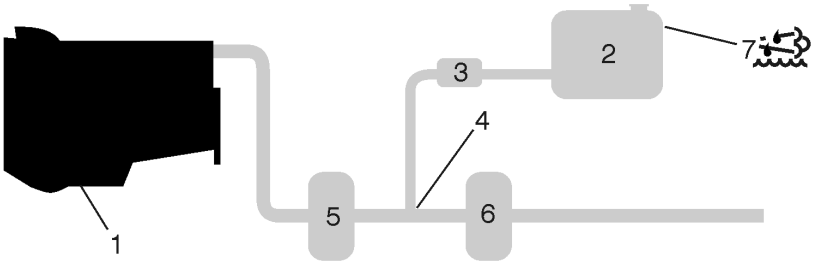
The aftertreatment hydrocarbon dosing system is a part of the exhaust aftertreatment system and is used to increase the exhaust gas temperature (EGT) needed for the aftertreatment system. The dosing system allows diesel fuel to be injected into the exhaust system of the engine to increase the amount of hydrocarbon (HC) released. The injected fuel will increase the EGT by oxidation of hydrocarbon. An aftertreatment diesel oxidation catalyst (DOC) is mounted upstream of the aftertreatment diesel particulate filter (DPF). This elevated temperature is needed for the aftertreatment selective catalytic reduction (SCR) system and DPF. The HC-system shall be governed by the engine control module (ECM).

The dosing system has interfaces with a most of the vehicle's, major control systems including the fuel system, compressed air system , exhaust system, electrical system, control system and external mechanical interfaces.

Selective Catalytic Reduction (SCR)

Selective Catalytic Reduction (SCR) is an emissions-reduction technology with the ability to deliver near-zero emissions of nitrogen oxides (NOx), a smog-causing pollutant and greenhouse gas. SCR's performance has been proved in millions of mi of real-world truck operations in other countries, as well as in long-term field tests in the U.S. SCR reduces NOx emissions to very low levels, while at the same time delivering excellent fuel economy and reliability. The system doesn't change the design or operation of the basic engine. Rather, SCR is an aftertreatment system which converts NOx in the exhaust stream into harmless gases. Modern diesels already use exhaust aftertreatment systems, called diesel particulate filters, to control emissions of another pollutant, soot (also known as particulate matter or PM). SCR works by injecting Diesel Exhaust Fluid (DEF) into the exhaust steam, after the DPF. DEF is a safe, simple solution of water and urea. DEF works with the heat of the exhaust and a catalyst to convert NOx into nitrogen and water vapor - two harmless and natural components of the air we breathe. The end result is cleaner air, excellent fuel efficiency and a reliable emissions control system for today's modern diesel engine.



W2031651

1. Diesel Engine
2. Aftertreatment DEF Tank
3. Aftertreatment DEF Pump
4. Aftertreatment DEF Dosing Unit
5. Aftertreatment Diesel Particulate Filter (DPF)
6. Selective Catalytic Reduction (SCR) Catalyst
7. Aftertreatment DEF Tank Gauge

CAUTION

Do not put diesel fuel in the Aftertreatment DEF tank. Diesel fuel, if sprayed into the hot exhaust along with the DEF, could ignite explosively causing a fire resulting in personal injury or damage to the exhaust system.

There are two different configurations for the SCR catalysts, they are vertical and horizontal. The horizontal SCR catalyst comes in two different sizes, one for the D11/D13 engines and larger size for the D16 engine. The vertical SCR catalyst also comes in two different sizes, one for the D11/D13 engines and larger size for the D16 engine.

The VOLVO SCR system is simple and effective, with few components. It consists of a Aftertreatment DEF tank positioned near the standard diesel tank, plus a Aftertreatment DEF pump, Aftertreatment DEF Dosing unit and SCR catalyst. The advantage of using DEF is that it enables the engine to use less EGR -- and higher oxygen levels -- for better combustion, while meeting the EPA near-zero NOx emissions requirement of 0.2 g/hp-hr NOx. By using DEF, we avoid the disadvantages of increasing EGR to massive levels. This results in better fuel economy from your VOLVO engine.

Diesel Exhaust Fluid (DEF)

Diesel Exhaust Fluid (DEF) is a reactant that's key to the SCR process. It's a nontoxic, aqueous solution of urea and water. Urea is a compound of nitrogen that turns to ammonia when heated. It is used in a variety of industries, perhaps most commonly as a fertilizer in agriculture. The fluid is not flammable, nor is it dangerous when handled normally. However, it is highly corrosive to metal, particularly copper and aluminium. Read the separate section concerning the handling of DEF solution. Only use approved DEF fluid.

W3036787

Diesel Exhaust Fluid (DEF) Handling

When handling DEF solution, it is important that electrical connectors to be connected or well encapsulated. Otherwise there is a risk that the DEF will cause oxidation that cannot be removed. Water or compressed air do not help, since DEF quickly oxidizes metal. If a connector comes into contact with the DEF solution it must be replaced immediately to prevent the DEF solution from creeping further into the copper wiring, which takes place at a speed of about 60 cm (2.4 in) per hour.

CAUTION
When detaching hoses and components, do not spill DEF on disconnected connectors. If DEF is spilled on a connector, the connector must be replaced immediately

Things to know about spilled Diesel Exhaust Fluid (DEF)

If urea solution comes into contact with the skin, rinse with plenty of water and remove contaminated clothing.
If urea solution comes into contact with the eyes rinse for several minutes and call for medical help if necessary.
If inhaled breathe fresh air and call for medical help if necessary.
Do not allow the DEF solution to come into contact with other chemicals.
The DEF solution is not flammable. If the DEF solution is exposed to high temperatures, it breaks down into ammonia and carbon dioxide.
The DEF solution is highly corrosive to certain metals, including copper and aluminium.
If the DEF solution is spilled onto the vehicle, wipe off the excess and rinse with water. Spilled DEF solution can form concentrated white crystals on the vehicle. Rinse off these crystals with water.

Note: Do not flush DEF spills into the normal drain system.

WARNING
DEF spilled onto hot components will quickly vaporize. Turn your face away!

Diesel Exhaust Fluid (DEF) Consumption

DEF consumption is related to fuel consumption. A highway truck may travel 225-300 mi or more on one gallon of DEF. A gauge much like a fuel gauge will indicate the level of DEF in the tank. A DEF low-level warning will activate when DEF is low. If a driver runs out of DEF completely, vehicle power will be reduced to derate mode. Refill the DEF tank when refilling the fuel tank, the engine will resume normal power.

Note: DEF tanks are sized for a two to one fuel to DEF ratio in order to meet US 2010 requirements.

Diesel Exhaust Fluid (DEF) Availability

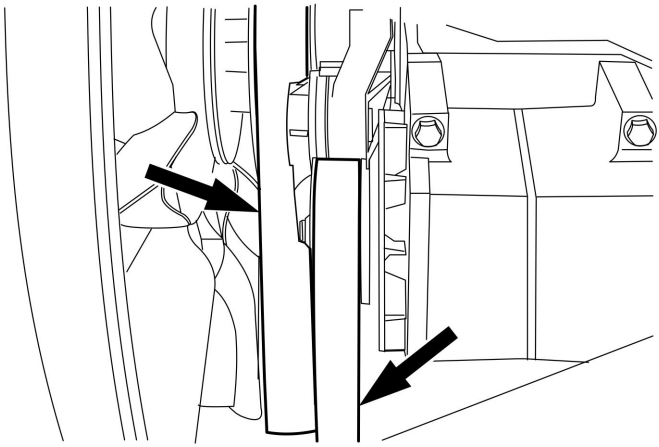
DEF will be available in 2.5 gallon containers, 55 gallon drums, 275 gallon IBC and in bulk storage for fleet locations, truck stops and dealerships. All major truck stops, dealers and distributors will carry DEF. For more information on DEF and availability please visit the website www.Volvoscr.com.

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.

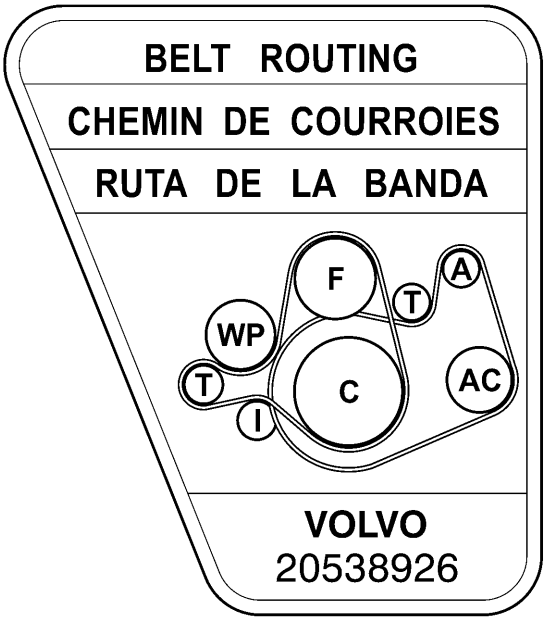
All engine belts should be checked at each service point. Inspect for cracked or frayed material. All belts have automatic belt tensioners to keep the correct tension without adjustment.



W2006045

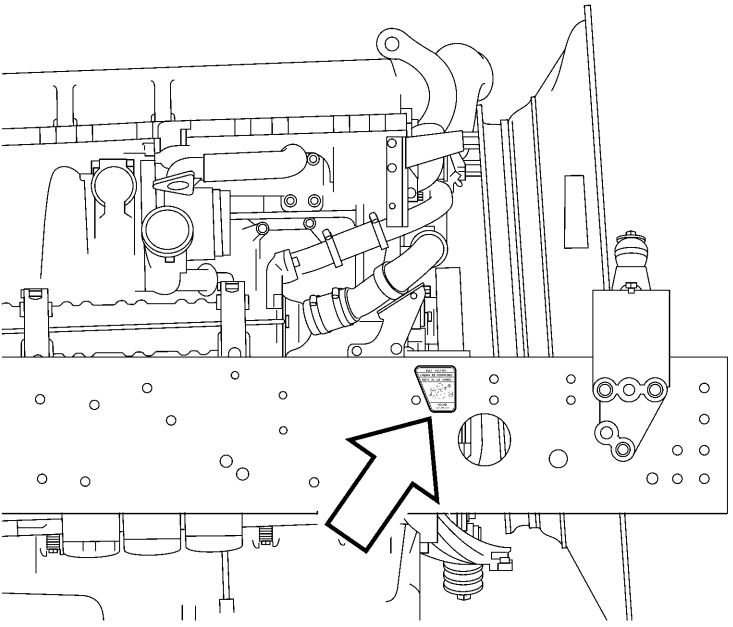
Drive Belts

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



W2005874

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.

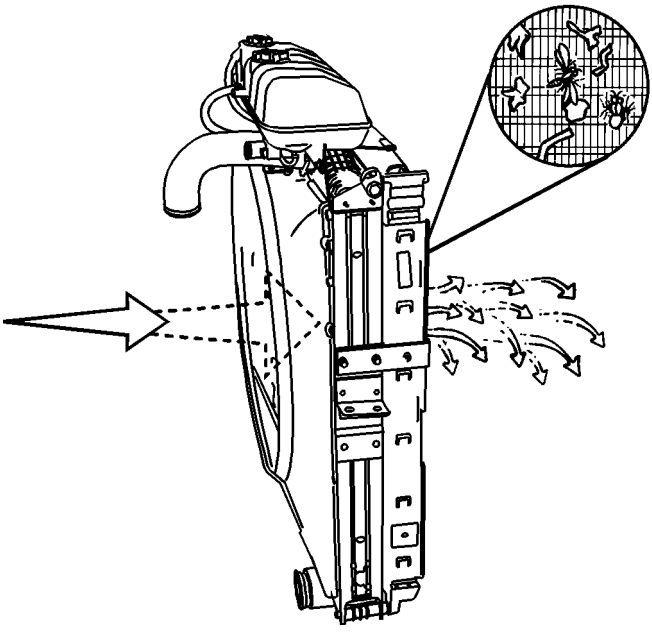
Periodically inspect the front of the radiator/charge-air-cooler package for buildup of dirt, mud, insects, etc. Over time, there may be a build-up of dirt, mud, insects, etc., between the radiator and charge air cooler. Inspect for build-up and contact your authorized VOLVO Truck dealer, if necessary.

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 30 psi (200 kPa) for radiator and charge air cooler cores. The use of a fin comb is also a good tool to loosen bugs and dirt from the fins. If dirt cannot be cleaned off with this procedure, consult your VOLVO Truck dealer.



W2001496

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

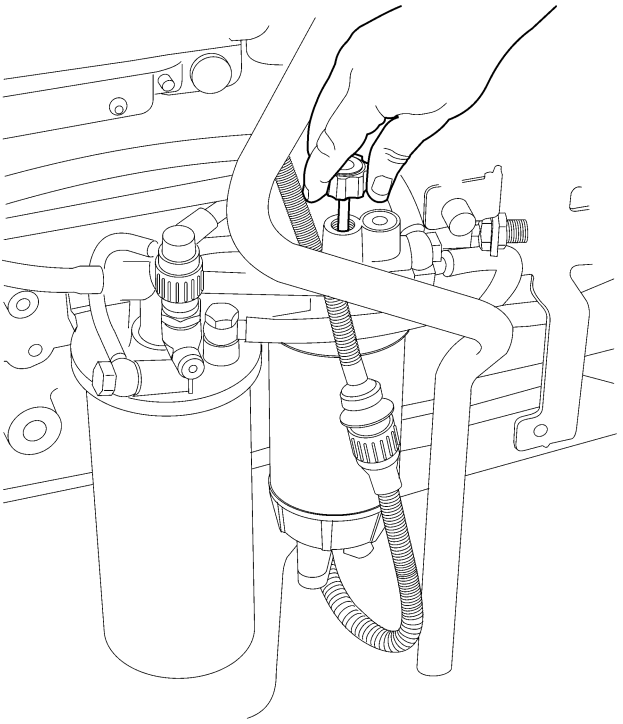
The fuel system will need to be bled if:

- 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.



W2006062

D11H and D13H Primer Pump (D11H shown, D13H 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.

W3004309

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

T3019229

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

W3029783

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.

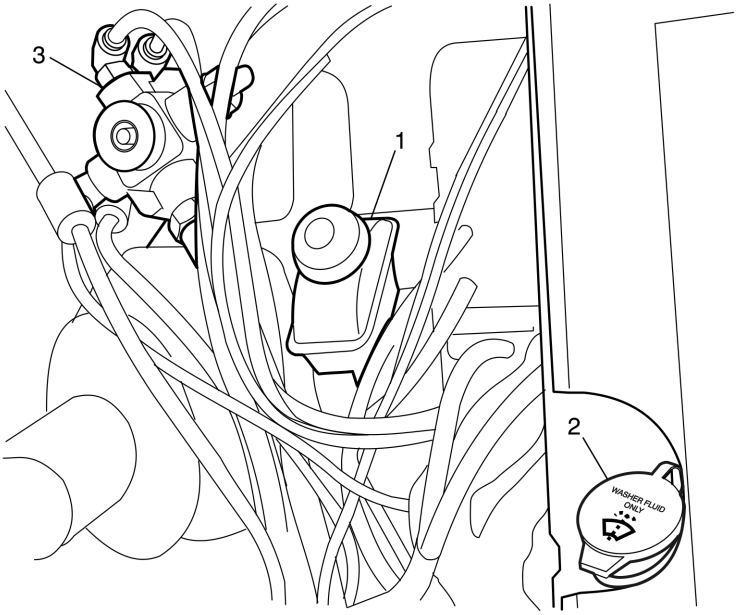
Transmissions should not be operated consistently at temperatures above 120 °C (250 °F). Operating temperatures above 120 °C (250 °F) increase the lubricants rate of oxidation and shorten its effective life.

If the temperature reaches 140 °C (285 °F), stop the vehicle to let the temperature go down. See the vehicle Operators 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 ft) 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.



W2006043

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

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.

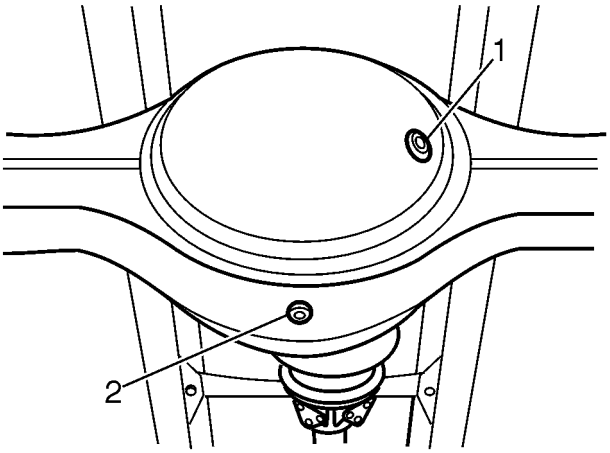
Rear Axle

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.



W0002103

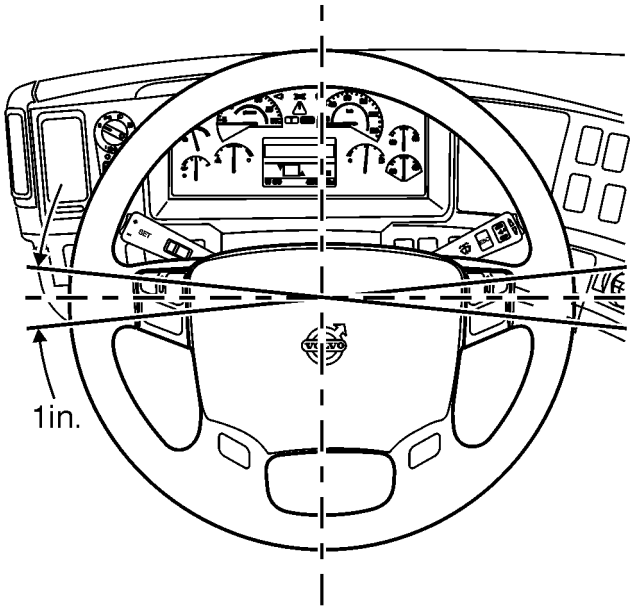
Rear Axle

1. Check and Fill Plug	2. Drain Plug

Steering and Brakes Maintenance

Steering System

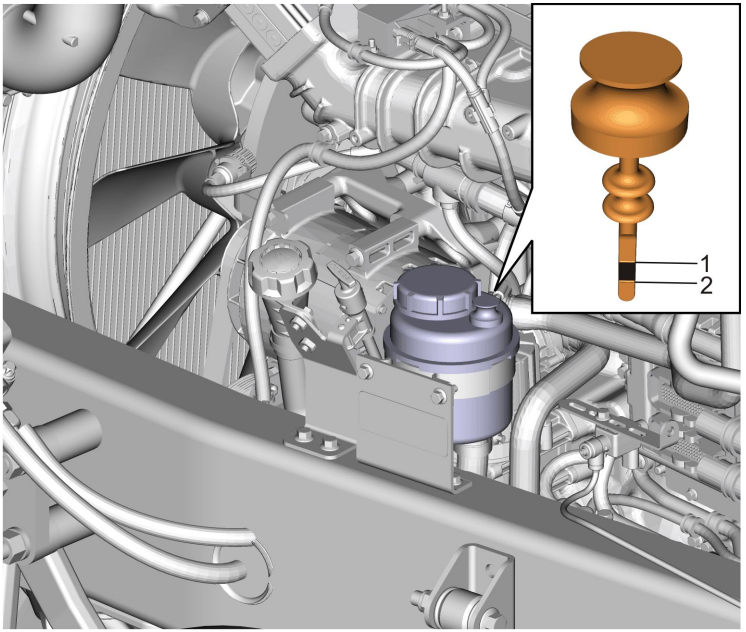
Excessive play in the steering system is checked by turning the steering wheel while the engine is stopped. With the front wheels pointing straight ahead, turn the steering wheel until the front wheel starts moving. Then, turn the steering wheel the other way until the front wheel moves. Play should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



W6001506

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 mi). Change the 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.



W2064870

1 Maximum Level

2 Minimum Level

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 vehicles brake system could cause a malfunction, leading to loss of control of the vehicle resulting in severe personal injury or death.

DANGER

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

DANGER

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.

Note: Your vehicle may be equipped with air disc brakes. If so please contact your nearest VOLVO dealer for service and maintenance information

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 reach the end of its useful life. See your authorized VOLVO Truck dealer.

Effective mid-September 2008, all VOLVO chassis are equipped with air dryers which utilize an oil coalescing desiccant cartridge which removes atomized oil and other particulate matter from the air system. The oil coalescing desiccant cartridge must be changed yearly. Refer to the specific air dryer service literature for detailed information.

The coalescing air dryer filter needs to be replaced every twelve months.

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.

Disc Brake Check

Note: Your vehicle may be equipped with air disc brakes. If so please contact your nearest VOLVO dealer for service and maintenance information

During each pre-trip inspection, the disc brakes should be checked for excessive brake lining and rotor wear. To perform this check complete the following steps:

1 Each disc brake lining has a visual wear indicator. Find the visual wear indicator and confirm that the lining is within specifications.

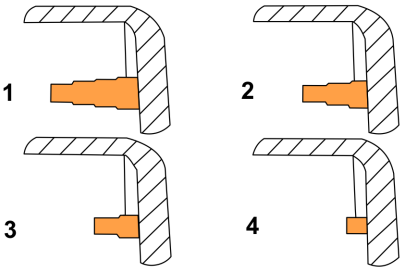
Note: The location of the lining wear indicator varies based on brake model. The lining wear indicator can usually be found via a visual search. For additional instructions on locating the lining wear indicator reference the brake manufacturer's service information. The two main brake manufacturer's found on VOLVO vehicles are Meritor and Bendix. Service documentation for each maker can be found at their main internet site:

- Meritor: http://www.meritor.com/customer/northamerica/default.aspx
- Bendix: http://www.bendix.com/en/servicessupport/documentlibrary/doclib_1.jsp

An example of indicator wear is shown below.

2 Examine the brake rotors for excessive wear and damage.

If the brakes are deemed serviceable and all other inspections are satisfactory then the vehicle is ready for use. If the brakes or any part of the vehicle covered in the pretrip inspection are deemed inoperable, take the vehicle for service at a VOLVO certified dealer.



W5082347

Brake Pad Wear Indicator

1. New Condition
2. 25% Wear
3. 50% Wear
4. 75% Wear

Note: If the brake pad wear indicator shows 75% or more wear then the pads require further inspection or replacement.

Electrical System Maintenance

Battery Care

WARNING

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

WARNING

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

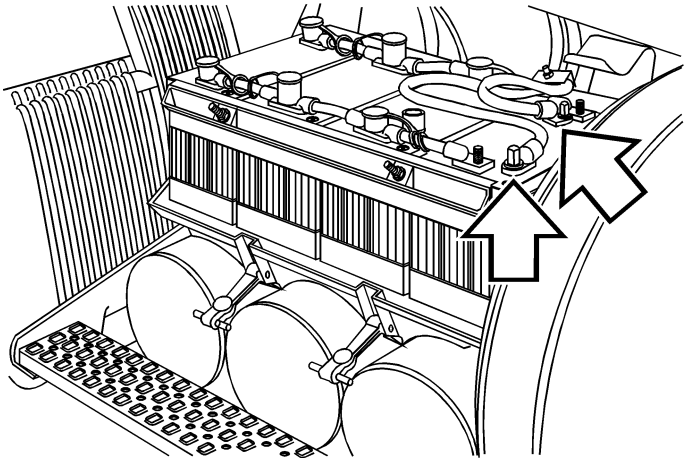
CAUTION

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

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 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.



W3001022

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.

Wiring Harness/Cable and Connector Protection

To help protect your vehicle's external high amperage electrical cables and connections from corrosion due to the effects of newer salts (calcium chloride and magnesium chloride) on the roadways.
VOLVO recommends coating all high amperage (positive and ground) exposed electrical connections at a minimum of every 6 months or, whenever the connector has been disassembled. The following list contains the recommended connections that should be liberally coated with the corrosion inhibitor;

- Battery connections
- Battery main shut off switch connections
- Maxi and/or Mega fuse connections
- All ground stud connections
- Electrical pneumatic pass-thru connections
- All alternator connections
- All starter connections
- Intake preheater and preheater relay connections
- Electrical power inverter connections
- EFRC
- Ground studs on the cab firewall

All connections should be cleaned and free of previously applied inhibitors, oil, dirt, dust or other contaminants prior to application. Allow time for the product to dry before use (drying time may vary depending temperature, humidity, etc.).

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.

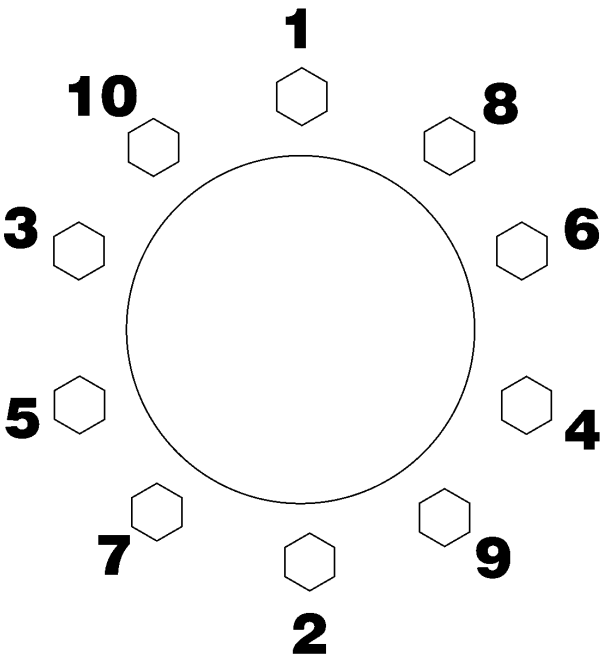
Check wheels for signs of rust streaks around the wheel nuts. This indicates looseness (steel rims). Inspect all types of rims for cracks. Cracks can appear in many places but typically radiate out from where a load is applied. Inspect closely around wheel nuts, hand holes and inside circumference.

Wheel Nut Tightening

DANGER

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 mi). 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 ft-lb). 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.



W7001392

10-Stud Wheel Nut Tightening Sequence

Tire Inflation and Wear

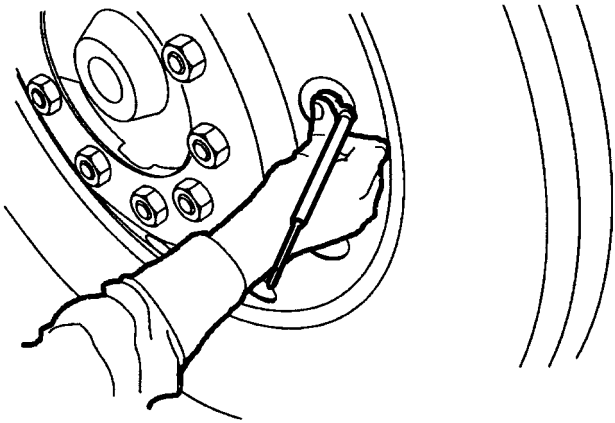
WARNING

DO NOT operate the vehicle with under-inflated tires. Always keep your tires inflated to the manufacturers 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.



W7001270

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

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

- 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.

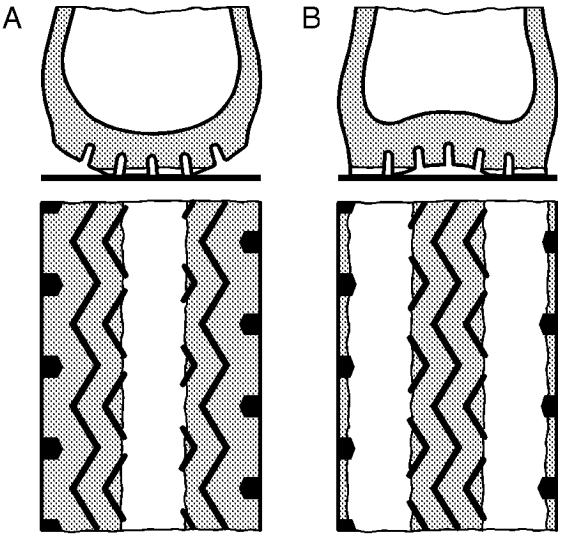
Hints on How to Avoid Unnecessary Tire Wear

Typical Wear Patterns

Incorrect Air Pressure

A. Air pressure too high gives rapid wear in the middle.

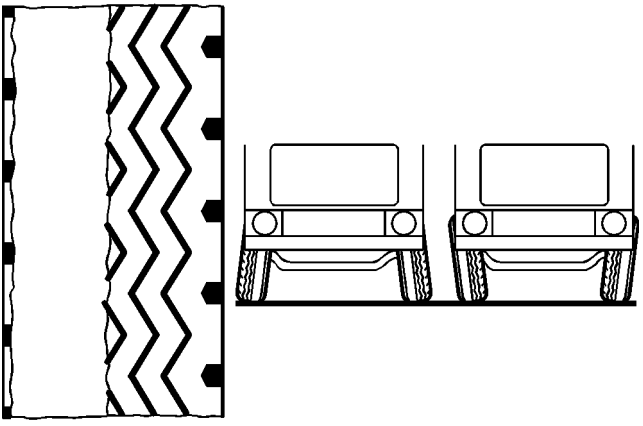
B. Air pressure too low gives rapid shoulder wear.



T1006457

Incorrect Camber

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



T1006458

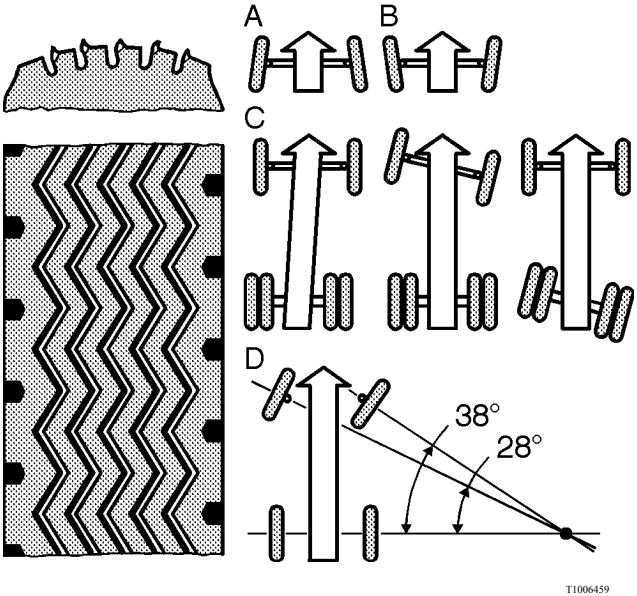
Incorrect Toe and Axle Alignment

A. Incorrect toe-in

B. Incorrect toe-out

C. Out-of-line axle

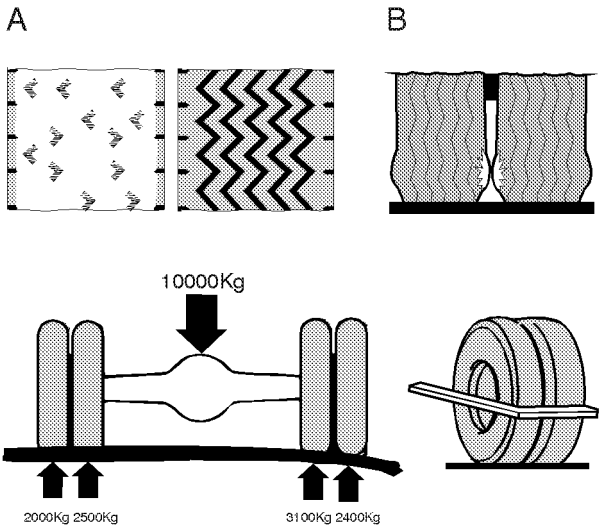
D. Steering arm defect



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.



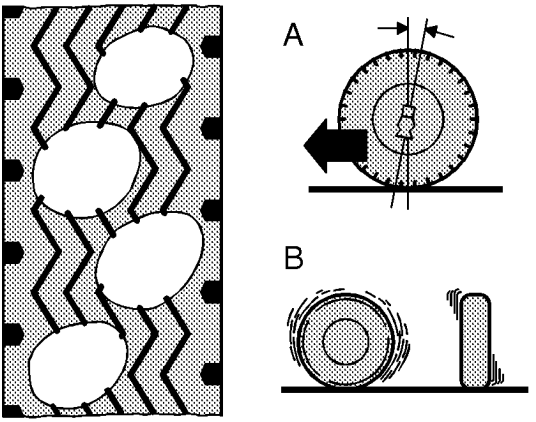
T1006718

Incorrect Caster and Imbalance

A. Caster angle

B. Imbalance

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

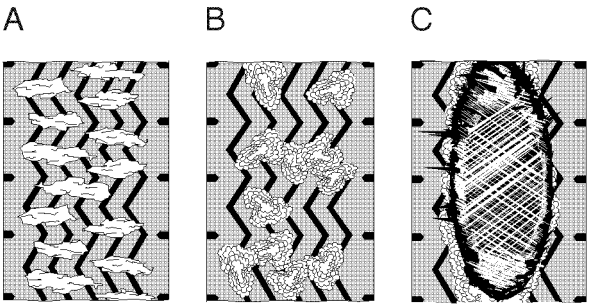


T1006460

Cuts in the Tire Tread

A. Cuts
B. Flaking cuts
C. Rubber flaking

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

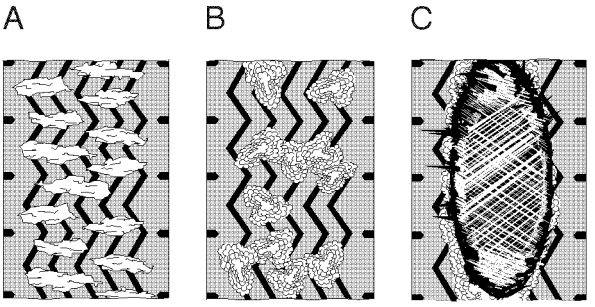


T1006720

Cuts in the Tire Tread

A. Cuts
B. Flaking cuts
C. Rubber flaking

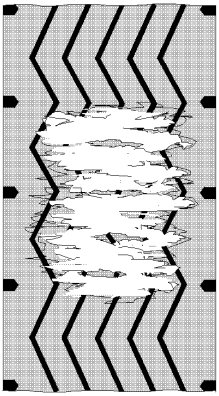
Cuts are due to poor roads, air pressure too high or incorrect tire type.



T1006720

Spot Wear

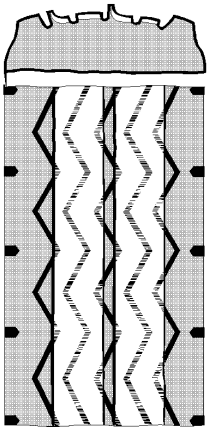
Sudden braking, locking brakes or out-of-round brake drums give spot wear.



T1006721

Feathered Edges

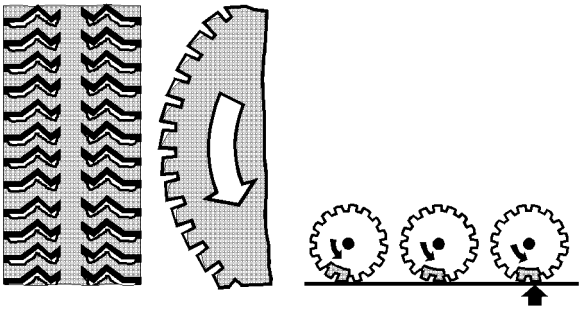
Normal occurrence on non-driving wheels on good roads and high mileage.



T1006722

Cupping

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



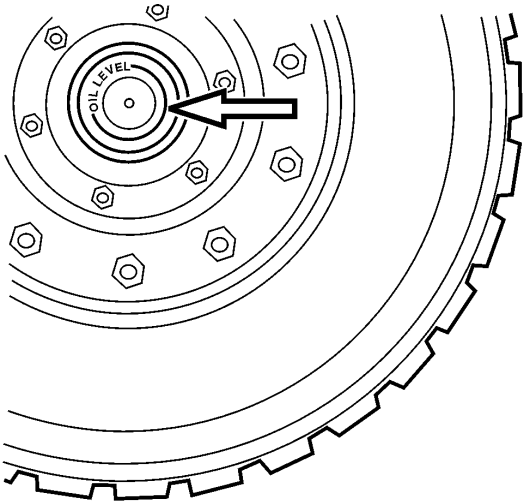
T1006723

Front Wheel Hubs

DANGER

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.

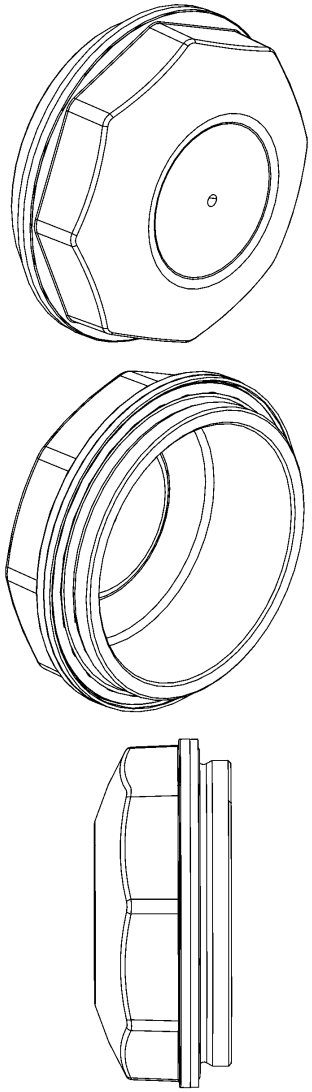
The front wheel hubs can be filled with one of several types of oil. Motor oil should be SAE 30 or 15W40. The oil can be either petroleum based or synthetic (synthetic should not be used for the VOLVO axle). Axle oil, API GL-5, SAE 75W-90, can also be used. There are no set change intervals for hub lubrication. The only requirement is that if the hub is opened, the lubricant must be changed.



W7001271

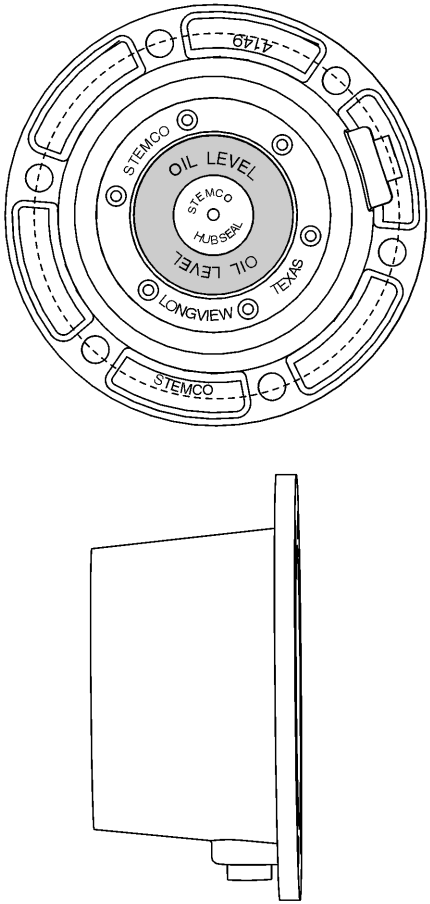
Unitized Front Hubs

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



W1000213

Unitized Hubs, Non-Tapered Axle End



W1000212

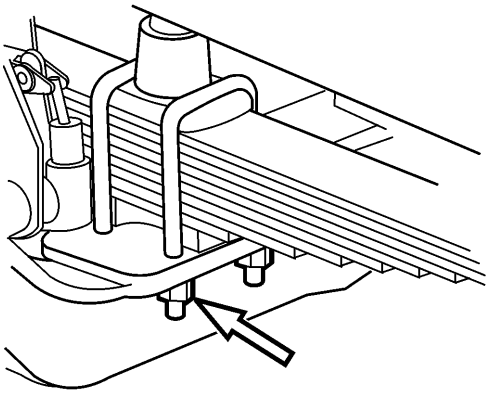
Tapered Axle End

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 mi).

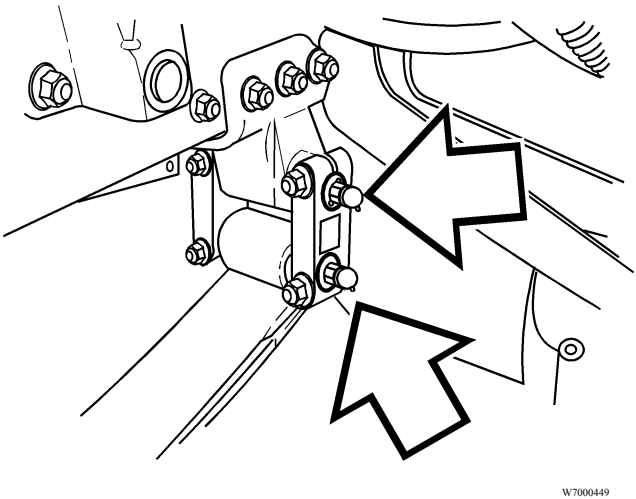


W6001504

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.



W7000449

Grease Fittings

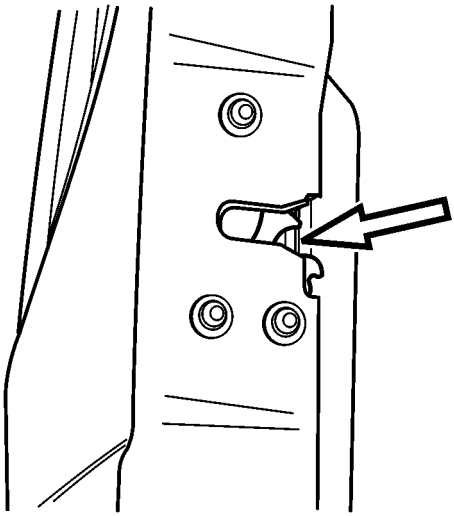
Rubber Bushings

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

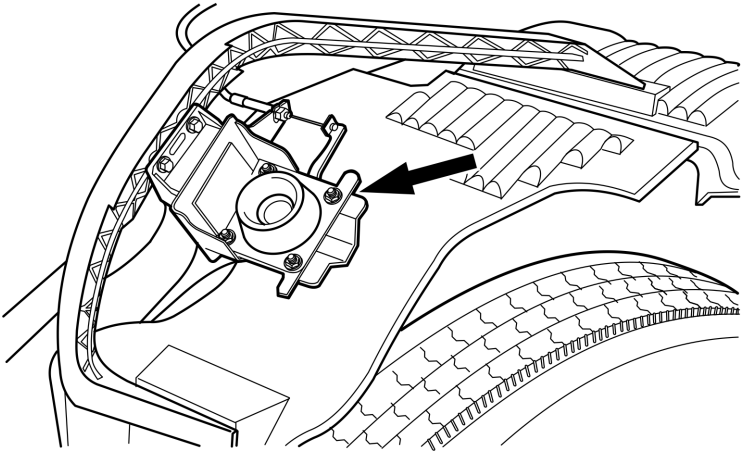
The door lock mechanism should be greased annually using white grease. Lubricate the door lock cylinder with liquid graphite annually, or more often in climates with a lot of snow and salt on the roads. Coat the door stop arm with white grease annually. On wet and salted roads, road spray can enter the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



W8003203

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.



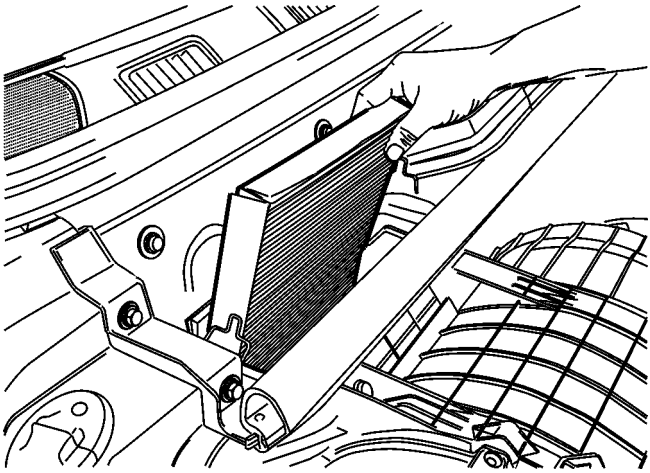
W8003841

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 mi). 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.



W8003189

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 mi), 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.

If signs of delamination of the frame rail are apparent, complete the following steps:

1 Clean chassis with high pressure water spray. Use mild detergent if available; remove loose dirt and grease.

2 Continue high pressure wash to affected delamination areas of paint from the frame rails. Apply high pressure spray until paint holds on frame substrates.

After completing these steps, to avoid further delamination, have the framerail serviced as soon as possible.

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.

Alcntera Suede-Like Material

Suede-like upholster 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

DANGER

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 mi). 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 mi) or less. All lubricating points are found on the chassis lubrication chart on the next page.

Lubricating Grease

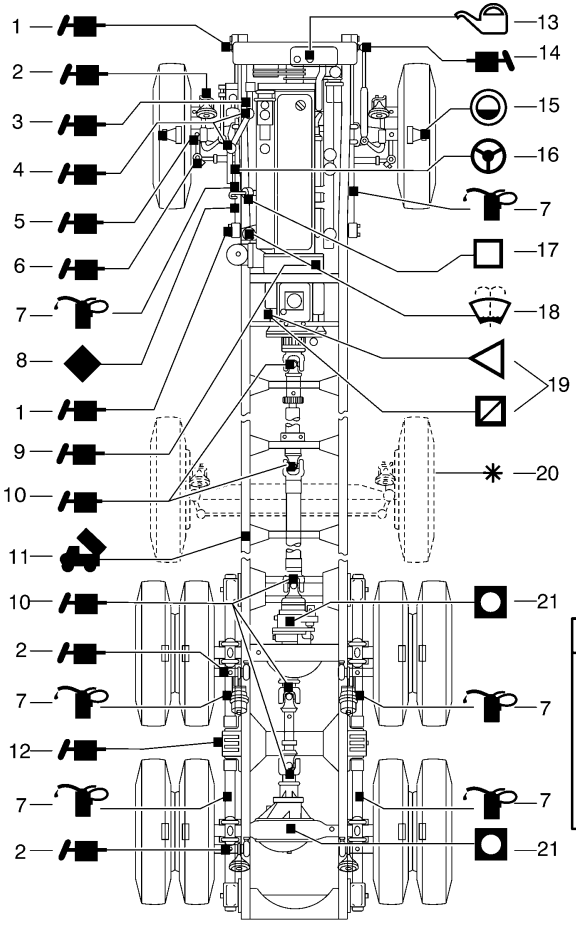
Use grease with a lithium base with EP additives and a consistency of NLGI No. 2. Care should be taken not to use any grease other than one with EP additives for the driveshaft. DO NOT use any solid lubricants, such as graphite, copper or molybdenum disulfide.

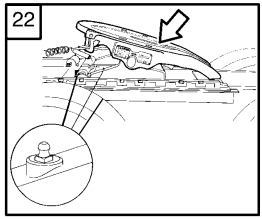
Lubrication Procedure

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.

Note: 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





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The numbers in the lubrication chart correspond with the numbered notes in the Lubrication Chart Notes section. For more information refer to "Lubrication Chart Notes", page 150.


Grease


Hub Oil


Engine Oil


Hydraulic Oil


Steering Fluid


Auxiliary axle(s)


Lubricate


Coolant


Automatic Transmission Fluid


Manual Transmission Oil


Rear Axle Oil


Brake Fluid


Windshield washer fluid level


Dump body oil reservoir level

Lubrication Chart Notes

1 **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.

Note: The rock guard will have to be removed (if equipped).

Note: Always grease a VOLVO front axle with the wheels on the ground.

Note: To grease non-VOLVO axles, they are typically greased with the wheels on the ground. Consult with the axle manufacturer for the latest recommendation.

2 **Slack adjuster** Do not grease till 1st scheduled maintenance interval.

Note: See Manufactures Specifications for specific grease. Adjust according to the specific slack adjuster manufacturing specifications.

2A **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.

3 **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: To grease non-VOLVO axles, they 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 **Leaf Springs:** Front and rear leaf spring eye pins, should be pressure lubricated with chassis grease. Vehicles equipped with multi leaf springs should also have, the leaves lubricated with a spray gun or brush using a rust inhibiting oil.

CAUTION

Keep grease and oil, off of rubber bushings. Failure to do so will result in component damage.

Note: If the vehicle is operated in sandy or dusty environments, the spring ends should be left dry. Dirt and grease can mix, resulting in a "sandpaper" action that may cause pre-mature wear to the spring ends.

8 **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.

9 **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. See http://www.roadranger.com for the latest heavy-duty clutch service information.

10 **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.

11 **PTO/Hydraulic reservoir.**

12 **Rear Suspension (48k-70k suspension):** When lubricating the spring pin busing use a lithium based grease with specification API NLGI No. 2.

Note: Newer versions may have rubber bushing that do not need lubrication.

Note: Earlier versions of the T-Ride and B-Ride spring cradle required lubrication.

13 **Coolant level:** Add coolant if necessary. Only use pre-mixed clean water and antifreeze in a 50/50 mix.
Add only the same type antifreeze, that is: extended life or standard.

14 **Steering assist cylinder:** Use a lithium based grease with EP additives to specification API NLGI No. 2 to grease both ball joints.

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 **Power steering fluid:** Check the fluid in the reservoir with the dipstick. Add oil if necessary. Use ATF Dexron® III or better. Change fluid every 240,000 Km (150,000 mi). Change filter every year. Use a lithium based grease with specification API NLGI No. 2.

17 **Engine oil and filter:** For oil change schedule see Service Information in Group 175-60.

18 **Windshield washer fluid level.**

19 **Automatic and manual transmission: Automatic transmission:** Use Dexron® III or better Automatic Transmission fluid. See the manufacturer's Operator's 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.
I-Shift transmission: With the vehicle level, the oil should be between the maximum and minimum levels on the sight glass. Only use VOLVO approved oils. Refer to function group 1 for the approved oils list.

20 **Auxiliary axle(s):** If equipped with auxiliary lift axles use a lithium based grease with specification API NLGI No. 2. Also, lubricate the Brake, Cams, Slack adjuster and Tie-rod ends.

21 **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.

Note: Refer to Service information in 175–60 for Oil Types and 176–61 for Approved/Correct Oils.

22 **Fifth wheel:** The fifth wheel and slider assemblies should always be re-lubricated after steam cleaning or at least every oil change.

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.

D11H and D13H 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 (mi)	56 000 (35,000)	40 000 (25,000)	24 000 (15,000) 450 hours	16 000 (10,000) 300 hours

D16H Engine Oil and Filter Change Intervals

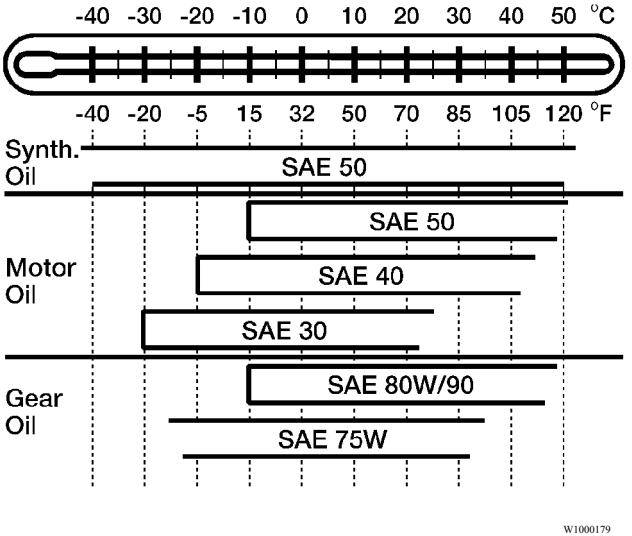
Engine Operating Condition	Medium	Heavy	Severe	Very Severe
Fuel Consumption (mpg)	more than 6.0	more than 4.7	more than 3.7	more than 2.0
Fuel Consumption (L/100 Km)	less than 39	less than 50	less than 64	less than 120
Engine Oil and Filter Change Interval, Km (mi) 42 L (44 quart) oil capacity, standard in VNL	56 000 (35,000)	40 000 (25,000)	24 000 (15,000)	16 000 (10,000)
Engine Oil and Filter Change Interval, Km (mi) 52 L (55 quart) oil capacity, standard in VT, optional in VNL	80 000 (50,000)	56 000 (35,000)	40 000 (25,000) 750 hours	24 000 (15,000) 450 hours

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 manufacturers operators manual.	
Capacity	
9-speed	12.0 liters (13.5 quarts)
10, 13, 15 and 18-speed	13.0 liters (14.0 quarts)



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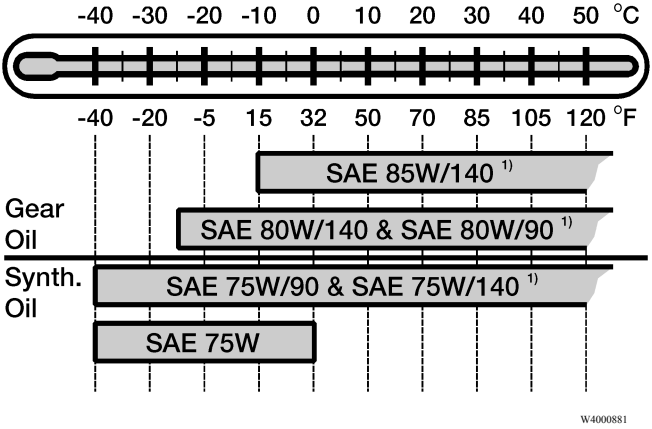
Meritor Single RS23, 25, 26 and 30, Meritor Tandem RT40, 44 and 46

For oil change intervals, see the manufacturers operators 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 46160 front RT 46160 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 manufacturers operators 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 lll
Change interval	Every 240 000 Km (150,000 mi) 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

Service Check List

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 Compressors 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	

TYPE OF OPERATION	CHECK / CHANGE BASIC (4 MONTHS)	CHECK / CHANGE ANNUAL (12 MONTHS)	ADDITIONAL SERVICE
Check Rear Spring Bolts	X	X	
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	

TYPE OF OPERATION	CHECK / CHANGE BASIC (4 MONTHS)	CHECK / CHANGE ANNUAL (12 MONTHS)	ADDITIONAL SERVICE
Check Transmission Oil Cooler hoses and Connections for leaks	X	X	
Valve Adjustment		X	REQUIRED: Once a year, every 209 000 Km, (130,000 mi) 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	

Service Charts

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.

Scheduled Service Date		Work Completed	
		Date	Mileage

Noise Control Log

NOISE CONTROL SYSTEM MAINTENANCE LOG			
DATE	MILEAGE	MAINTE-NANCE PER-FORMED	MAINTE-NANCE FA-CILITY

Repair Record

Keep track of repairs being made. This helps over the lifetime of the vehicle to spot trends that can be used to alter maintenance schedules, for example.

Repair Record				
Date	Mileage	Work Order or Invoice No.	Dealer	Notes

Tire Record

Tire Record			
Date	Type Front	Type Rear	Notes (Tire Pressure, Tread Depths)

Fuel and Oil Record

Keeping track of the fuel and oil consumption gives a record of what is normal for the vehicle. This can be compared with other vehicles in the same service application to indicate what is normal fuel and oil consumption for a certain application. Keep a record of how much fuel was filled between oil fill up or oil change.

Date	Accumulated		Oil Qty.	SAE No.	Notes
	Mileage	Fuel Qty. (Gallon)			

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)

Literature

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:

1 Delivery Assurance If you need roadside assistance, VAS can arrange for load forwarding or equipment rental.

2 Personal Assurance Trained staff for handling any vehicle problems.

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

4 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”, page 26.

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