



OPERATOR'S HANDBOOK

**MAINTENANCE
AND LUBRICATION**

21636397

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Mack[®] MAINTENANCE AND LUBRICATION OPERATOR'S HANDBOOK 21636397



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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.

MACK Trucks

QLD, 4076

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Warning Label Information

IMPORTANT: Before driving this vehicle, be certain that you have read and that you fully understand each and every step of the driving and handling information in this 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 MACK Truck dealer for assistance regarding Warning and Advisory labels.

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General Information

Information For the Owner

If there are questions on the maintenance and performance of your vehicle, please discuss them with your MACK 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 MACK 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 MACK components and MACK drivetrain.

Establish a Preventive Maintenance Program with the help of your local MACK 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 through an authorized MACK Truck dealer. This is the only way we will be able to contact you if necessary.

This Maintenance Manual covers all MACK vehicles manufactured by MACK, including the whole chassis and all MACK manufactured components. For specific maintenance information on vendor components, see the respective manufacturers service and maintenance literature.

This manual, together with manuals for specific components 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.

<https://www.truck-manuals.net/>

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.

MACK reserves the right to make changes at any time or to change specifications or design without notice and without incurring obligation.

Noise Emissions

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
- Air Intake/Air Induction System
- Engine Control and Fuel Systems
- Selective Catalytic Reduction (SCR)

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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, if fitted.
- Removal of engine block shields, if fitted.
- Removal of engine crankcase shields or insulation, if fitted.
- Removal of insulated rocker arm covers.
- Removal of transmission noise shields, if fitted.

Noise Shielding and Insulation Devices

Maintenance

Ensure sound shielding and insulating devices are intact, if fitted. 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 (when fitted):

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, air system exhaust silencers, 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.).

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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 and Fuel Systems

Acts that constitute tampering with Engine Control and Fuel Systems:

Removing rendering inoperative, or modifying the engine control system such as the ECU, SCR and other 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.

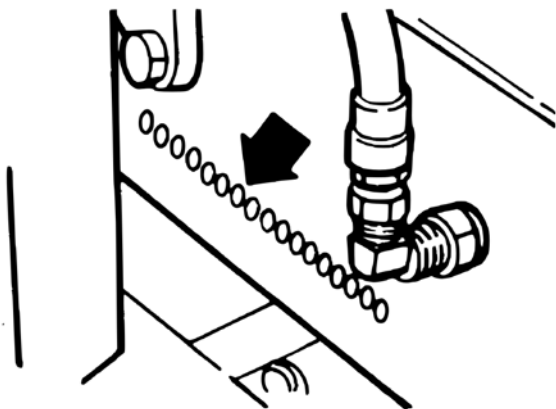
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Label Information

Vehicle Identification Number Label

All motor vehicles are required to be identified by a 17-digit Vehicle Identification Number (VIN). The VIN gives specific information about the vehicle as manufactured by MACK.

The VIN can be found at several different locations on a MACK vehicle. Locations include a stamping on the vertical face of the right-hand frame rail (somewhere between the front spring hanger brackets), a VIN label inside the cab (on the door edge, the door opening area). When the vehicle is received, check the VIN at each location on the vehicle and verify that they are identical. The vehicle identification number must not be changed, covered or obliterated.



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VIN Frame Stamping

VIN	MODEL	VN		
	ENGINE No.			GVM kg
	D.O.M.		DEL	
	GCM 1			
	GCM 2			
	GCM 3			
MACK TRUCKS AUSTRALIA				

W0061426

VIN Label on Inside Driver's Door

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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.

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- DO NOT attempt repairs you do not understand. If you do not have the proper tools/knowledge to perform the repairs correctly, MACK recommends contacting your nearest MACK 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 MACK engine and replacement parts for it shipped from the factory are asbestos free. MACK recommends the use of only genuine MACK 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.

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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.

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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 MACK 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.

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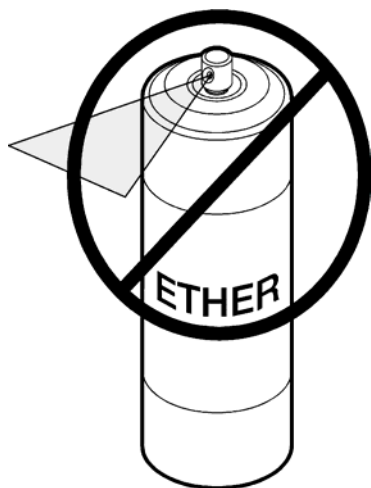
Starting Aids



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.

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



W0001484

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.

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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.

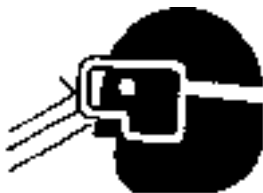


W0001524

Never attempt adjustments or repairs while the engine is running, see your authorized MACK 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 cowlings 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 MACK Service Technicians may attempt repairs on this vehicle.

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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.

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.

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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

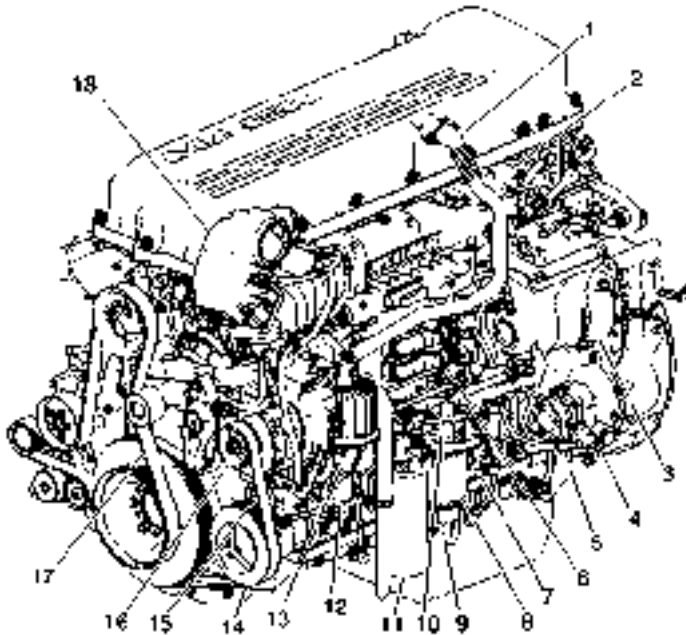
Tampering with the electronic system installation can be dangerous and could result in personal injury or death and/or engine damage. It is very important to take the proper precautions with the electrical and electronic system when charging the batteries, jump-starting or performing electric welding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

General Engine Information

Engine Overview, MP8 Left Side View

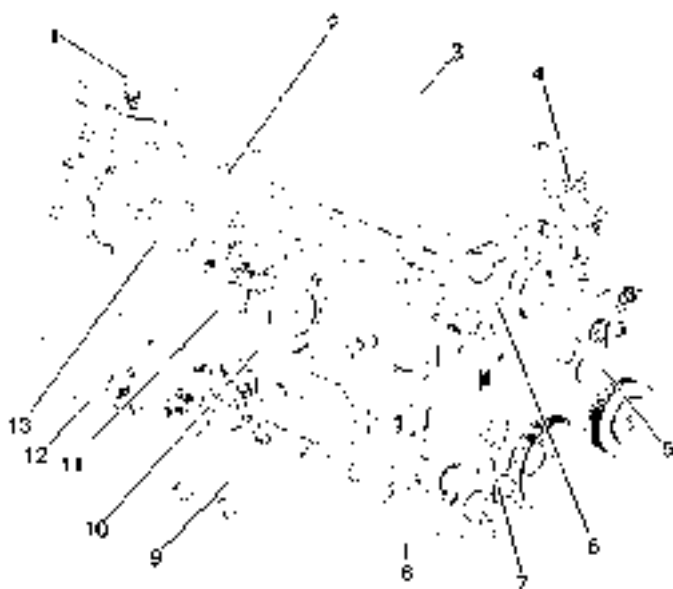


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MP8 Engine Shown

1. Breather Tube	10. Hand-Priming Pump
2. Intake Manifold	11. Fuel Filter
3. Air Compressor	12. Air Valve EPG (Exhaust Pressure Governor) and Wastegate
4. Power Steering Pump	13. Crank Case Ventilator
5. Fuel Pump	14. AC Compressor
6. Engine Control Module (ECM)	15. Alternator/AC Compressor Belt
7. Air Valve On/Off Switching EPG (Exhaust Pressure Governor)	16. Alternator
8. Fuel Filter	17. Fan/Coolant Pump Belt
9. Fuel/Water Separator	18. Intake Housing

Engine Overview, MP8 Right Side View



W2061650

MP8 Engine Shown

1. Exhaust Counter-Pressure Sensor	8. Coolant Pipe
2. Exhaust Manifold	9. Oil Filters
3. Valve Cover	10. Turbocharger
4. Intake Air Heater (IAH) [optional]	11. Turbocharger Wastegate Actuator
5. Belt Tensioner	12. Starter Motor
6. Thermostat	13. Exhaust Brake Acuator
7. Coolant Pump	

Electrical System

Batteries



WARNING

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



CAUTION

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



WARNING

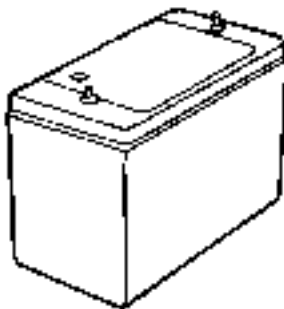
Always wear eye protection when working around batteries to prevent the risk of injury due to contact with sulfuric acid or an explosion.



CAUTION

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.

A maintenance-free battery does not require the addition of water for its normal expected life. Typical features include heavy-duty construction and a wrought lead-calcium grid to resist vibration, shock, overcharge, heat and thermal runaway. Nevertheless, these batteries are vulnerable to the ravages of cold weather operation if totally ignored.



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Be sure that the batteries used in a particular vehicle are rated for the specified Cold Cranking Amperes (CCAs) necessary to ensure reliable cold weather starts. This is important, since even well-maintained batteries chilled to 18 °C (0 °F) may temporarily be capable of providing only 40% of their rated capacity at 27 °C (80 °F).

Keep the terminals clean to prevent formation of power-robbing corrosion.

In winter, to avoid freezing the electrolyte, the battery must be fully charged. A fully discharged battery will freeze solid at 5 °C (23 °F) and possibly sustain permanent damage.

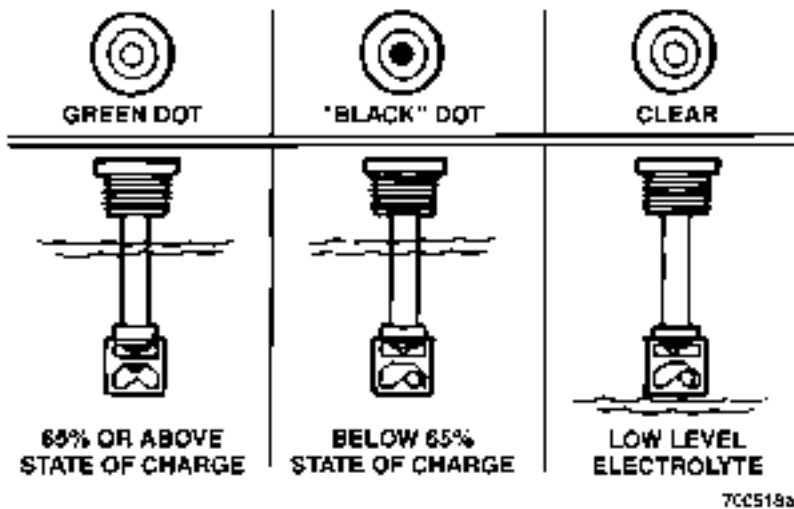
Before the onset of cold weather, be sure to protect this vital component by monitoring its condition as well as inspecting the charging and starting systems.

Battery Condition

The first procedure when testing a battery is to check for external damage such as a cracked case, loose or corroded terminals, or signs of excessive gassing or overcharging.

A battery must be fully charged before a load test is performed. Test the battery with a hydrometer to determine the level of charge.

On maintenance-free batteries equipped with a built-in hydrometer (eye), the battery condition is interpreted as follows:



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Battery Condition

- **Green dot visible** Any green appearance should be interpreted as a green dot and means that the battery is at or above a 65% state of charge and is ready for use or testing. This does *not* automatically mean that the battery is in good condition.
- **Dark green dot not visible (black dot)** This indicates that the battery is below a 65% state of charge and must be charged before testing. A black dot does *not* mean that the battery is automatically bad.
- **Clear or light yellow** This means that the electrolyte level is below the level of the built-in hydrometer, which may have been caused by tipping of the battery, a cracked case, or overcharging. This battery should be replaced.

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Charging

Charging should be conducted carefully under controlled conditions. Never charge a frozen battery. If a frozen battery is suspected, thaw it in a warm area for several hours before charging.

The following chart shows the normal charging times necessary to reach a full charge at 26 °C (80 °F). In colder temperatures, the necessary charging time may increase.

Open Circuit Voltage	Battery Specific Gravity*	State of Charge	Charging Time to Full Charge at 26 °C (80 °F)**					
			at 60 amps	at 50 amps	at 40 amps	at 30 amps	at 20 amps	at 10 amps
12.6	1.265	100%	Full Charge					
12.4	1.225	75%	15 min.	20 min.	27 min.	35 min.	48 min.	90 min.
12.2	1.190	50%	35 min.	45 min.	55 min.	75 min.	95 min.	180 min.
12.0	1.155	25%	50 min.	65 min.	85 min.	115 min.	145 min.	280 min.
11.8	1.120	0%	65 min.	85 min.	110 min.	150 min.	195 min.	370 min.
* Correct for temperature.								
** If colder, it will take longer.								

Completely Discharged Batteries

Extremely cold or completely discharged batteries may not initially show a charge since the electrolyte is nearly pure water and, therefore, a poor conductor. As the acid level in the electrolyte increases during charging, the charging current will also increase. Use the following procedure when charging a completely discharged battery:

- 1 Measure the voltage at the battery terminals. If it is below 10 volts, current will be very low and may not show up on many battery charger ammeters.
- 2 Set the charger on the high setting.
- 3 Some chargers have a polarity protection feature which prevents accidental reversal of the charger leads. A completely discharged battery will not have enough voltage to override this feature, making it appear that the battery will not accept a charge. Check the charger manufacturers instructions on how to bypass this feature.
- 4 Once the battery starts to accept a charge, the charging rate will rise very rapidly. Carefully monitor the ammeter to prevent too-high a charging rate.

- 5 Proceed to charge battery at one-tenth of its rated capacity for one-half hour.
Example: For battery rated at 64 (amps-hour), charge at 6.4 amp setting.

Note: Batteries with very low voltage (below 11.6 volts) or those that do not initially accept a charge are not necessarily defective. Batteries that have been discharged for long periods of time may be heavily sulfated or hydrated (containing lead shorts that cause the battery to self-discharge). To accept a charge, batteries with either of these conditions may require a longer charging time or a very high initial charge.

Use the following chart to determine the time required for the battery to begin accepting a measurable charge. (If the battery has not started to accept a charge after the specified time, it should be replaced.)

Charger Voltage	Hours
16.0 or more	Up to 4
14.0 to 15.9	Up to 8
13.9 or less	Up to 16

Load Test

A battery must be fully charged before performing a load test. To load-test a battery that is fully charged, proceed as follows:

- 1 Connect a load tester and voltmeter across the battery terminals.
- 2 Apply a load so that a figure of 300 amps is obtained for 15 seconds to remove the battery surface charge.
- 3 Wait 60 seconds to let the battery recover and then apply the proper test load to the battery to determine its condition. To get the proper load, use half the cranking performance rating. Read the voltage after 15 seconds. Remember that the minimum voltage varies according to temperature. Consult the following chart for the proper specification. If the battery voltage does not fall below the minimum test voltage after 15 seconds, the battery is acceptable for use.

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Load Test Temperature Correction		
Minimum Voltage	Temperature	
	C	F
9.6	21	70
9.5	16	60
9.4	10	50
9.3	4	40
9.1	1	30
8.9	7	20
8.7	12	10
8.5	18	0

Electrical Connection Protection

If corrosion is seen at any external ring-type terminal connections, such as those used at the starter, alternator, chassis and/or engine grounds, etc., LPS HardCoat Corrosion Protectant must be applied to the connection after disconnecting, cleaning and reconnecting the ring terminal. Additionally, LPS HardCoat should be applied to any ring-type terminal connector following any type of service procedure which involved disconnecting/reconnecting the ring terminals (such as component replacement, troubleshooting, service and repair, etc.).

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, MACK is offering a corrosion inhibitor for purchase through the PDC.

MACK 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

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.).

For more information regarding this corrosion inhibitor produced by LPS Worldwide, visit their web site at www.lpslabs.com.

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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.

Precautions When Installing Electrical Equipment

Connecting electrically powered or electrically controlled equipment to a vehicle may cause interference with other vehicle electrical or electronic equipment (such as ABS systems, Rollover Stability Systems, etc.). The amount of interference depends upon the operating frequency of any new signals and the degree to which transient signals are coupled to the vehicle system.

Note: Whenever new electrical equipment is installed, it is the obligation of the installer to ensure that the new equipment does not interfere with the proper operation of all other electrical systems on the vehicle.

If new electrical equipment is installed, a vehicle checkout procedure should be performed.

- 1 Perform the checkout procedure under the following conditions:
 - Engine running
 - Brake system air pressure in operating range
 - Vehicle stationary
 - Brake pedal fully depressed
- 2 Operate the new equipment under all starting, running and shutdown conditions.
- 3 Listen for signs of air exhausting from the ABS modulator valves (which is an indication of an interference condition).
- 4 Correct all interference conditions before operating the vehicle.

Note: The center pin of the standard seven-pin trailer electrical connector has been standardized as the dedicated connection for uninterrupted power for trailer ABS. This pin is always hot when the tractor ignition is turned on.



DANGER

Some trailers manufactured prior to the trailer ABS regulations may use the center pin to power certain trailer auxiliary equipment. The possibility exists that this auxiliary equipment may be unexpectedly activated by the truck or tractor electrical system, resulting in personal injury or damage to equipment. Caution must be used when connecting the trailer electrical connector to ensure that power to the center pin will not unintentionally activate any trailer auxiliary equipment.

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 VCS coolant 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.

Engine Components, Service Schedules

Component	Operation	Km (Miles)/Maximum Months/Hours
Fuel Filter (MP8)	Change	Each oil change*
Water Separator (MP8)	Filter change	Each oil change*
Air Filter Euro 5	Change	Every 12 months
Coolant (MP8)	Change	500 000 (300, 000) or 48 months, whichever comes first
Valves/Injectors (MP8) **	Adjust	400 000 (250,000) or 24 months, whichever comes first
Drive Belts Euro 5	Change	500 000 (300,000) or 36 months, whichever comes first
Catalyzed DPF Filter (If equipped)	Change	Refer to the appropriate Cummins operator's manual or a certified Cummins dealer.

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Component	Operation	Km (Miles)/Maximum Months/Hours
Aftertreatment Doser (If equipped)	Clean	Refer to the appropriate Cummins operator's manual or a certified Cummins dealer.
Diesel Exhaust Fluid (DEF) Pump Filter (MP8)	Change	180 000 (112,000) or 12 months
Diesel Exhaust Fluid (DEF) Tank Filler Neck Filter Cleaning (MP8)	Clean	180 000 (112,000) or 12 months, 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.		

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


MACK 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 MACK cooling system care/maintenance recommendations can render the warranty invalid.

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The cooling system plays an important role in overall engine performance by keeping the engine within the normal operating temperature range hot enough for efficient combustion, and cool enough to prevent engine damage caused by overheating. Good preventive maintenance practices, along with monitoring cooling system performance, go a long way in preventing engine damage that could result from cooling system problems. The maintenance items and tests outlined in this section should be performed at the intervals specified to ensure optimum performance from the cooling system.

Surge Tank Cap

MACK conventional models utilize a coolant surge tank mounted on top of the radiator. The surge tank has a fill cap located on the top right-hand side of the tank, and a one stage pressure cap rated at 120 kPa (13 PSI). Also incorporated is an overflow tube located on the left-hand side of the tank. Check the coolant level regularly, making sure the coolant level is between the COLD MIN and COLD MAX lines on the back of the tank. At each inspection interval, inspect the rubber gaskets on each of the caps. Replace the cap(s) if the gaskets show evidence of damage which could affect sealing.

**WARNING**

DO NOT remove the fill cap while the cooling system is hot. Allow the system to cool sufficiently before removing. Turn the fill cap slowly counterclockwise and wait for the pressure in the system to dissipate. After the pressure has dissipated, completely remove the cap.



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Surge Tank Conventional Models

1. Pressure Cap	2. Fill Cap
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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.

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

Coolant System Capacities



CAUTION

Capacities may vary due to hoses and size of radiator, as well as accessory cooling equipment. After running the engine until normal operating temperature is reached, check the coolant level and add coolant as needed.

Chassis Model	Engine Model	Coolant Capacity in Liters (Quarts)
CMM and CMH	MP8*	54 (57)
CSM	Cummins ISL	32.5 (34)
CLX and CXX	Cummins ISX	55.5 (59)
* Coolant capacities listed are for chassis equipped with manual transmissions. For automatic transmissions, add 16.5 liters (17 qts).		

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Coolant Mixture

The coolant mixture must be properly maintained to provide maximum protection against corrosion, cavitation erosion and pitting. The following coolant tests should be performed to ensure that the coolant is providing maximum protection.

- 1 Check coolant level.

Note: For use down to -25 ° C (-17 °F), 40% plus (+) or minus (-) 2% of **Bulldog VCS coolant — Water**.

- 2 Check and record the concentration of VCS coolant with a refractometer. **Change the coolant every 4 years or 500 000 Km (310,000 miles).**

Note: Do not mix VCS coolant with other coolants.

Use a refractometer to measure VCS coolant protection. A refractometer that measures VCS coolant concentrations is available from SPX Kent-Moore.

The standard factory-fill coolant for all engines is **Bulldog VCS coolant. Do not use other coolants.**

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 89 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.

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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 2008 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 MACK

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

For MP8 Euro 5 engines, to ensure that the emissions requirements are met, the maximum sulfur content is 50 ppm.

Cummins ISX engines equipped with a DPF must run on ULSD fuel with a maximum sulfur content of 15 ppm. Failure to do so will result in damage to the aftertreatment system.

For Cummins ISL engines equipped with SCR, the maximum sulfur content is 50 ppm.

Note: The use of ultra-low sulfur diesel fuel does not permit extension of engine oil change intervals or oil filter changes.

Filtration

Fuel should be clean and free of contamination. Clean fuels should have no more than 0.05% of sediment and water.

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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: MACK 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 MACK.

Bio Diesel

The only Bio Diesel Fuel approved by MACK. for use in MACK Engines is Soy Methyl Ester (SME or SOME) in blends up to B5 Concentration (5% blend).

Note: Although higher concentrations are available, concentration up to B5 (maximum) are the only blends currently approved by MACK.

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Fuel Storage

If fuel is stored on site:

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

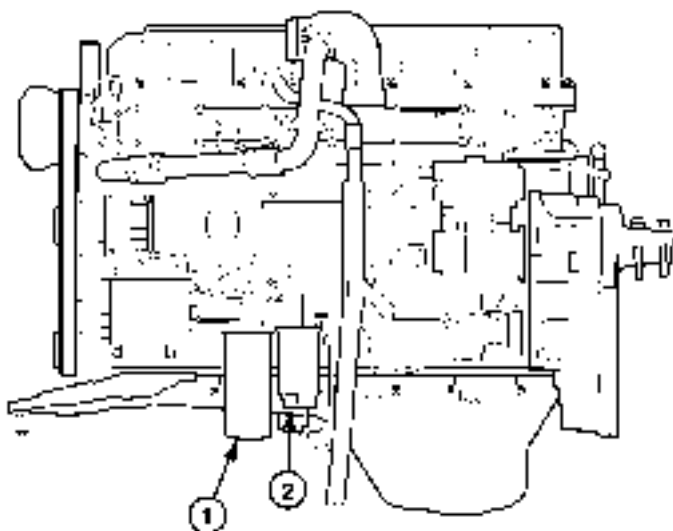
Generally, fuel contamination occurs as the result of improper fuel handling. The most common types of contamination are water, dirt and microbial growth (black slime). The formation of varnishes and gums resulting from poor fuel stability or long storage (stale fuel) also affects fuel quality. The best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

Fuel Filters

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

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

MACK MP engines utilize a spin-on primary and secondary fuel filters. Both filters are located on the right-hand side of the engine.



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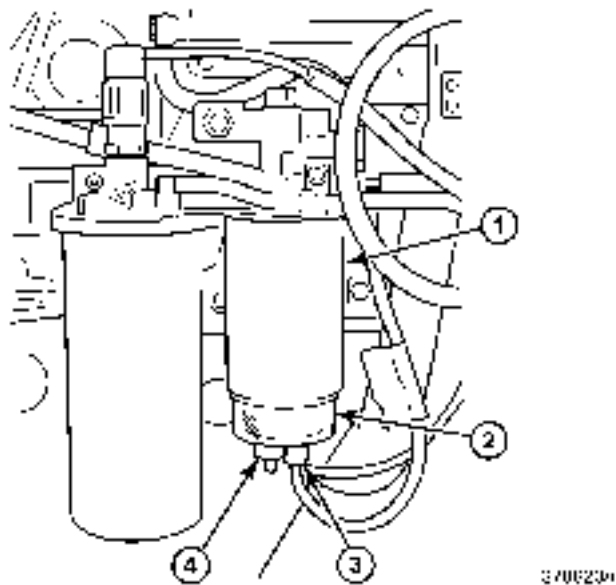
Fuel Filters MACK MP Engine

1. Secondary Fuel Filter	2. Primary Fuel Filter
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The primary fuel filter on MACK MP engines incorporates a plastic water separator bowl. Additionally, the plastic bowl includes a water-in-fuel sensor. A warning lamp on the instrument panel illuminates when water is detected in the fuel. Refer to Fuel/Water Separator section.

Primary Fuel Filter Replacement Procedures MACK
MP Engines

At each specified oil and filter change interval, change the primary fuel filter as follows:



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MACK MP Primary Fuel Filter

1. Primary Filter	3. Water-in-Fuel Sensor Harness
2. Water Separator Bowl	4. Drain Assembly

- 1 Thoroughly wash the area around the fuel filter and mounting adapter mating area with a suitable solvent and blow dry with compressed air.
- 2 Disconnect the water-in-fuel sensor harness connector from the plastic water separator bowl.
- 3 Using tool J 24783, remove the primary filter.
- 4 While holding the filter above a suitable container, open the drain valve on the plastic water separator bowl and allow the fuel in the bowl to drain. Dispose of the drained fuel in an environmentally safe manner.
- 5 Unscrew the plastic separator bowl from the bottom of the spin-on primary filter cartridge.
- 6 Apply a thin film of clean engine oil to the water separator bowl O-ring on the bottom of the **new** primary filter cartridge.
- 7 Install the plastic water separator bowl to the primary filter cartridge, and tighten the bowl by hand 1/4 to 1/2 turn after the bowl contacts the O-ring.
- 8 Apply a thin film of clean engine oil to the sealing gasket of the **new** filter cartridge.
- 9 Install the **new** filter and tighten an additional 1/2 to 3/4 turn by hand after the gasket contacts the base.
- 10 Reconnect the water-in-fuel sensor harness connector.
- 11 Prime the engine as required prior to starting the engine (refer to "Priming the Fuel System MACK MP Engines", page 55).
- 12 Start the engine and check for leaks.

Secondary Fuel Filter Replacement Procedures

At each specified oil and filter change interval, change the secondary fuel filter as follows:

Note: Because of ice buildup in the fuel system or fuel waxing which can clog fuel filters, it may be necessary to reduce the time or mileage interval between fuel filter changes during extremely cold weather.

To install a new filter:

- 1 Thoroughly wash the area around the fuel filter and mounting adaptor mating area with a suitable solvent and blow dry with compressed air.
- 2 Using tool J 24783, remove the old filters.
- 3 Apply a thin film of clean engine oil to the sealing gasket of the new filters.
- 4 Install the **new** filters and tighten an additional 3/4 to 1 turn by hand after the gasket contacts the base.
- 5 Prime the engine as required prior to starting the engine (refer to "Priming the Fuel System MACK MP Engines", page 55).
- 6 Start the engine and check for leaks.

Priming the Fuel System MACK MP Engines

On MACK MP engines, the priming pump is located on the primary fuel filter mounting adapter. Prime the fuel system as follows:



DANGER

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



WARNING

DO NOT work near the fan while the engine is running. The engine fan can engage at any time without warning, resulting in serious injury. Before turning the ignition on, make sure that no one is near the fan.



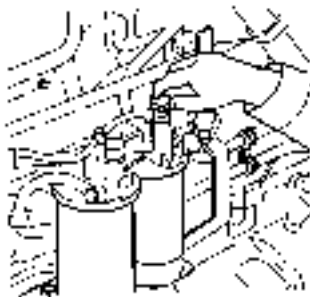
DANGER

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

Note: There are NO bleed nipples that must be opened in order to prime the fuel system.

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- 1 Unlock the primer pump handle by pushing the handle downward and then turning it counterclockwise.



275446-1

W0054026

Unlocking Fuel System Primer Pump Handle

- 2 Operate the pump handle until pumping effort increases.



275446-1

W0054027

Pumping Hand Primer Pump

Note: With a fuel system that is completely empty, 200 or more strokes of the pump may be necessary to properly prime the system.

- 3 When the fuel system is primed, lock the primer pump handle by pushing it fully into the housing and turning it clockwise.
- 4 Start the engine and run it at 1000 rpm for approximately 5 minutes to purge any remaining air from the system.

Note: If the engine does not start after performing the above priming procedure, contact your local MACK dealer for assistance.

Fuel/Water Separator MACK MP Engines

The primary fuel filter on MACK MP engines includes a plastic water separator bowl with an integral water-in-fuel sensor and a drain assembly. A warning lamp on the instrument panel illuminates when water is detected in the fuel. When the lamp illuminates, drain the water from the separator by opening the drain valve and allowing the water to drain from the bowl into a suitable container. When fuel begins to drain, close the valve and tighten to 0.655 Nm (5 lb-in). Dispose of the drained water/fuel in an environmentally safe manner.



W0054022

2-35-81

Water Separator Drain Valve MACK MP
Engines

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

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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

MACK 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-N Premium Plus (or VDS-3) diesel engine oil is the minimum requirement for Euro 5 ADR 80/03.

	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, 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 125.

For additional information about oil change intervals, see your MACK Truck dealer.

Note: Oil filters should always be changed when changing oil.

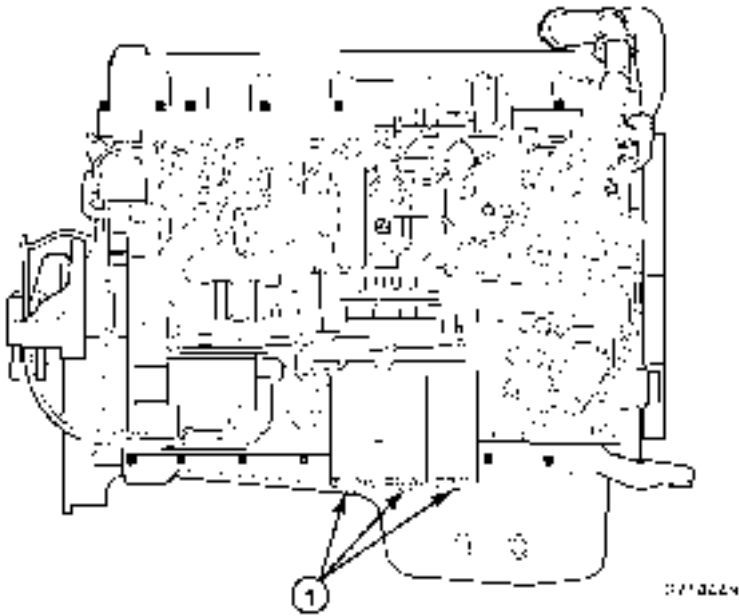
Oil Filters

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

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



W0054029

Spin-On Oil Filters

1. Spin-On 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 MACK engines, provided they meet the quality levels specified in the previous sections of this manual.

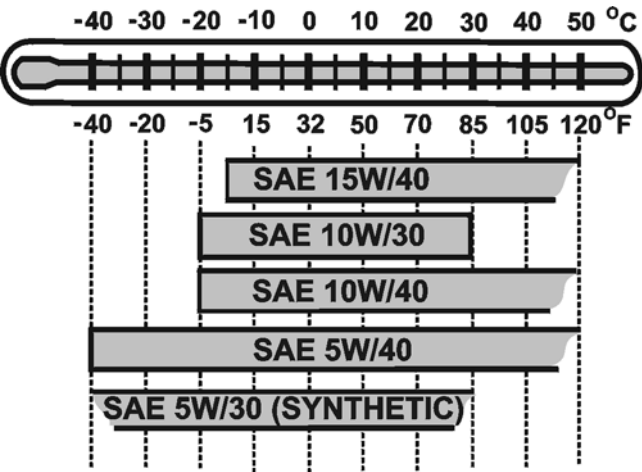
The use of synthetic oils does not permit the extension of the recommended oil change intervals. It is the contamination rate, i.e., soot, and the depletion of additives, rather than base oil quality that determines the useful engine oil life and therefore the oil change intervals.

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 MACK engines is 10W/30.

MACK recommends the viscosities shown in the viscosity/temperature table for MACK engines.



W1000144

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.

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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 58 and “Oil Capacity Tables and Viscosity Charts”, page 125 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

MACK-branded oil filters are designed to provide the proper level of filtration and protection for MACK 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.

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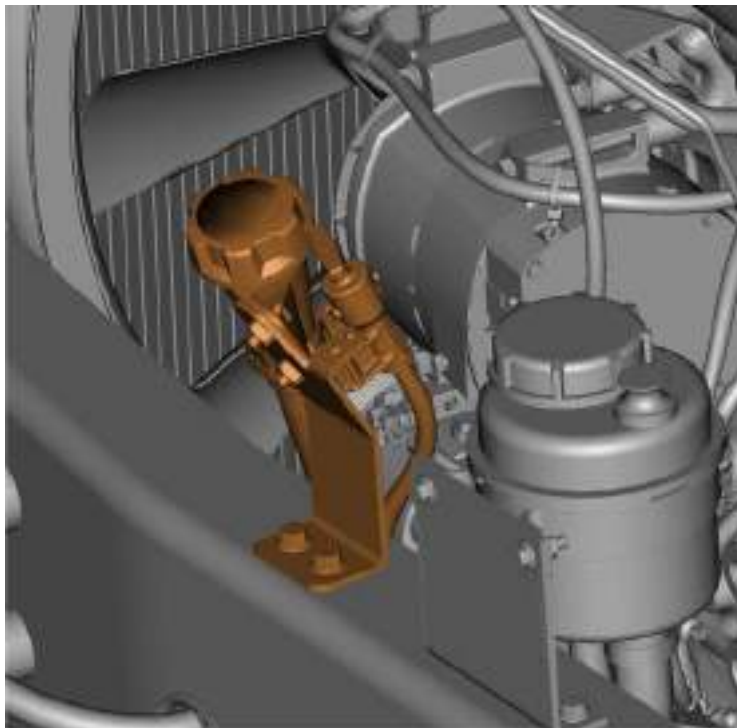
Checking Oil Level



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.



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Engine Air Filter

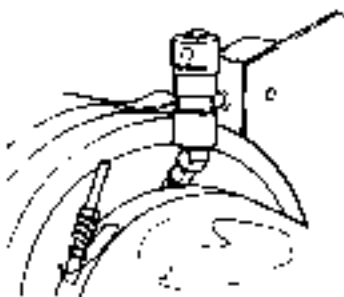
The air cleaner prevents dust, dirt and other harmful contaminants from entering the engine through the air intake system. Maximum engine protection can only be achieved through regularly scheduled maintenance practices that include periodic air intake system inspections and air filter element changes.

The most efficient method of determining air filter element change intervals is by regularly checking the air filter restriction gauge, which may either be mounted directly to the air cleaner canister, on the air cleaner outlet tube or inside the cab. The restriction gauge measures the amount of restriction in the air filter element. Some chassis may have a dash-mounted dial-type restriction gauge which measures filter restriction in mm/inches of water.

Change the air filter element in accordance with the procedures as outlined, when the restriction gauge red signal locks in full view, or the dash-mounted gauge indicates inlet restriction as follows:

Mounted Gauge Inlet Restriction Indication

Engine	Millimeters (Inches) Water/kPa
MP8	510 mm (20)/5 kPa
Cummins	635 mm (25)/5 kPa



FILTER MOUNTED GAUGE



DASH MOUNTED GAUGE

W0054007

Air Filter Restriction Gauge

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Damage to the air filter element, such as holes in the filter medium, will give an inaccurate restriction reading. Therefore, even if maximum restriction is not indicated, the air filter element should be changed every twelve (12) months.

When replacing the air filter element, or whenever the air inlet system has been disassembled, inspect the inlet air ducts between the air cleaner canister outlet and the turbocharger inlet as follows:

- Inspect the rubber elbows for cracks, splitting and/or holes. Rubber components must be flexible so that they conform to the plastic ducts and ensure a tight seal.
- Inspect plastic ducts for cracks and/or holes.
- Ensure that all hose clamps are properly installed and tightened to specifications.
- Make sure the plastic ducts do not rub against any components such as air conditioning hoses, wire harnesses, etc.

To properly install a new filter element:

- 1 Wipe the air cleaner housing clean.
- 2 Remove the filter element(s).
- 3 Inspect sealing areas for dirt tracks which would indicate that dust has leaked past the seal. If dirt tracks are found, the cause must be determined and corrected.
- 4 Thoroughly clean the inside of the air cleaner canister with a damp cloth or vacuum cleaner.
- 5 If equipped with a metal canister, inspect inside the canister for rust. If rust is present:
 - 1 Remove the air cleaner canister from the chassis.
 - 2 Remove all loose rust with a wire brush or a coarse Scotch Brite pad.
 - 3 Sand with 180/240 grit wet or dry sand paper.
 - 4 Thoroughly wash the area with PPG DX-440, DX-436, DX-437 or equivalent, wax and grease remover and wipe dry.
 - 5 Prime immediately with PPG DEP-351 epoxy primer.
 - 6 Reinstall the air cleaner canister.
- 6 Inspect the sealing areas of the housing for damage. Repair or replace as necessary.
- 7 Use MACK-approved replacement elements and gaskets. Make sure the new elements and gaskets are not damaged. Be sure to use new gaskets each time the element is changed. Install the cover and, depending upon cover configuration, tighten as follows:
 - Air cleaner with large wing nut in center of cover hand-tighten wing nut.
 - Air cleaner with three thumb screws around outer edge of cover hand-tighten thumb screws.
 - Air cleaner with retaining nuts around outer edge of cover tighten retaining nuts between 11 – 14 Nm (8 – 10 lb-ft).

Note: DO NOT attempt to clean the air filter element with compressed air, as this could damage the filter medium and possibly result in severe engine damage.

FOR BEST RESULTS...

USE GENUINE



REPLACEMENT PARTS AND FILTERS

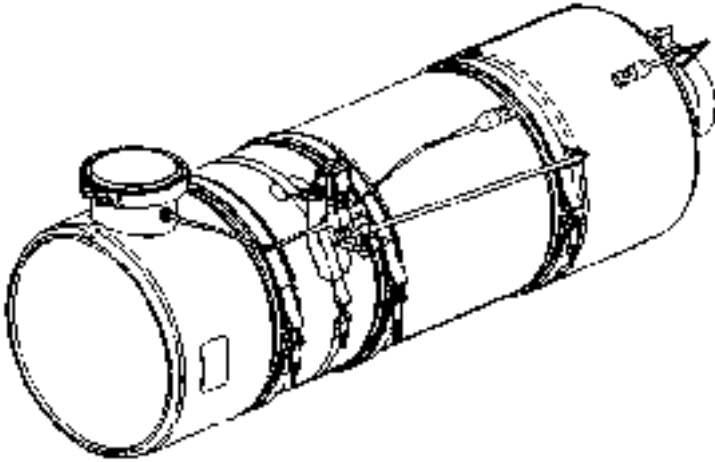
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Replacement Parts and Filters

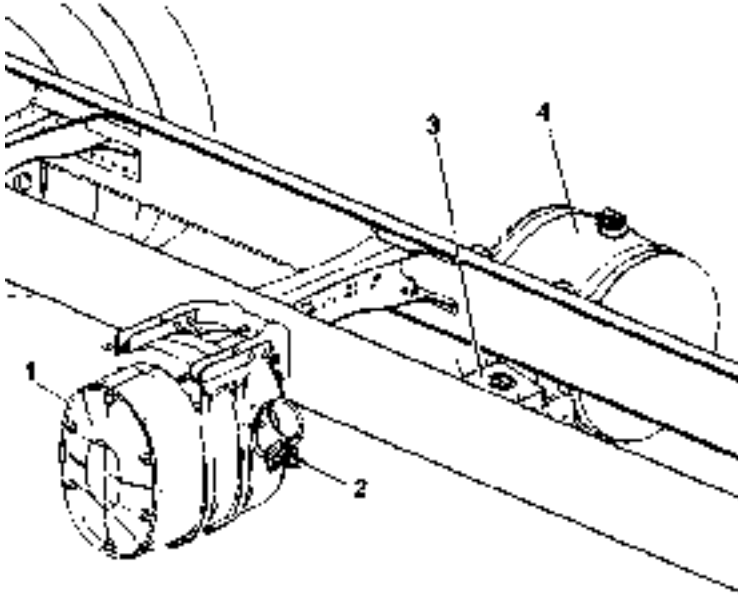
Exhaust After-Treatment System

Aftertreatment Diesel Particulate Filter (DPF)



W4061331

Standard System View



W2061423

1. Selective Catalytic Reduction (SCR) Catalyst
2. Aftertreatment DEF Tank
3. Aftertreatment DEF Dosing Unit
4. Pump Unit Urea Dosing 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.

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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 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.

Exhaust Emissions (Cummins ISX)

New stringent standards for exhaust emission control begin with the ADR 80/03 introduction. 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 ADR 80/03 standard.

Particulate matter consists of soot and ash in the exhaust that Cummins 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.

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.

Passive regeneration naturally occurs at exhaust temperatures of 260 °C (500 °F) or greater. If passive regeneration is not sufficient to eliminate the collected soot, the active regeneration process will occur when engine conditions permit.

During the active regeneration process, fuel is injected into the exhaust stream and passes through an oxidation catalyst to increase the temperature inside the particulate filter. Typical exhaust temperatures during the active regeneration process are 500-625 °C (932-1157 °F).



WARNING

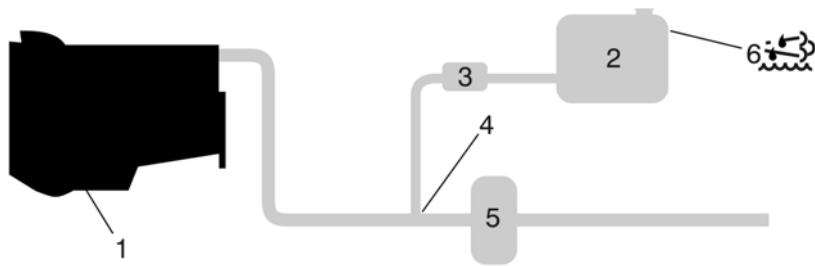
Prior to ever working on the exhaust, allow time for the entire exhaust system to cool. Failure to do so may result in personal injury. Severe burns can occur.

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Selective Catalytic Reduction (SCR)

Selective Catalytic Reduction (SCR) is an emissions-reduction technology with the ability to deliver reduced emissions of nitrogen oxides (NOx), a smog-causing pollutant and greenhouse gas. SCR's performance has been proved in millions of kilometers (Km) 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. 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.



W2061387

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

The 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 no EGR. By using DEF, we avoid the disadvantages of the EGR. This results in better fuel economy from your engine.

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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.

Description	Min./Max.
Urea Content	31.8 to 33.2 % by weight
Density	20 °C (68 °F) 1.0870 1.0930 g/cm ³
Refracting Index	at 20 °C (68 °F) 1.3814 1.3843
Alkalinity	as NH ₃ : 0.2 %
Biuret	0.3 %
Aldehyde	5 mg/kg
Insolubles	20 mg/kg
Phosphate (PO ₄)	0.5 mg/kg
Calcium	0.5 mg/kg
Iron	0.5 mg/kg
Copper	0.2 mg/kg
Zinc	0.2 mg/kg
Chromium	0.2 mg/kg
Nickel	0.2 mg/kg
Aluminium	0.5 mg/kg
Magnesium	0.5 mg/kg
Sodium	0.5 mg/kg
Potassium	0.5 mg/kg




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Note: Common Names and References for Diesel Exhaust Fluid (DEF): AdBlue™, Urea, NOx Reduction Additive and Air1™

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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 spilt onto hot components will quickly vaporize. Turn your face away!

Diesel Exhaust Fluid (DEF) Consumption

DEF consumption is related to fuel consumption. 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. When the DEF tank is refilled, the engine will resume normal power.

Diesel Exhaust Fluid (DEF) Availability

Contact your local Mack dealer for DEF availability.

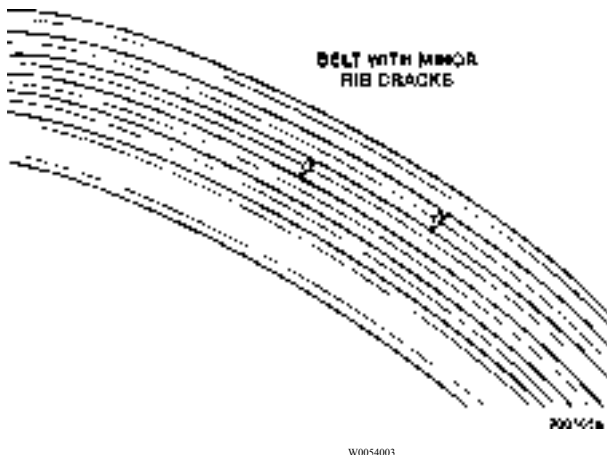
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Drive Belt Replacement Intervals

If belts squeak or squeal, clean with hydraulic brake fluid or an approved cleaning fluid. Replace belts that are severely worn or frayed.

Rib Cracking

An in-service poly V-belt will go through several phases of cracking during its life. After an extended time in service, minor rib cracks may appear, usually one or two cracks per inch. This cracking is normal.

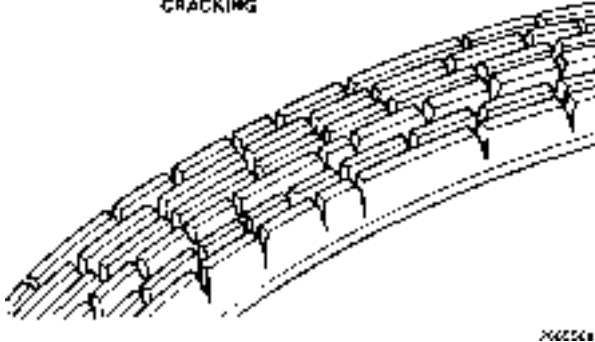


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Belt with Minor Rib Cracks

Belts should not be replaced unless the ribs exhibit severe multiple cracking as shown below. Multiple cracking will lead to rib chunking.

**BELT WITH MULTIPLE
CRACKING**

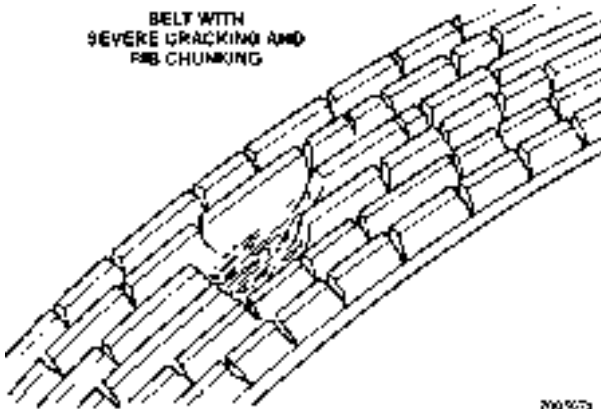


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Belt with Multiple Cracking

**BELT WITH
SEVERE CRACKING AND
RIB CHUNKING**



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Belt with Severe Cracking and Rib Chunking

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Rib Sidewall Glazing

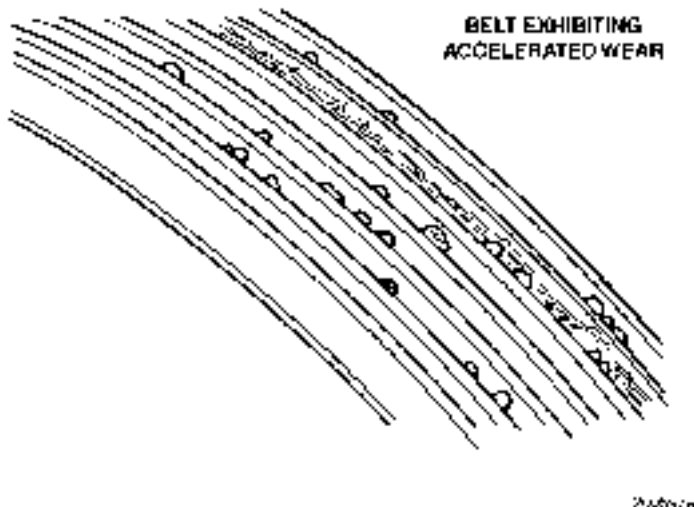
When the belt ribs appear to have a shiny surface that is hard and brittle, it is usually an indication of belt slippage. This is attributed to inadequate tension and/or extreme temperature. Both these conditions will lead to severe cracking and belt failure, often with little advance warning. If this occurs, locate the cause and correct before installing a new belt.

Belt Wear

Accelerated wear on any part of the belt (fabric backing, tensile cord or rib rubber) is a concern and should be investigated for cause, and corrected before installing a new belt.

Possible Causes of Accelerated Belt Wear

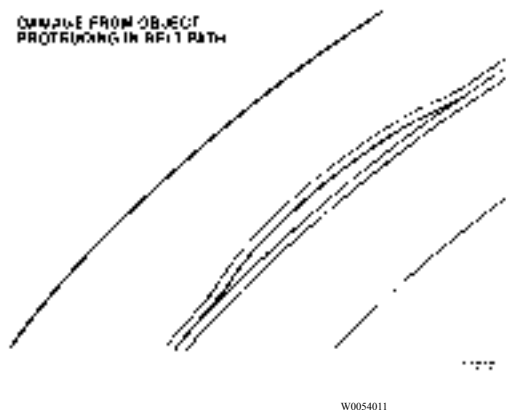
- Drive Misalignment Belt performance will be adversely affected when misalignment exceeds 1/16 inch for every 12 inches of belt span.
- Belt Length Must be correct.
- Environmental Conditions Temperature, exposure to engine fluids, etc.
- Abrasive Materials Small stones, metal shavings, etc.



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Foreign Objects

Any object protruding in the path of the belt drive and contacting the belt will cause damage and eventual failure. Locate the object before installing a new belt. (See)



Damage from Object Protruding in Belt Path

Noise, Vibration and Harshness (NVH)

Poly V-belt drive systems were designed to prevent Noise, Vibration and Harshness (NVH) problems. Field problems, however, which may be related to NVH causes occasionally occur.

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Possible Causes

Insufficient belt tension may create a high-pitched howl (squeal) or rasping sound during engine acceleration or deceleration.

Misalignment may cause a chirping noise, especially at, or near, idle speed. Rigid bracketing of accessories is a must for reasonably vibration-free belt spans. Some span vibration is to be expected during the range of engine speed and accessory loading.



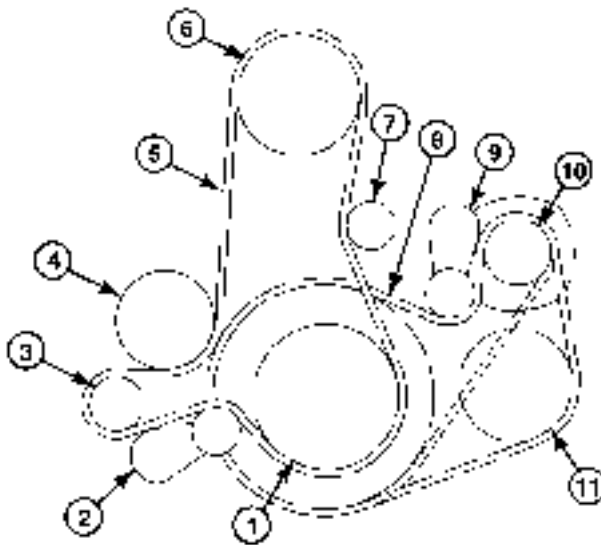
WARNING

Failure to follow recommended application information and recommended procedures for installation, care maintenance and storage of belts may result in failure to perform properly and may result in damage to property and serious bodily injury. Make sure the belt selected for any application is recommended for that service.

Drive Belt Installation

To install a poly V-belt, swing the automatic tensioner to the full sprung position (fully toward the install stop), then place the belt over the pulleys. Slowly return the automatic tensioner back to its original position. Do not allow the tensioner to snap against the stops. For proper belt routing, refer to the following belt routing diagrams. Before installing the new belt, ensure that the pulley grooves are clean and free of debris.

Drive Belt Routing MACK MP8 engines, all models.



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Drive Belt Routing MP8 Engines

1. Crankshaft Pulley	7. Idler Pulley (when applicable)
2. Automatic Tensioner	8. Accessory Drive Belt
3. Idler Pulley	9. Automatic Tensioner
4. Water Pump	10. Alternator
5. Main Drive Belt	11. Air Conditioner Compressor (if equipped)
6. Fan Drive	

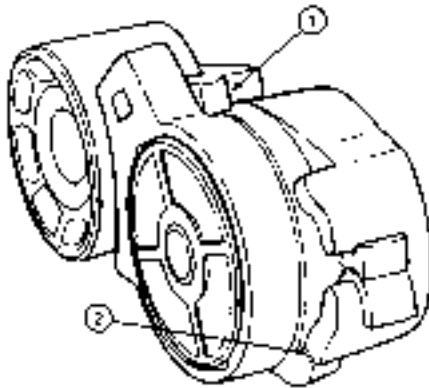
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Automatic Belt Tensioner Maintenance

The automatic belt tensioner is designed to maintain proper belt tension throughout the life of the tensioner. The belt tensioner cannot be adjusted or repaired, at each inspection interval or once per year, whichever occurs first, check the following:

- With the belt on the drive, check the following:

Check to see if the tensioner is resting against the install stop or the free-arm stop. If the tensioner is resting against either stop, the tensioner must be replaced.



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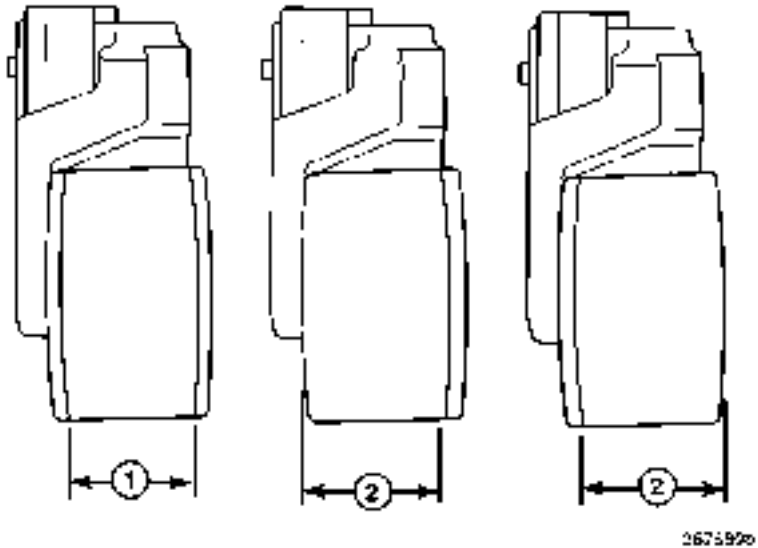
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Tensioner Install Stop and Free-Arm Stop (Main Drive Belt Tensioner Shown)

1. Install Stop

2. Free-Arm Stop

On main drive belt tensioners, check belt tracking. If the belt is tracking all the way to one side of the tensioner pulley (either the front- or back-side), replace the tensioner. Belt tracking can be determined by looking at the witness mark (the shiny area on the pulley where the belt rides). The witness mark should be approximately the same width of the belt.



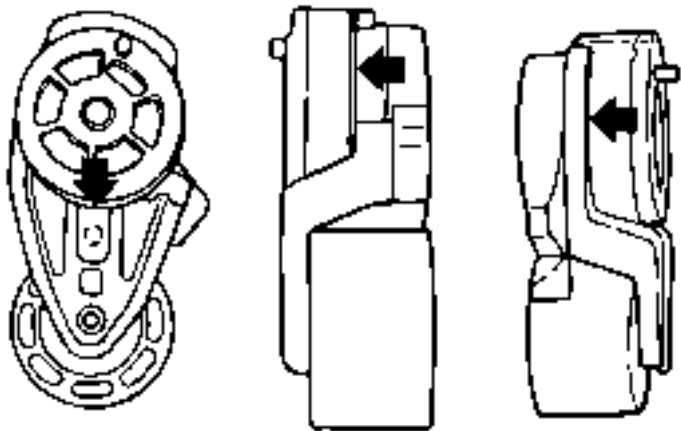
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Main Drive Belt Tensioner Belt Tracking Witness Mark

- | | |
|--|---|
| 1. Acceptable (Witness Mark
Approximately Same Width as Belt) | 2. Not Acceptable (Witness Mark
Tracking Off Edge of Pulley) |
|--|---|

- Remove the belt by using a 3/8 inch breaker bar to pull the tensioner back to the install stop. Slowly return the tensioner to the free-arm stop.
- With the belt removed, use the breaker bar to slowly pull the tensioner from the free-arm stop to the install stop and then slowly releasing it back to the free-arm stop. Any excessive roughness or hesitancy noticed while performing this check indicates that the tensioner must be replaced.
- Check for metal-to-metal contact as follows:
Check for contact between the arm and the spring case. Replace if metal-to-metal contact is seen.

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CMH, CLX, CSM, and CXX

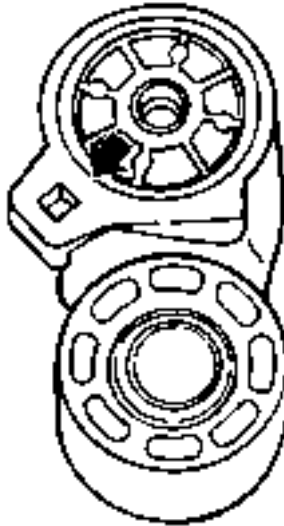


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W0054015

Checking for Contact Between Arm and Spring Case

Check for metal-to-metal contact between the arm and the end cap. Replace if contact is seen.



2E75B12

W0054016

Checking for Contact Between Arm and End Cap

Check for cracks in the tensioner body or for broken stops on the spring case. If either is seen, replace the tensioner.

Reinstall the belt making sure that the belt is properly seated in the grooves of ALL pulleys.



CAUTION

If an automatic belt tensioner must be replaced, make sure that the proper tensioner is used. Tensioner spring tension varies by engine and chassis model. Do not substitute one tensioner part number for another, as drive belt failure can result.

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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.



CAUTION

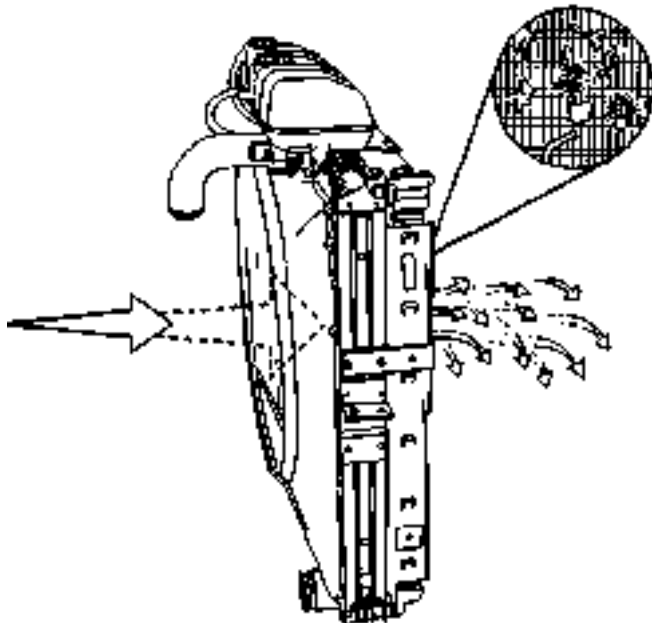
When using a pressure washer to clean the vehicle, do not direct the spray at electrical components in the engine compartment such as the alternator, starter and compressors. Water spray from pressure washers can damage electrical components.

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 MACK 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.

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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 MACK 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.

Preventive Maintenance Air Suspensions

Note: The following maintenance items should be performed on all air suspensions (including MACK AL, AL II, AL-401LH, MAXAIR 40/40A, MAXLITE 2040, MAXLITE 2040 EZ and Hendrickson PRIMAAX) at each inspection interval, or every 40 200 Km (25,000 miles) or six months, whichever comes first.

- **Visual Inspection:** Inspect all suspension components, checking for signs of wear, damage or unwanted movement. Look for bent or cracked parts. Replace all worn or damaged components as required.
- **Air Spring:** Inspect for chafing or any signs of spring or components damage. Ensure that the upper bead plate is tight against the underside of the frame. Check for lateral slippage at the lower air spring bracket. Slippage of 3.3 mm (1/8 inch) in either direction is acceptable. Replace worn or damaged components as required.
- **Support Beam Assembly:** Inspect the overall condition of the support beam for dents, dings or other damage. On Hendrickson PRIMAAX suspensions, check the D-pin bushings for tearing or extreme bulging. Check for metal-to-metal contact in the bushed joints. Replace worn or damaged components as required.
- **Frame Hanger Bracket:** Inspect for any signs of loosening or damage. On Hendrickson PRIMAAX suspension, check for loosening or damage at the QUIK-ALIGN connections or longitudinal torque rod connections. Replace worn or damaged components as required.
- **Cross Beam:** Inspect for cracks, damage, metal shavings or looseness at the beam connections. Replace worn or damaged components as required.
- **Transverse Torque Rods:** Inspect for signs of looseness at the transverse torque rod connections. Check bushings for tearing or excessive bulging. Check the transverse torque rod for dents or bending. Replace worn or damaged components as required.
- **Shock Absorbers:** Inspect for signs of dents or leaking (oil misting is not considered leakage). Replace worn or damaged shocks as required.
- **Tire Wear:** Inspect tires for wear patterns that might indicate suspension damage or misalignment. Replace worn or damaged components as required.
- **Height Control Valve and Air Lines:** Check for loose, bent or damaged parts. Check air lines for chafing or any unwanted contact with moving components. Check height control valve and air lines for leakage. Replace worn or damaged components as required.

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.

Power Steering Fluid Reservoir

The power steering fluid reservoir is filled with Automatic Transmission Fluid (ATF) Dexron III for the power steering system. 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 MACK Truck dealer for troubleshooting the overheating and to have the fluid changed.

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.

The following Dual Circuit Brake System Function Test should be performed at each inspection interval, or after any air system service procedures that involve disconnecting and reconnecting air lines where incorrect reconnection, such as the treadle valve, is a possibility.

- 1 Block the wheels to prevent the vehicle from moving.
- 2 Start the engine and build air system pressure to governor cutout.
- 3 Stop the engine.
- 4 Completely drain one air reservoir.
- 5 Release the parking brakes.
- 6 Apply and hold the treadle valve.

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- 7 Have an assistant check for proper results by observing the movement of the slack adjusters as indicated below:

TRUCK:

- The brakes on the rear drive axle(s) should always apply as indicated by movement of the slack adjuster.
- The low-air warning buzzer and warning lamp should activate for at least two of the tests.

TRACTOR:

- The brakes on either the steering axle or the rear drive axle(s) should always apply as indicated by movement of the slack adjuster.
- The low-air warning buzzer and warning lamp should activate for at least two of the tests.

- 8 Repeat the above procedures for the remaining air reservoirs.

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 MACK Truck dealer.

Air Dryers

All MACK 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.

Tires, Wheels and Hub Maintenance

Wheel Safety Information



DANGER

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



DANGER

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



DANGER

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



DANGER

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



DANGER

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



DANGER

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



DANGER

DO NOT use mismatched tires on the same axle. Always use the same type (radial or bias ply) or size. Mixing tires on the same axle will affect the roadholding and can lead to an accident, and serious personal injury or death.

Wheels



DANGER

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



DANGER

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

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

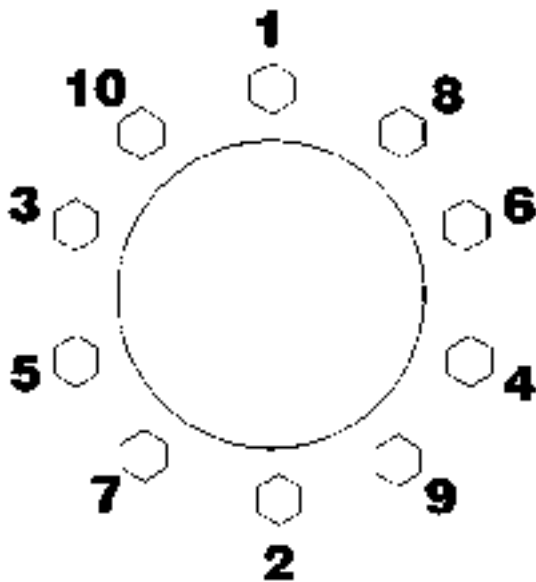
Wheel Nut Tightening



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 miles). After the first retightening, only normal inspection of nut tightness is needed. Check front and rear wheel nut tightness with a torque wrench. All disc wheels for MACK vehicles have a tightening torque of 610 Nm (450 lb-ft). Tighten the nuts in the correct sequence. Inspect bolts and nuts for signs of wear or cracks. Make sure that the bolts are not bent. This tightening check is particularly important when rims or brake drums are newly painted. Paint can flake off from these surfaces, causing the nuts to lose their grip and the wheel to loosen.



W7001392

10-Stud Wheel Nut Tightening Sequence

Tire Inflation and Wear



WARNING

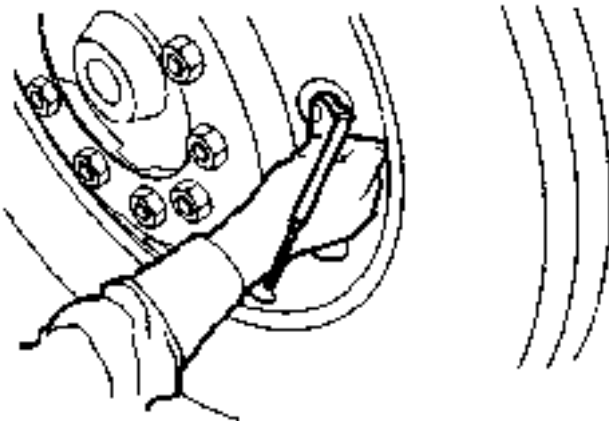
DO NOT operate the vehicle with under-inflated tires. Always keep your tires inflated to the manufacturers recommendation. Increased flexing in the tire sidewall produces heat. The heat can build to the point of blowing the tire out causing an accident.



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.

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Tire Hints

Hints on How to Avoid Unnecessary Tire Wear

- Maintain correct tire pressure
- Check the tire pressure when the tires are cold
- Check that valve caps are not missing
- Keep the wheels balanced
- Tire wear increases with speed
- Overloading not only decreases tire life but also creates a hazard
- Incorrect front end alignment causes increased wear
- Unnecessary tire rotation may cause excessive wear

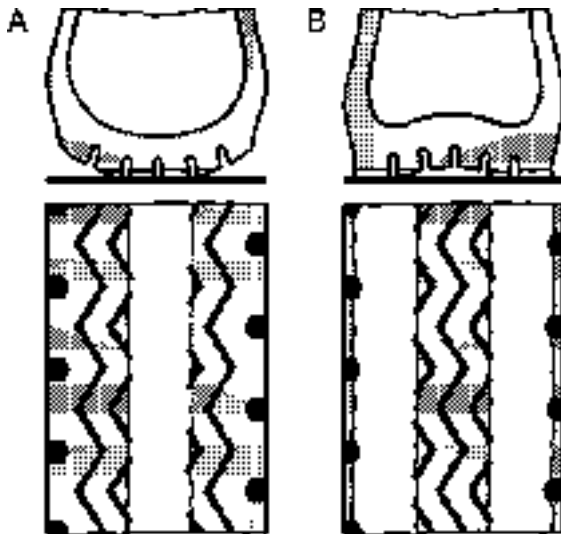
Note: Dual mounted wheels should always be of the same type and diameter (maximal diameter difference allowed is 6 mm [1/4 in]).

Typical Wear Patterns

Incorrect Air Pressure

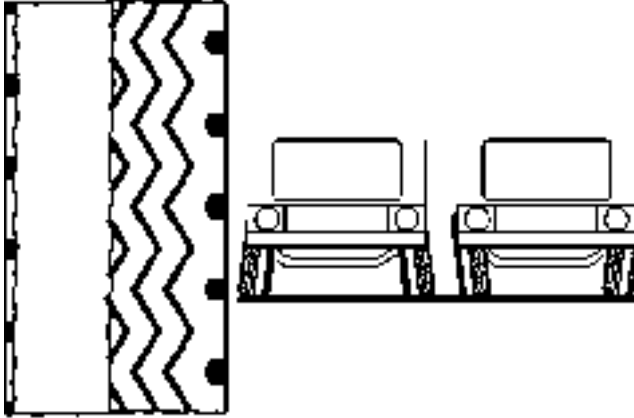
A. Air pressure too high gives rapid wear in the middle.

B. Air pressure too low gives rapid shoulder wear.



Incorrect Camber

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

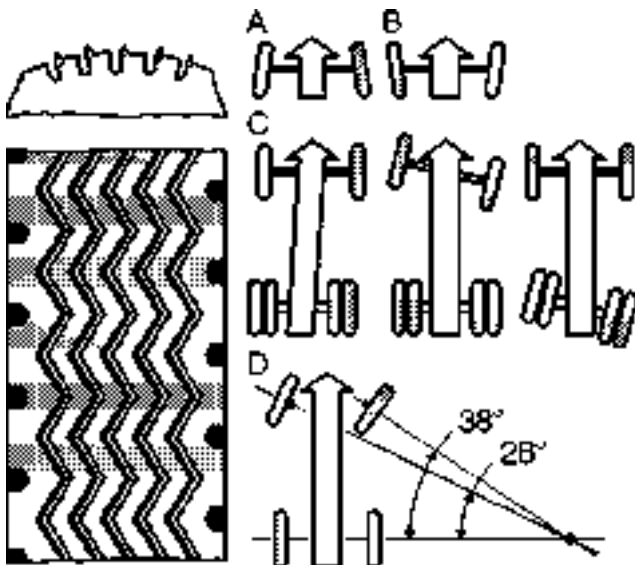


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Incorrect Toe and Axle Alignment

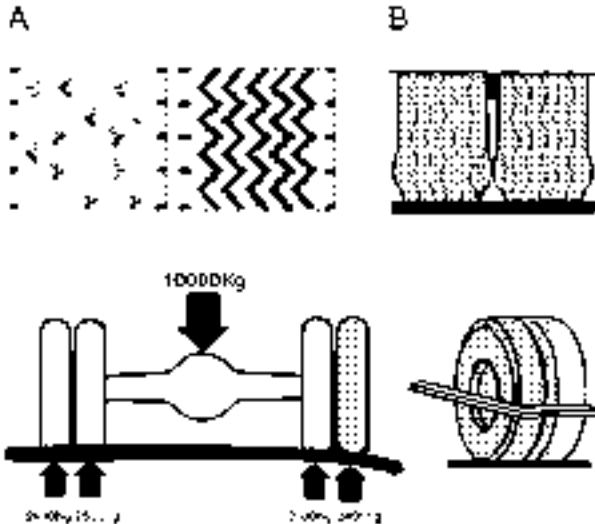
- A. Incorrect toe-in
- B. Incorrect toe-out
- C. Out-of-line axle
- D. Steering arm defect



T1006459

Dual Wheel Mounting

- A. Excessive road camber, different types of tire, different circumference or off-center loading 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.



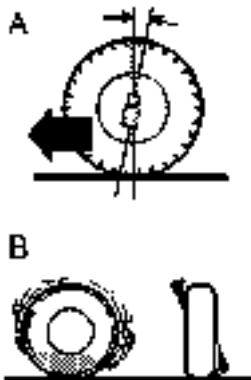
T1006718

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Incorrect Caster and Imbalance

- A. Caster angle
- B. Imbalance

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

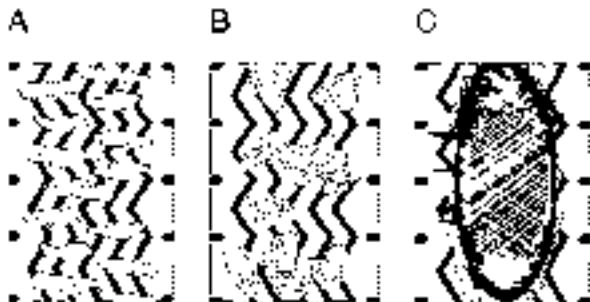


T1006460

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.

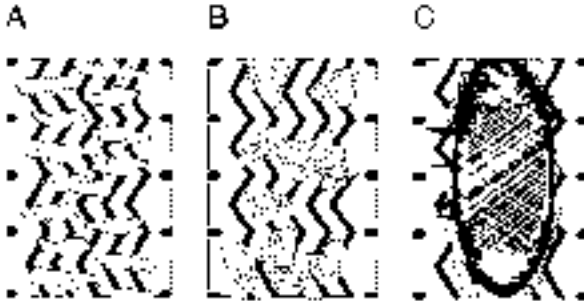


T1006720

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

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Spot Wear

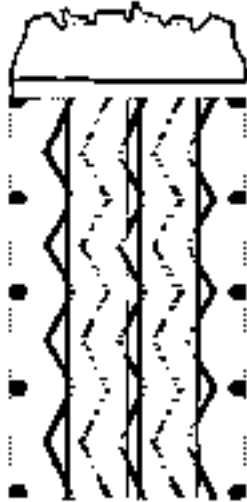
Sudden braking, locking brakes or out-of-round brake drums give spot wear.



T1006721

Feathered Edges

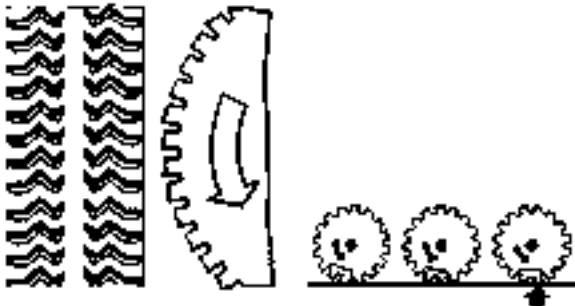
Normal occurrence on non-driving wheels on good roads and high mileage.



T1006722

Cupping

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



T1006723

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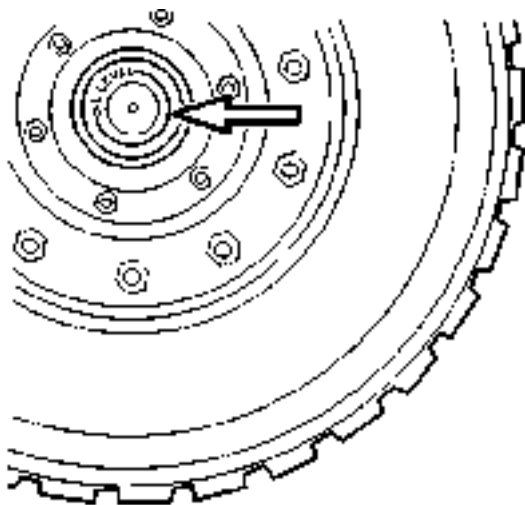
Front Wheel Hubs



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. For the proper oil type refer to the manufacturer. The proper oil type is dependant on operating conditions. Oil change interval maximum is: 12 months or 160000 Km (99,500 miles) depending on operating conditions or if the hub is opened.



W7001271

Unitized Front Hubs

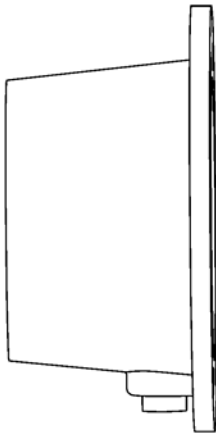
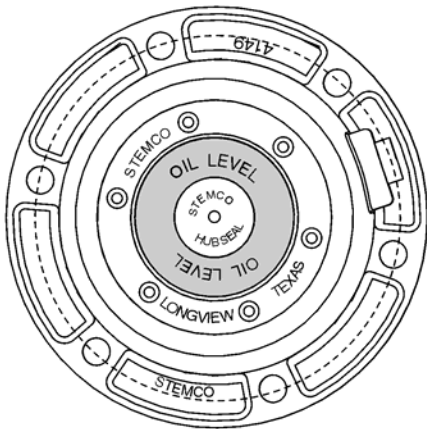
The non-tapered axle hubs are sealed with lubricant inside the hub and do not require lubrication.



W1000213

Unitized Hubs, Non-Tapered Axle End

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CMH, CLX, CSM, and CXX**



W1000212

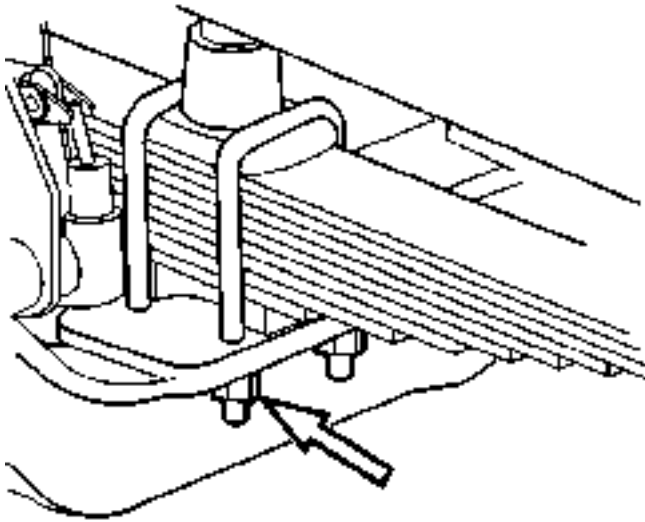
Tapered Axle End

Chassis Maintenance

Springs

Note: This work is best performed by a MACK 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 MACK dealer.

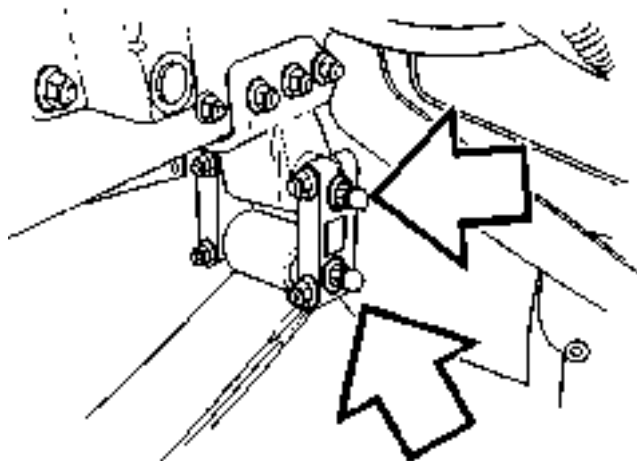


W6001504

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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.

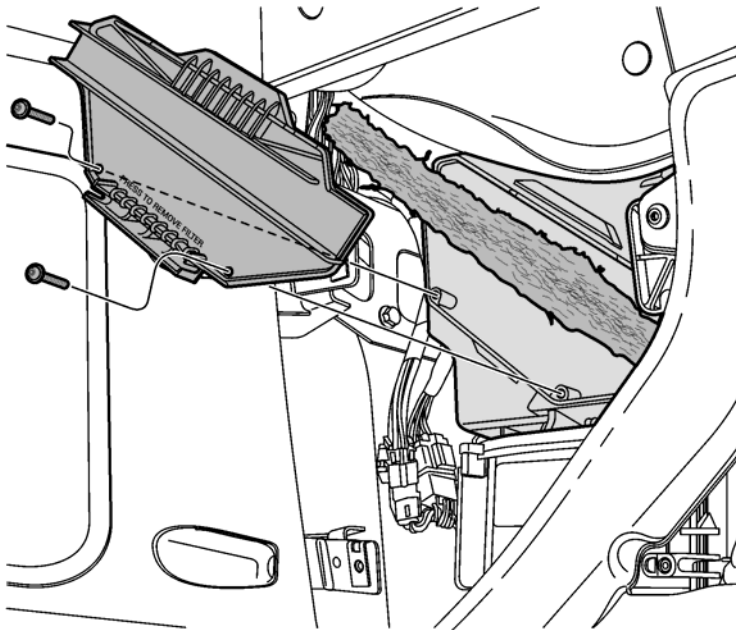
Cab Maintenance

Cab Air Filter

To provide comfortable and clean fresh air in the cab, the heating and air conditioning system is designed with a replaceable filter.

Depending on operating conditions the filter should usually be checked every 12 months to ensure the efficiency of the heating and air conditioning system. Failure to replace the filter may cause damage to heater/AC components.

Dusty conditions may require more frequent replacement.

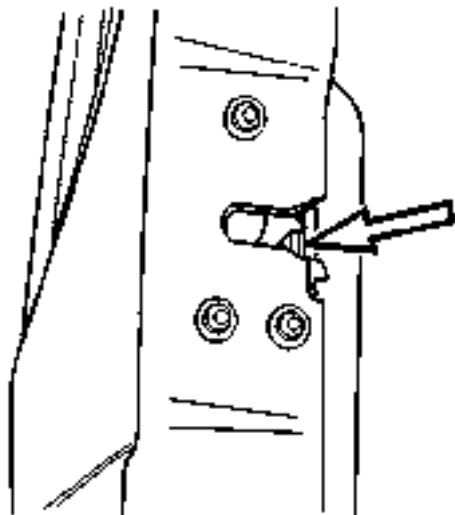


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Doors

The door lock mechanism should be greased annually using white grease. Lubricate the door lock cylinder with liquid graphite annually. Coat the door stop arm with white grease annually. 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, occasionally spray on a silicone compound.



W8003203

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.

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 framerrail 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

Use an approved leather cleaner and reviver. 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 miles). However, if the vehicle is in a demanding application or running in a dirty or corrosive atmosphere, adjust the lubrication intervals to reflect heavy-duty use. For example, if driven in heavy stop-and-go traffic with a lot of maneuvering, the lubrication intervals should be every 16 000 Km (10,000 miles) or less. All lubricating points are found on the chassis lubrication chart on the next page.

Lubricating Grease

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

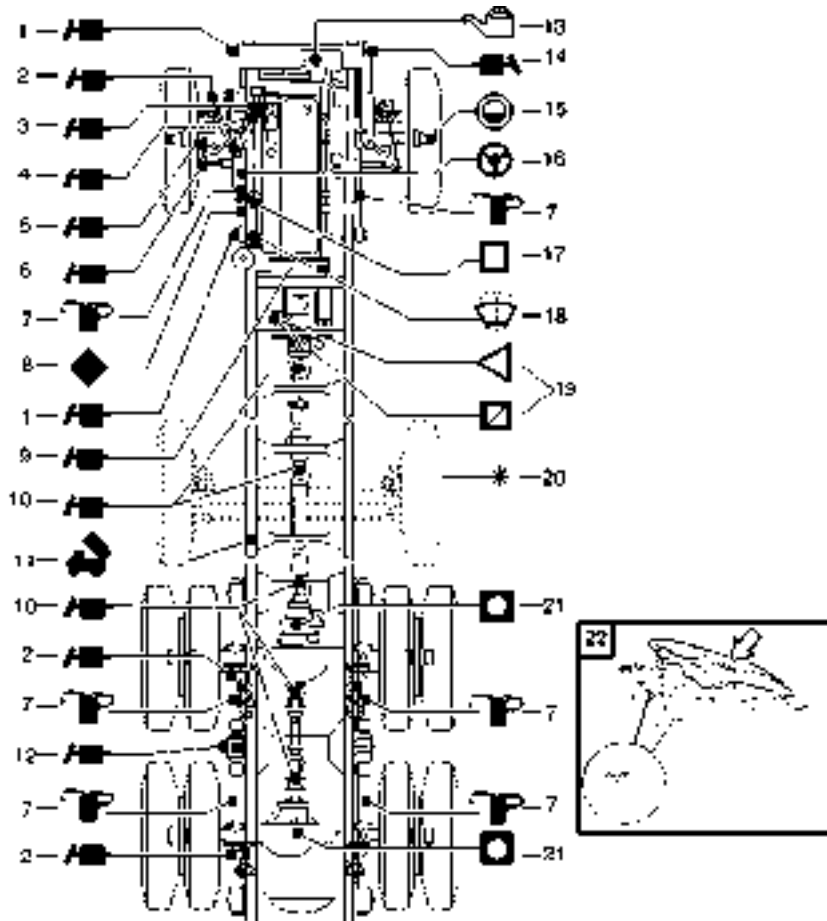
Lubrication Procedure

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

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.

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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 Notes", page 122.



Grease



Coolant



Hub Oil



Automatic
Transmission Fluid
Man. Transm. Oil



Engine Oil



Rear Axle Oil



Hydraulic Oil



Brake Fluid



Steering Fluid



Auxiliary
axle(s)
Lubricate



Windshield washer
fluid level
Dump body oil
reservoir level



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Lubrication 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 MACK front axle with the wheels on the ground.

Note: To grease non-MACK 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:**

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 MACK front axle with the wheels on the ground.

Note: To grease non-MACK 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: MACK 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 cables and air reservoir:** Not applicable for Australia.

- 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 VCS coolant.
- 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):** The proper oil type is dependant on operating conditions. Oil change interval maximum is: 12 months or 160000 Km (99,500 miles) depending on operating conditions or if the hub is opened.

- 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 miles). Change filter every year.

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

- 18 **Windshield washer fluid level.**

- 19 **Automatic and manual transmission:**
Automatic transmission: 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.

M-Drive transmission: With the vehicle level, the oil should be between the maximum and minimum levels on the sight glass. Only use MACK approved oils.

- 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 for Oil Types.

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

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Note: A heavy coating of grease is recommended on the fifth wheel plate by using the grease gun or a putty knife by direct application to the top of the plate.

Due to different manufactures of 5th wheels and models, some 5th wheels may not have grease fittings.

Use a lithium based grease with specification API NLGI No. 2 on tracks and moving components.

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.

MP8 Euro 3 (Export) and Euro 5 Engines

Use the information in the following tables to determine the operating condition and usage applicable to your vehicle.

Euro 3 & Euro 5 Powertrain Operating Conditions (POC)															
Transport Cycle	Long Distance							Distribution			Construction ¹				
								Regional							City
GCW	≤44		45-70		71-80		≥80	≤32	33-44	45-70	≤32	≤32	33-34	45- 80	>80
Topography	PF	H	PF	H	PF	H						H	H	H	VH
POC	L ^{2,3}	M ³	H ³	S ³	S ³	VS	VS	M	H	S	S	H	S	VS	

¹ Examples include sugar cane, tipper, dumper, swap carrier, concrete mixer and refuse bodies.

² If vehicle speed frequently exceeds 90 km/hour, move to the next higher POC.

³ If the combined PTO (vehicle stationary) and idle time exceeds 25% of total operating time, move to the next higher POC.

Euro 3 Oil Service Intervals						
POC	L	M	H	S	VS	
Max fuel consumption (litres/100 km)	≤33	≤39	≤50	≤64	≤120	—
Oil Quality	Driving Distance (km)/ Time (hours)					
VDS-3/VDS-4	100 000/-	75 000/-	60 000/750	45 000/600	20 000/600 ¹	-/600 ¹
VDS-2	60 000/-	50 000/-	40 000/500	30 000/400	15 000/400 ²	-/400 ²
VDS/Other	30 00/-	25 000/-	20 000/250	15 000/200	10 000/200 ³	-/200 ³
For waste collection, mine operation, airport services, etc., engine hours (hours) can be used instead.						
¹ Max permitted fuel to be used between each engine oil change is 25 000 litres. ² Max permitted fuel to be used between each engine oil change is 16 000 litres. ³ Max permitted fuel to be used between each engine oil change is 8 000 litres.						

Euro 5 Oil Service Intervals

POC	L	M	H	S	VS	
Max fuel consumption (litres/100km)	≤33	≤39	≤50	≤64	≤120	–
Oil Quality	Driving distance (km)/ Time (hours)					
VDS-4	100 000/-	75 000/-	60 000/750	45 000/600	20 000/600 ¹	-/600 ¹
VDS-3	80 000/-	60 000/-	40 000/500	30 000/400	15 000/400 ²	-/400 ²
For waste collection, mine operation, airport services, etc., engine hours (hours) can be used instead.						
¹ Max permitted fuel to be used between each engine oil change is 25 000 litres. ² Max permitted fuel to be used between each engine oil change is 16 000 litres.						

Mack Manual Transmission Oil



CAUTION

Drained manual transmission oil must NEVER BE REUSED and must be replaced along with the transmission oil filter.

Use only mineral or synthetic transmission oil approved by MACK Trucks Australia in the T300 series of manual transmissions. The capacity of the transmission ranges from 9.5 liters (20 US qts.) to 14.2 liters (30 US qts.), depending on the specific T300 transmission model and the number of gears used. At this time, GO-J, GO-J PLUS and TO-A PLUS specification oils are acceptable transmission oil types. However, either GO-J PLUS SYNTHETIC or TO-A PLUS SYNTHETIC is required for extended oil change intervals.

Recommended SAE Grades (All Temperatures, All Manual Transmissions)		
GO-J and GO-J PLUS – Mineral Base	GO-J and GO-J PLUS – Synthetic Base	TO-A PLUS – Mineral or Synthetic Base
SAE 80W-90, 80W-140, 85W-140	SAE 75W-90, 75W-140, 80W-140	SAE 50

Manual Transmission Oil Change Interval

The length of time a manual transmission can operate before a transmission oil change is required depends on the quality of the oil used, the vehicle usage, and engine size. For severe service or off-highway applications, more frequent oil changes may be necessary.

The following table shows recommended manual transmission oil change intervals:

Highway Use – Standard	120 000 km (75,000 miles) or 12 months, whichever comes first
Highway Use – Extended	400 000 km (250,000 miles) or 36 months, whichever comes first
Very Severe Vocational Use – Standard	64 000 km (40,000 miles) or 12 months or 1,200 hours, whichever comes first
Very Severe Vocational Use – Extended	128 000 km (80,000 miles) or 12 months or 1,200 hours, whichever comes first

Note: Extended change intervals require the use of either GO-J PLUS SYNTHETIC or TO-A PLUS SYNTHETIC spec oil.

Mack Rear Axle, Lubrication

Rear Axles With Front-Mounted Carriers



CAUTION

Add rear axle oil or drain and refill while the axles are hot. DO NOT overfill.

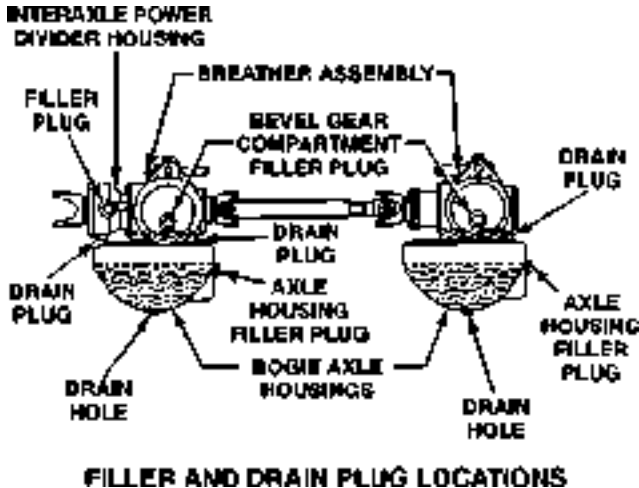
To drain and refill rear axles with front-mounted carriers, first get the axles to operating temperature and park the vehicle on a level surface. Then, remove the magnetic drain plug and drain the oil from the housing. Clean and reinstall the drain plug. Remove the filler plug and fill the housing with recommended oil until it is level with the bottom of the filler plug hole. Install the filler plug.

Rear Axles With Top-Mounted Carriers

To drain and refill rear axles with top-mounted carriers, first get the axles to operating temperature and park the vehicle on a level surface. Remove the magnetic drain plugs from the interaxle power divider on the front carrier (if equipped), the carrier bevel gear compartment(s) and the axle housing(s) and allow the oil to drain. Clean and reinstall the drain plugs. Remove the filler plug from the interaxle power divider (if equipped) and add 1 pint (1.5 pints for CRD200 carriers) of recommended oil. Install the filler plug. Next, remove the filler plugs from the bevel gear compartment(s) and fill with recommended oil until it is level with the bottom of the filler plug hole. Install the filler plug(s). Then, remove the filler plugs from the axle housing(s) and fill with recommended oil until it is level with the bottom of the filler plug hole. Install the filler plug(s). If the axle is equipped with an elbow fitting in the axle housing fill plug hole, the easiest method for filling the housing is by removing the breather fitting from the right-hand side of the carrier and the fill plug from the elbow fitting. Fill the housing through the breather hole until the oil begins to run out the elbow fitting. Reinstall the breather fitting and the fill plug in the elbow fitting.

Note: An oil trough with magnetic strips is attached to the inside of the bevel gear compartment cover. Clean this magnetic strip each time the rear axle oil is changed or when the cover is removed.

Note: Clean the carrier housing breather(s) with a recommended solvent and blow dry with compressed air each time the rear axle oil is changed.



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Typical Rear Axle Filler and Drain Plug
Locations

Checking Rear Axle Oil Levels

To check the oil level in rear axles having top-mounted carriers, first get the axles to operating temperature and park the vehicle on a level surface. Remove the fill/level plugs from the axle housings and the bevel gear compartments. The oil level is correct when oil runs out of the fill plug hole in the axle housing and slightly below the fill plug hole in the bevel gear compartment. On axle housings with the elbow fitting in the axle housing fill hole, the oil level must be to the top of the elbow fitting. If needed, add oil to the axle housing and bevel gear compartment until the oil level reaches the lower edge of the fill plug holes. Reinstall the fill plugs.

Note: It is not necessary to check the oil level in the interaxle power divider. If the oil level is correct in the carrier, the level in the interaxle power divider is sufficient.

For more information on the rear axle, refer to the Service Information in Group 4 and appropriate vendor literature.

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Rear Axle Oil Change Intervals

GO-J and GO-J PLUS specification gear oil (mineral or synthetic base) are required for MACK rear axle lubrication. The length of time a rear axle can operate before an oil change is required depends on the quality of the oil used and the engine used. For severe service or off-highway applications, more frequent oil changes may be necessary. GO-J is used for standard axle drain intervals while GO-J PLUS SYNTHETIC **must** be used for extended axle drain intervals.

The following table shows recommended rear axle oil change intervals:

Highway Use – Standard	120 000 km or 12 months, whichever comes first
Highway Use – Extended	400 000 km or 36 months, whichever comes first
Very Severe Vocational Use – Standard	64 000 km or 12 months or 1,200 hours, whichever comes first
Very Severe Vocational Use – Extended	128 000 km or 12 months or 1,200 hours, whichever comes first

Note: GO-J PLUS MUST be used for extended axle drain intervals.

Rear Axle Oil Viscosity

The following chart indicates the recommended rear axle oil weights.

Recommended SAE Grades for Rear Axles	
GO-J and GO-J PLUS – Mineral Base	GO-J and GO-J PLUS – Synthetic Base
SAE 80W-90, 80W-140, 85W-140	SAE 75W-90, 75W-140, 80W-140

Rear Axle Oil Capacity

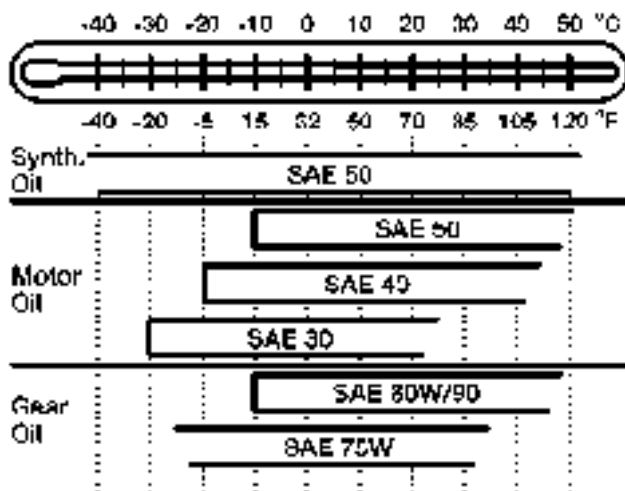
MACK rear axle capacity ranges from 16.1 liters (34 US pints) to 17 liters (36 US pints), depending on the axle model.

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)

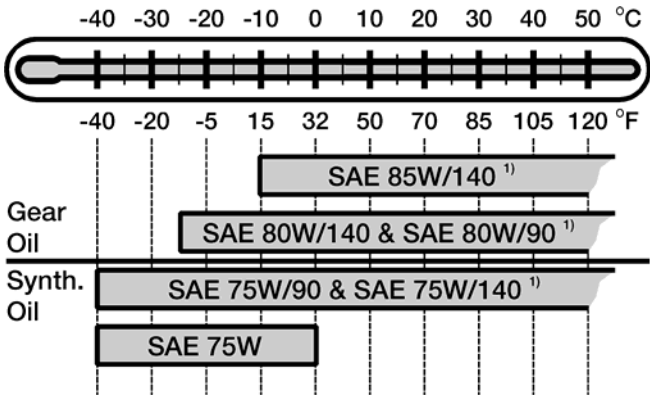


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Meritor Single RS23, 25, 26 and 30, Meritor Tandem RT40, 44 and 46

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)



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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,
and 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 III
Change interval	Every 240 000 Km (150,000 miles) or every 12 months

CUSTOMER SERVICE

Questions and Complaints

Your satisfaction is our most important concern.

If questions or complaints arise, first discuss the matter with the service manager at the MACK facility involved. If you are not satisfied with the service manager's response, contact the branch manager, principal or general manager of the distributorship. If assistance is required at a service dealer, contact the owner of the establishment.

If, for any reason, you need further assistance after dealing with the personnel at a MACK subsidiary or distributor, contact the regional service manager at the nearest MACK regional service office. The regional service manager has the responsibility and the authority to recommend action in most cases and will make every effort to conduct a fair review of the situation.

Addresses

The addresses, telephone and fax numbers of the MACK Trucks, Inc. regional offices:

Australia

MACK Trucks – 20 Westgate St., Wacol QLD 4076

Mail: PO Box 1047, Sumner Park, QLD 4074

