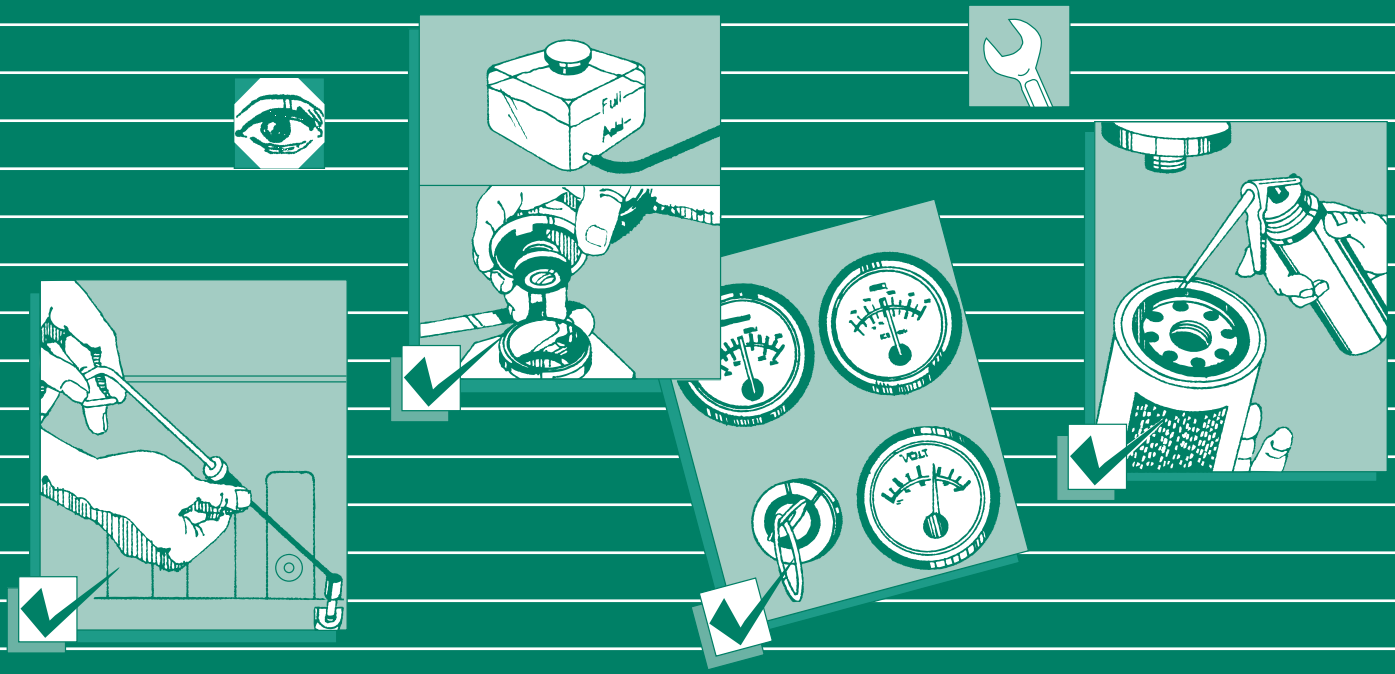
Owners Manual
B6.7 CM2450 B155B



CALIFORNIA
Proposition 65

⚠ **WARNING**: Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to www.P65warnings.ca.gov/diesel.

Off-Road Equipment

CALIFORNIA
Proposition 65 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.

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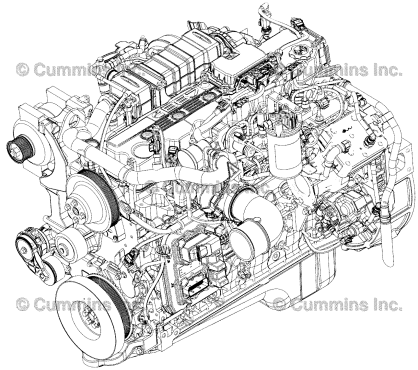

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Foreword

Thank you for depending on Cummins® products. If you have any questions about this product, please contact your Cummins® Authorized Repair Location. You can also visit cumminsengines.com or quickserve.cummins.com for more information, or go to locator.cummins.com for Cummins® distributor and dealer locations and contact information.

Read and follow all safety instructions. See the General Safety Instructions in Section i - Introduction.

Table of Contents

Important Reference Numbers

Fill in the blank spaces provided below. This will provide a reference whenever service or maintenance is required.

Description	Number	Comments/Additional Information
Engine		
Engine Model		
Engine Serial Number (ESN)		
Control Parts List (CPL)		
Electronic Control Module (ECM) Part Number(s)		
Electronic Control Module (ECM) Serial Number(s)		
Governor Control Module (GCM) (if applicable)		
Belt Part Number(s)		
Filter Part Numbers:		
Air		
Lubricating Oil		
Fuel*		
Fuel (Water Separator)		
Coolant (if equipped)		
Crankcase/Breather (if equipped)		

Description	Number	Comments/Additional Information
Eliminator™ Filter Centrifuge (if equipped)		
*The number of fuel filters may vary by application. Record all fuel filters.		
Aftertreatment (if applicable):		
Aftertreatment Diesel Particulate Filter (if equipped)		
Aftertreatment Diesel Exhaust Fluid Dosing Unit Filter (if equipped)		
Aftertreatment Diesel Exhaust Fluid Dosing Air Oil Separator (if equipped)		
Clutch or Marine Gear (if applicable):		
Model		
Serial Number		
Part Number		
Oil Type		
Sea Water Pump:		
Model		
Part Number		

Section i - Introduction

Section Contents

To the Owner and Operator

General Information

This guide contains information for the correct operation and maintenance of your Cummins® product. This manual also includes important safety information which can be found in Section i - Introduction.

Cummins Inc. will claim all emissions credits authorized by EPA, CARB, or CARB-adopting state regulations for sale of our engines. This may result in products being ineligible for purchase using certain grant or incentive funding ("voluntary purchase incentive program(s)"). Purchasers and users of products are solely responsible for ensuring their compliance with the terms of any voluntary purchase incentive program(s).

Thank you for depending on Cummins® products. If you have any questions about this product, please contact your local Cummins® Authorized Repair Location. To locate a Cummins® Authorized Repair Location, refer to Section S - Service Assistance in this manual.

About the Manual

General Information

Cummins Inc. manuals are created to support Cummins® products. For information on components or fault codes not supplied by Cummins Inc., contact the original equipment manufacturer or supplier.

The content of this manual is based on the information in effect at the time of publish. Cummins Inc. reserves the right to make any changes at any time without obligation. If differences are found between your engine and the information in this manual, contact a Cummins® Authorized Repair Location.

About

Cummins® manuals are divided into sections. Each section consists of procedures which are associated with the title of the section.

When viewing a manual online, the sections of the manual are displayed to the left of the procedure display. If a section is selected, the section will expand to show the procedures within that section. To view a procedure, select the procedure title.

When viewing a printed manual, the table of contents provides the list of sections and their subsequent procedures, with page numbers located to the right.

Symbols

General Information

The symbols are used **only** in printed manuals to help communicate the intent of the instructions. Symbols will **not** appear in the online version of this procedure. When one of the symbols appears in the printed manual, the symbol conveys the meaning defined below.

Four symbols are possible for each text and graphic combination.

⚠ WARNING ⚠
Serious personal injury or extensive property damage can result if the warning instructions are not followed.

⚠CAUTION⚠
Minor personal injury can result or a part, and assembly, or the engine can be damaged if the caution instructions are not followed.

Indicates a **REMOVAL** or **Dissassembly** step.

Indicates an **INSTALLATION** or **ASSEMBLY** step.

INSPECTION is required.

CLEAN the part or assembly.

PERFORM a mechanical or time **MEASUREMENT**.

LUBRICATE the part or assembly.

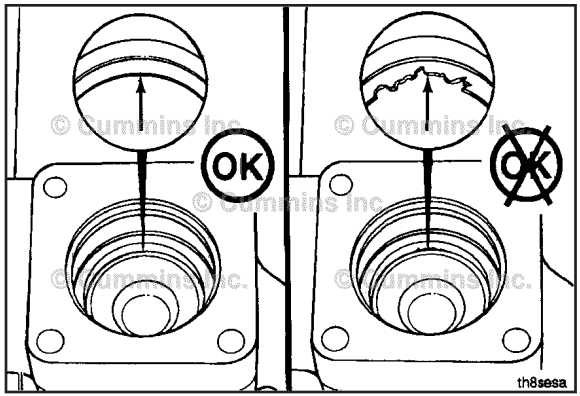
Indicates that a **WRENCH** or **TOOL SIZE** will be given.

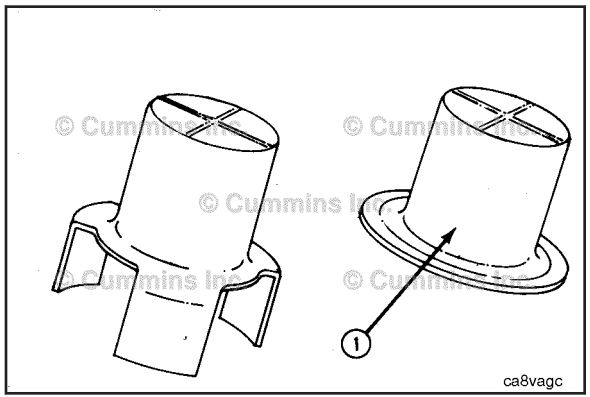
TIGHTEN to a specific torque.

PERFORM an electrical **MEASUREMENT**.

Refer to another location in this manual or another publication for additional information.

The component weighs 23kg [50 lb] or more. To reduce the possibility of personal injury, use a hoist or get assistance to lift the component.





Illustrations

General Information

Some of the illustrations throughout this manual are generic and will **not** look exactly like the engine or parts used in your application. The illustrations can contain symbols to indicate an action required and an acceptable or **not** acceptable condition.

The illustrations are intended to show repair or replacement procedures. The procedure will be the same for all applications, although the illustration can differ.

General Safety Instructions

Important Safety Notice

Read and understand the safety information and precautions before performing any repair or operating equipment. This procedure contains general safety precautions that **must** be followed to provide personal safety. **Always** follow procedures to mitigate safety concerns.

Work Environment

Follow these recommended practices when servicing products.

- **Always** follow on-site safety requirements.
- **Always** follow local training, certification, authorization, and specific customer requirements. Do **not** work on products unless proper training has been completed to allow safe repair completion. Do **not** operate equipment unless proper training has been completed to allow safe operation.
- Work in a well-ventilated area away from ignition sources.
- If adverse weather conditions are present, take appropriate safety precautions when performing work.
- **Always** be aware of hazardous conditions that can exist in the work environment.

Best Practices

Follow these recommended practices when servicing or operating equipment.

- **Always** wear protective glasses and protective shoes.
- Remove rings, watches, long jewelry, or metallic items.

- Do **not** wear loose fitting or torn clothing, jewelry, long hair, and so forth. These increase the risk for personal injury.
- Do **not** perform any repairs, or operate equipment, when fatigued or impaired due to drugs or alcohol.
- **Always** use tools that are in good condition.
- Do **not** work on equipment with the key switch ON or that is running unless otherwise directed by troubleshooting procedures.
- If any work **must** be performed while the key switch is ON or the unit is running, use extreme caution around hot components, moving parts, and so forth.
- Exercise caution when working on products that have just been turned off. Hot parts can cause burns or ignite or melt common materials.
- Do **not** bleed the fuel system of a hot engine. Contact with hot manifolds or other components can cause a fire.
- Do **not** attempt to rotate the crankshaft by pulling or prying on the fan. **Only** use proper engine barring techniques.
- Do **not** lift components that weigh 23 kg [50 lb] or more. Use mechanical help or seek assistance.
- Exercise caution when working around rotating parts. Rotating parts can cause cuts, mutilation, or strangulation.
- Exercise caution when working on electrical components. High voltages can cause serious injury or death.
- Relieve system pressure as instructed before removing or disconnecting lines, fittings, or related items.
- **Always** test for pressure leaks as instructed.
- **Always** torque fittings and connections to the required specifications. Over or under tightening can damage threads and create leaks.
- **Always** use the same fastener part number, or equivalent, when replacing fasteners.

Perform the following prior to beginning work on any products.

- Shutdown the equipment unless otherwise directed by troubleshooting procedures.
- **Always** allow the product to cool.
- **Always** support the product by blocks or stands. Do **not** work on a product supported **only** by lifting jacks or hoists.
- Disconnect the battery unless otherwise directed by troubleshooting procedures.
- Disconnect the starting motor, if equipped, unless otherwise directed by troubleshooting procedures.
- Place a "Do **Not** Operate" tag in the operator area or near the product controls.
- Become familiar with the tools required for performing the task at hand and how to use those tools correctly.
- Use only genuine Cummins or Cummins Recon replacement parts as instructed.

Personal Protective Equipment (PPE)

To reduce the possibility of personal injury, personal protective equipment (PPE) is recommended to be utilized. Various types of PPE are listed below. Use proper judgment to determine which types of PPE are required for a given task. **Always** meet on-site safety regulations for required PPE. Proper maintenance of safety equipment **must** be practiced. Integrity of safety equipment **must** be checked to verify equipment functionality is maintained.

Eye Protection

Always wear eye protection. Wear appropriate eye protection based on the task being completed. Types of eye protection to consider are listed below.

- Safety glasses. Exposure to flying particles or debris, chemicals or caustic liquids, gases or vapors.
- Polarized safety glasses. Working in outdoor or bright lighting environments.

- Over-the-glass safety glasses. Add protection to prescription glasses.
- Safety goggles. Handling caustic liquids or chemicals.
- Shade or arc rated eyewear. Exposure to welding. Use appropriate filter ratings.

Foot Protection

Always wear protective shoes. Wear appropriate foot protection based on the task being completed. Types of protective footwear to consider are listed below.

- Steel toed shoes. Exposure to falling or rolling objects. Working with or around parts, tools, and equipment.
- Chemical resistant. Exposure to chemicals and other fluids.
- Overshoes and overboots. Add protection to everyday work shoes.
- Foot, toe, and metatarsal guards. Add protection to everyday work shoes.
- Electrical hazard safety toe shoes. Exposure to electrical hazards.
- Leather footwear or shoe protectors. Exposure to welding or arc flash.
- Cold protection. Exposure to cold weather.

Head and Face Protection

Wear appropriate face protection based on the task being completed. Types of head and face protection to consider are listed below.

- Hard hats. Exposure varies. Consider welding, heat, or arc-rated.
- Visors. Exposure varies. Consider welding, heat, or arc-rated.
- Face liners. Exposure to cold weather.
- Face shields. Exposure to liquid splash. Handling caustic liquids or chemicals.

Hand Protection

Wear appropriate type and fit of gloves based on the task being completed. Types of protective gloves to consider are listed below.

- Heat resistant or insulated. Exposure to hot items.
- Flame resistant. Exposure to welding or arc flash.
- Impact resistant. Performing repetitive impact and vibration work. Using pneumatic tools.
- Impervious. Exposure to high pressure fluids.
- Chemical resistant. Exposure to chemicals, fluids, or batteries.
- Cut resistant. Handling sharp objects or tools.
- Cold weather. Exposure to cold weather.

Hearing Protection

When working around operating equipment, appropriately rated hearing protection is recommended to be worn. Types of hearing protection to consider are listed below.

- Single use ear plugs.
- Pre-formed ear plugs.
- Ear muffs.

Protective Clothing

Wear appropriate protective clothing based on the task being completed. Types of protective clothing to consider are listed below.

- Flame resistant. Exposure to electrical hazards. Exposure to oil and gas or generator set applications. Performing welding.
- Chemical resistant. Exposure to chemicals.
- High visibility. Exposure to reduced visibility working environments. Working on mining, oil and gas, or sites with large equipment.

Respiratory Protection

Wear appropriate respiratory protection based on the task being completed. Types of respiratory protection to consider are listed below.

- Disposable respirators. Exposure to dust and particles, welding fumes, nuisance odors, nuisance level acid gas.
- Reusable respirators. Exposure to cleaning, machining, welding, sanding, grinding, and so forth.

Fall Protection

Utilize fall protection if a task is being completed more than 1.2 m [4 ft] above a solid surface. Types of fall protection to consider are listed below.

- Fall harness and lanyard combinations.
- Safety nets.
- Guardrails.

Fuels

Follow these recommended practices when interacting with equipment that uses different fuel types. For information regarding proper handling of various substances, refer to the manufacturer's safety data sheet.

Diesel Fuel

- Protect eyes.
- Protect skin.
- **Always** test for fuel leaks as instructed.
- Do **not** dilute.
- Avoid sparks, arcing switches and equipment, cigarettes, pilot lights, flames, and other sources of ignition.
- Provide extra ventilation to the work area.
- Do **not** troubleshoot or repair fuel leaks while the engine is running.
- If material is spilled, avoid contact and dispersal with runoff, soil, waterways, drains, and sewers. Absorb with sand, clay, or commercial absorbent. Transfer to containers and neutralize the material. Flush spill area with soap and excess water.
- Report spills effecting water source contamination to local authorities immediately.
- Proper disposal is required. Dispose of in accordance with local and environmental regulations.
- **Always** torque fittings and connections to the required specifications. over or under tightening can damage threads and create leaks.

Gasoline

- Protect eyes.
- Protect skin.
- **Always** be alert for the smell of gas.
- **Always** test for fuel leaks as instructed.
- Do **not** dilute.

- Avoid sparks, arcing switches and equipment, cigarettes, pilot lights, flames, and other sources of ignition.
- Vapors accumulate near the floor. Check the work floor, sumps, and low lying areas for ignition sources before servicing equipment.
- Provide extra ventilation to the work area.
- Do **not** troubleshoot or repair fuel leaks while the engine is running.
- If material is spilled, avoid contact and dispersal with runoff, soil, waterways, drains, and sewers. Absorb with sand, clay, or commercial absorbent. Transfer to containers and neutralize the material. Flush spill area with soap and excess water.
- Report spills effecting water source contamination to local authorities immediately.
- Proper disposal is required. Dispose of in accordance with local and environmental regulations.
- **Always** torque fittings and connections to the required specifications. over or under tightening can damage threads and create leaks.

Biodiesel

- Protect eyes.
- Protect skin.
- **Always** test for fuel leaks as instructed.
- Do **not** dilute.
- Avoid sparks, arcing switches and equipment, cigarettes, pilot lights, flames, and other sources of ignition.
- Vapors accumulate near the floor. Check the work floor, sumps, and low lying areas for ignition sources before servicing equipment.
- Provide extra ventilation to the work area

- Do **not** troubleshoot or repair fuel leaks while the engine is running.
- If material is spilled, avoid contact and dispersal with runoff, soil, waterways, drains, and sewers. Absorb with sand, clay, or commercial absorbent. Transfer to containers and neutralize the material. Flush spill area with soap and excess water.
- Report spills effecting water source contamination to local authorities immediately.
- Proper disposal is required. Dispose of in accordance with local and environmental regulations.
- **Always** torque fittings and connections to the required specifications. over or under tightening can damage threads and create leaks.

Compressed Natural Gas

- Protect eyes.
- Protect skin.
- **Always** be alert for the smell of gas. Compressed natural gas is typically treated with an odor producing chemical for leak detection. Non-refined sources of natural gas (landfill gas, biogas, coal bed gas, wellhead gas, and so forth) can **not** be detected by smell **always**.
- **Always** test for fuel leaks as instructed. Odorant can fade.
- Upon entering a room or approaching a vehicle where the smell of gas is present, immediately shutoff all engines and ignition sources.
- Natural gas ignites when a 5% - 15% mixture is in the air. Asphyxiation can occur when concentration reaches 21% or more.
- Do **not** start equipment or nearby equipment until a suspected gas leak is corrected and the area is ventilated.
- Avoid sparks, arcing switches and equipment, cigarettes, pilot lights, flames, and other sources of ignition.

- Work in areas that do **not** share common ventilation with areas containing ignition sources.
- Store and service natural gas fueled equipment in large, well-ventilated areas, or outside.
- Provide extra ventilation to the work area.
- Natural gas accumulates near the ceiling. Check the ceiling of the work area for ignition sources before servicing equipment.
- **Only** disconnect gas lines in a well-ventilated area.
- Do **not** troubleshoot or repair gas leaks while the engine is running.
- Natural gas ignition systems produce high voltage during operation. Do **not** touch ignition wiring or components while the engine is operating. If necessary, use **only** insulated tools.
- Natural gas exhaust systems operate at higher temperatures than similar diesel exhaust systems. Do **not** touch exhaust components. Do **not** route lines or hoses which deteriorate from heat exposure near exhaust components or in the flow path of the exhaust.
- **Always** torque fittings and connections to the required specifications. over or under tightening can damage threads and create leaks.

Liquefied Natural Gas

- Protect eyes.
- Protect skin.
- **Always** be alert for the smell of gas. Liquefied natural gas might **not** have an odor. Non-refined sources of natural gas (landfill gas, biogas, coal bed gas, wellhead gas, and so forth) can **not** be detected by smell **always**.
- **Always** test for fuel leaks as instructed. Odorant can fade.

- Upon entering a room or approaching a vehicle where the smell of gas is present, immediately shutoff all engines and ignition sources.
- Natural gas ignites when a 5% - 15% mixture is in the air. Asphyxiation can occur when concentration reaches 21% or more.
- Do **not** start equipment or nearby equipment until a suspected gas leak is corrected and the area is ventilated.
- Avoid sparks, arcing switches and equipment, cigarettes, pilot lights, flames, and other sources of ignition.
- Work in areas that do **not** share common ventilation with areas containing ignition sources.
- Store and service natural gas fueled equipment in large, well-ventilated areas, or outside.
- Provide extra ventilation to the work area.
- Natural gas accumulates near the ceiling. Check the ceiling of the work area for ignition sources before servicing equipment.
- **Only** disconnect gas lines in a well-ventilated area.
- Do **not** troubleshoot or repair gas leaks while the engine is running.
- Natural gas ignition systems produce high voltage during operation. Do **not** touch ignition wiring or components while the engine is operating. If necessary, use **only** insulated tools.
- Natural gas exhaust systems operate at higher temperatures than similar diesel exhaust systems. Do **not** touch exhaust components. Do **not** route lines or hoses which deteriorate from heat exposure near exhaust components or in the flow path of the exhaust.
- Liquefied natural gas is stored in vehicle tanks at extremely cold temperatures. If a liquefied natural gas spill occurs, evacuate the area immediately and do **not** attempt to make contact with the liquid.
- **Always** torque fittings and connections to the required specifications. over or under tightening can damage threads and create leaks.

- Vapors accumulate near the floor. Check the work floor, sumps, and low lying areas for ignition sources before servicing equipment.

Liquefied Petroleum Gas

- Protect eyes.
- Protect skin.
- **Always** be alert for the smell of gas. Liquefied petroleum gas is typically treated with an odor producing chemical for leak detection.
- **Always** test for fuel leaks as instructed. Odorant can fade.
- Upon entering a room or approaching a vehicle where the smell of gas is present, immediately shutoff all engines and ignition sources.
- Do **not** start equipment or nearby equipment until a suspected gas leak is corrected and the area is ventilated.
- Avoid sparks, arcing switches and equipment, cigarettes, pilot lights, flames, and other sources of ignition.
- Work in areas that do **not** share common ventilation with areas containing ignition sources.
- Store and service natural gas fueled equipment in large, well-ventilated areas, or outside.
- Provide extra ventilation to the work area.
- Liquefied petroleum gas accumulates near the floor. Check the work floor, sumps, and low lying areas for ignition sources before servicing equipment.
- **Only** disconnect gas lines in a well-ventilated area.
- Do **not** troubleshoot or repair gas leaks while the engine is running.
- Liquefied petroleum gas ignition systems produce high voltage during operation. Do **not** touch ignition wiring or components while the engine is operating. If necessary, use **only** insulated tools.

- Liquefied petroleum gas exhaust systems operate at higher temperatures than similar diesel exhaust systems. Do **not** touch exhaust components. Do **not** route lines or hoses which deteriorate from heat exposure near exhaust components or in the flow path of the exhaust.
- Liquefied natural gas is stored in vehicle tanks at extremely cold temperatures. If a liquefied natural gas spill occurs, evacuate the area immediately and do **not** attempt to make contact with the liquid.
- **Always** torque fittings and connections to the required specifications. over or under tightening can damage threads and create leaks.

Power Generation Applications

Follow these recommended practices when interacting with equipment in generator set applications.

Power generation applications produce high voltage during operation. When servicing a generator set, the following safety precautions **must** be taken.

- Remove any debris from the generator set.
- Keep the floor clean and dry throughout servicing
- Service access doors **must** be secured in the "open" position before working on enclosed generator sets.
- Use insulated or non-conducting tools.
- Prevent accidental or remote starting. Disconnect the starting battery cables. Disconnect the negative (-) terminal first.
- Isolate all auxiliary supplies.
- Switch the generator set control panel "off."
- Place a "Do **Not** Operate" tag on the control panel.

- Lock the generator set circuit breaker in the "Open" position.
- Activate the manual "Emergency Stop" device.
- Do **not** step on the generator set when servicing, entering, or leaving the generator room.

Aftertreatment

Follow these recommended practices when interacting with equipment that utilize aftertreatment systems. For information regarding proper handling of various substances, refer to the manufacturer's safety data sheet.

Diesel Exhaust Fluid

- Avoid breathing vapor or mist.
- Protect eyes. In case of contact with eyes, flush with water for a minimum of 15 minutes.
- Protect skin. In case of contact with skin, wash with soap and water.
- Do **not** ingest. If ingested, contact a physician immediately.

Diesel Particulate Filter

- Protect eyes.
- Protect skin.
- Avoid stirring up exhaust particulate dust.
- Avoid inhalation of exhaust particulate dust. Wear a dust mask. If respiratory irritation or discomfort occurs, leave the dusty area. Utilize breathing assistance or oxygen if necessary.
- Elevated concentrations of metals in the form of dust, soot, and contaminants are contained in these filters. Health regulations can exist for the materials found in these filters such as Zinc, Molybdenum, polynuclear

aromatic hydrocarbons. Potentially toxic materials found in these filters are oxides of calcium, zinc, phosphorous, silicon, sulfur, and iron.

- Proper disposal of the exhaust dust and filter are required. Dispose of in accordance with local and environmental regulations.
- Diesel particulate filter maintenance **must** be completed by appropriately trained personnel.

Selective Catalytic Reduction (SCR) Catalyst

- Protect eyes.
- Protect skin.
- Avoid stirring up exhaust catalyst dust.
- Avoid inhalation of exhaust catalyst dust. Wear a dust mask. If respiratory irritation or discomfort occurs, leave the dusty area. Utilize breathing assistance or oxygen if necessary.
- Do **not** cut open exhaust catalyst assemblies.
- Proper disposal of the exhaust catalyst is required. Dispose of in accordance with local and environmental regulations.

Oxidation Catalysts

Types of Oxidation Catalysts can include, but are **not** limited to the following.

- Diesel Oxidation Catalyst (DOC)
- 3-way Oxidation Catalyst

When working with oxidation catalysts, perform the following.

- Protect eyes.

- Protect skin.
- Avoid stirring up exhaust catalyst dust.
- Avoid inhalation of exhaust catalyst dust. Wear a dust mask. If respiratory irritation or discomfort occurs, leave the dusty area. Utilize breathing assistance or oxygen if necessary.
- Do **not** cut open exhaust catalyst assemblies.

Common Substances

Follow these recommended practices when interacting with the following substances. For information regarding proper handling of various substances, refer to the manufacturer's safety data sheet.

Coolant

- Coolant is also referred to as antifreeze.
- Protect eyes. In case of contact with eyes, flush with water for a minimum of 15 minutes. Receive medical attention immediately.
- Protect skin. In case of contact with skin, wash with soap and water. Remove contaminated clothing. If injection occurs, injection is a medical emergency. Receive medical attention immediately.
- Do **not** ingest. If ingested, drink excess water for dilution and seek medical attention.
- Do **not** pour used antifreeze into containers that have been used to store other chemicals or products, such as oil or gasoline, unless the containers have been thoroughly cleaned.
- If material is spilled, avoid contact and dispersal with runoff, soil, waterways, drains, and sewers. Provide adequate ventilation to the area. Absorb with sand, clay, or commercial absorbent. Transfer to containers and neutralize the material. Flush spill area with soap and excess water.

- Report spills effecting water source contamination to local authorities immediately.
- Proper disposal is required. Dispose of in accordance with local and environmental regulations.

Liquid Nitrogen

- Work in a well-ventilated area.
- Protect eyes. In case of contact with eyes, flush with water for a minimum of 15 minutes. Receive medical attention immediately.
- Protect skin. In case of contact with skin, receive medical attention immediately.
- Wear protective clothing and gloves that insulate.
- Handle items with tongs or wire hooks.
- Avoid prolonged breathing of liquid nitrogen vapors. Utilize breathing assistance or oxygen if necessary.

Lubricating Oil

See Lubricating Oil in the "Hazardous Substances" step.

Refrigerant

- Protect eyes. In case of contact with eyes, flush with water for a minimum of 15 minutes. In case of frostbite, use lukewarm water, **not** hot. Seek medical attention if irritation continues.
- Protect skin. Wear leather or insulated gloves. In case of contact with skin, wash with soap and water. Seek medical attention if irritation continues.
- Proper disposal is required. Dispose of in accordance with local and environmental regulations.
- **Only** disconnect liquid refrigerant lines in a well-ventilated area. liquid refrigerant systems **must** be properly emptied and filled using equipment that prevents the release of refrigerant gas into the atmosphere. Federal law requires capturing and recycling refrigerant in the United States of America.

Solvents

- Follow the manufacturer's instructions for safe handling practices.
- Follow the manufacturer's recommendations for use.
- Some solvents are flammable and toxic..
- Protect eyes. In case of contact with eyes, follow manufacturer's recommendations.
- Protect skin. In case of contact with skin, follow manufacturer's recommendations.
- Dispose of in accordance with manufacturer's recommendations.

Starting Aids (Starting Fluid)

- Do **not** use starting fluid if the intake air heater option is used.
- Do **not** use volatile cold starting aids in underground mine or tunnel operations. The local United States Bureau of Mines inspector can provide more information and instructions.
- Avoid sparks, arcing switches and equipment, cigarettes, pilot lights, flames, and other sources of ignition.
- Work in a well-ventilated area.
- Avoid inhalation.

Hazardous Substances

Hazardous substances are known to some state and federal agencies to be carcinogenic and cause reproductive harm. Hazardous substances that can be encountered during service events are listed below.

Diesel Engine Exhaust

- Protect eyes. In case of contact with eyes, flush with water for a minimum of 15 minutes.

- Protect skin. In case of contact with skin, wash with soap and water.
- Avoid inhalation.

Lubricating Oil

- Protect eyes. In case of contact with eyes, flush with water for a minimum of 15 minutes.
- Protect skin. In case of contact with skin, wash with soap and water.
- Do **not** ingest. If ingested, contact a physician immediately.
- Proper disposal is required. Dispose of in accordance with local and environmental regulations.
- Do **not** allow water droplets to enter a container of hot oil. A violent reaction can result.

Mercury

- Protect eyes. In case of contact with eyes, flush with water for a minimum of 15 minutes.
- Protect skin. In case of contact with skin, wash with soap and water.
- Do **not** ingest. If ingested, contact a physician immediately.
- Proper disposal is required. Dispose of in accordance with local and environmental regulations.

Vanadium Pentoxide

- Can be found in some selective catalytic reduction (SCR) catalysts.
- Protect eyes. In case of contact with eyes, flush with water for a minimum of 15 minutes.
- Protect skin. In case of contact with skin, wash with soap and water.
- Do **not** ingest. If ingested, contact a physician immediately.
- Avoid inhalation of vapors or airborne particles.

- Proper disposal is required. Dispose of in accordance with local and environmental regulations.

Di-Ethyl Hexyl Phthalates (DEHP)

- Can be found in some obsoleted rubber hoses used for fuel, air handling, lubrication and cooling.
- Protect eyes. In case of contact with eyes, flush with water for a minimum of 15 minutes.
- Protect skin. Prolonged contact with human skin' means continuous contact of more than 10 minutes duration or intermittent contact over a period of 30 minutes, per day. In case of contact with skin, wash with soap and water.
- Do **not** ingest. If ingested, contact a physician immediately.
- Proper disposal is required. Dispose of in accordance with local and environmental regulations.

Electrical Components

Follow these recommended practices when interacting with electrical components.

Batteries

- Protect eyes. Wear safety glasses or goggles. In case of battery acid contact with eyes, flush with water for a minimum of 15 minutes. Receive medical attention immediately.
- Protect skin. Wear rubber gloves and a chemical apron. In case of battery acid contact with skin or clothing, rinse with water for several minutes. Avoid spreading the acid. Receive medical attention immediately.
- Do **not** open the battery caps with your face over or near the battery.
- Remove rings, watches, long jewelry, or metallic items when working with or near batteries.
- Ventilate the battery compartment before servicing the battery.
- Work in a well-ventilated area.

- Avoid sparks, arcing switches and equipment, cigarettes, pilot lights, flames, and other sources of ignition.
- Use insulated or non-conducting tools.
- Neutralize static buildup by contacting the nearest ground surface before working on a battery.
- Do **not** lift batteries by the posts.
- Do **not** touch both battery terminals with your bare hands at the same time.
- Disconnect the negative (-) battery cable first.
- Attach the negative (-) battery cable last.

Electronic Sensors, Electronic Control Modules (ECM) and Wiring Harnesses

- Lead (chemical element Pb) can be found in some obsoleted engine electronic components.
- Protect eyes. In case of contact with eyes, flush with water for a minimum of 15 minutes.
- Protect skin. In case of contact with skin, wash with soap and water.
- Do **not** ingest. If ingested, contact a physician immediately.
- Proper disposal is required. Dispose of in accordance with local and environmental regulations.

Common Hazards

Follow these recommended practices when interacting with equipment as the following hazards can exist.

High Temperature Area

Be alert for high temperature areas which can cause severe burns. High temperature areas can be encountered in the following situations.

- On products that have just been turned off.

- On or around exhaust related components (turbocharger, aftertreatment systems, and so forth).
- In exhaust gas flow paths.
- Contacting hot fluid lines, tubes, or compartments.

Recommended Practices:

- Allow components to cool before servicing. Verify the temperature of the component. Utilize an infrared gun, temperature sensor, temperature gauge, or other reliable method to determine component temperature. Take appropriate precautions before starting work.
- Protect eyes.
- Protect skin. Wear insulated gloves.
- Verify surrounding items do **not** come in contact with hot components or exhaust. Contact can ignite or melt those materials.

Heavy Objects

Be alert when working with heavy objects.

- Do **not** lift components that weigh 23 kg [50 lb] or more. Use mechanical help or seek assistance.
- Use mechanical help to move items whenever possible. Verify the load is securely fastened to the equipment.
- Verify lifting devices, like chains, hooks, slings, and so forth, are in good condition and are rated for the correct capacity before use.
- Verify lifting devices are positioned correctly before use.
- Use a spreader bar when necessary.
- If the item can be lifted manually, squat to lift and lower the item. Do **not** bend at the waist.

- Maintain balance when lifting items by keeping feet apart or staggered if possible.
- If the item **must** be carried, verify the path is clear when carrying the item to, and placing the item in, the desired location.

Pressurized Areas

Be alert for pressurized areas. Pressurized areas can be encountered in the following situations.

- Air, Oil, Fuel, and Cooling systems.
- When disconnecting or removing lines, fittings, or related items.
- When disconnecting a device from a pressurized system.
- When removing or loosening caps on tanks or pressurized systems.

Injuries that can result when interacting with pressurized areas are listed below.

- High pressure spray can penetrate the skin. Serious injury or death can result.
- Hot fluid spray can cause burns. See "High Temperature Area."

Recommended Practices:

- Protect skin. Wear impervious gloves. If skin penetration from high pressure spray occurs, penetration is a medical emergency. Receive medical attention immediately.
- Check for pressure leaks as instructed. **Never** check for pressure leaks with your hand.
- Allow product to cool before accessing pressurized areas.
- Relieve system pressure as instructed.
- Slowly loosen fill caps to relieve pressure before servicing.

Job Safety Assessment

Completing a Job Safety Assessment (JSA) prior to performing work helps identify job safety hazards and prevent incidents. Use the guidelines below to assess if a situation is safe or at risk prior to performing designated work. If deteremined to be at risk, take appropriate precautions to prepare for, or eliminate, the hazard. If the risks are uncontrollable, consult a knowledgeable resource to find a safe practice solution. A knowledgeable resource can include, but is **not** limited to, one of the following:

- Site supervisor
- Customer
- Work supervisor

Always check with the site where work is being performed to determine if safety assessment documentation is required.

Work Practices

Job Safety Analysis.

- Assess the job to identify safety hazards that can occur during the repair event.

Ascending or Descending

- Maintain 3 points of contact when using steps, ladders, or entering and exiting a unit.

Communication

- When working with others, understand what each other is doing to safely complete the task.

Eyes On Hands and Work.

- Confirm if you will be able to maintain an unobstructed view of your hands at all times while performing the task.

Eyes On Path

- Watch for hazards in your path to avoid trip or slip hazards. Examples are pits, platform edges, and so forth.

Line Of Fire

- Position yourself so that you avoid striking against, or being struck by, anything that can swing, fall, or roll.

Pinch Point

- Prevent exposure of all parts of your body to a nip hazard or pinch point.

Rushing

- Take adequate time to safely perform the job. Do **not** rush or take short cuts.

Follow Procedures

- Utilize QuickServe® Online or other standard procedures when available.
- Verify the procedures are correct and safe.

Ergonomics

Back-Bending and Twisting

- Avoid bending forward more than 45 at your waist.
- Avoid working with your back twisted with loads over 23 kg [50 lb].

Knee

- Avoid bending your knee more than 90.
- Avoid kneeling for more than 4 hours per day.

Lifting and Lowering

- Squat to pick up parts.
- Keep loads close to the body when lifting or carrying.
- Use a team lift or a lifting device if the object is more than 23 kg [50 lb].

Pulling or Pushing

- Pull with your arms.
- Push with your legs.
- Avoid exerting more force than necessary.
- Avoid moving heavy load(s) too quickly.

Tools and Equipment

Selection

- Select the correct tool or equipment to perform the task.

Condition

- Confirm the tool or equipment is free of defects before use.
- Confirm that safety devices are in place before use.

Use

- Use the tool or equipment as directed.
- Follow the manufacturer's instructions.

Personal Protective Equipment (PPE)

Eye, Face, and Head Protection

- Confirm the eye, face, or head protection you plan to use are adequate for performing the task at hand.

Foot Protection

- Confirm the foot protection you plan to use is adequate for performing the task at hand in the current environment.

Fall Protection

- Fall protection is recommended to be used if you are working more than 1.2 m [4 ft] above the floor.
- Use fall protection if you have been properly trained to do so. If you are **not** trained to use fall protection, allow someone who has received proper training to perform the task.

Hand Protection

- Avoid exposing hands to cuts or burns while completing the task.
- Confirm the proper glove type is being used for the task at hand. Examples are cut-resistant, chemical-resistant, electric shock-resistant, electric arc flash, welding, and so forth.

Hearing Protection

- Hearing protection is recommended to be worn when required or recommended.

Body Protection

- Body parts are recommended to be protected from work hazards.
- Avoid contact with sharp edges, hot surfaces, and so forth.

Work Procedures

Training

- Confirm if you have received task and safety training for the job being performed.

Working Alone

- Avoid working alone.
- Avoid working where you are **not** able to be seen or heard by another person.
- If you **must** work alone, notify others of your location and schedule check-in times.

Lockout and Tagout

- Lock out or tag out energy sources before work. Examples are electrical, mechanical, hydraulic, and pneumatic.

Barricades and Warnings

- Mark overhead work areas with barricade tape or signs.
- Mark open floor hazards with barricade tape, signs, or cones.

Confined Space

- Confirm if a confined space entry permit is required.
- If required, confirm the permit is posted, signed, and dated correctly.

Hot Work

- Confirm a functional fire extinguisher is readily available.
- Maintain separation between ignition sources and fuel sources.

Place Wheel Chocks

- Place wheel chocks at either the front or back tire of the unit prior to starting the task.

Spotter

- Use a spotter when moving a customer's unit.
- Confirm the driver can see and hear the spotter when moving.

Housekeeping (The 5 S's - Scrap or Segregate, Set to Order, Spotless, Standardize, and Sustain)

- Remove parts, extension cords, air hoses, and liquids from the work area that can cause trip, slip, or fall hazards.

Acronyms and Abbreviations

General Information

The following list contains some of the acronyms and abbreviations used in this manual.

ANSI	American National Standards Institute
API	American Petroleum Institute
ASTM	American Society of Testing and Materials
ATDC	After Top Dead Center
bhp	Brake Horsepower
BTU	British Thermal Unit
BTDC	Before Top Dead Center
°C	Celsius
CAN	Controller Area Network
CARB	California Air Resources Board
CCA	Cold Cranking Amperes
CCV	Closed Crankcase Ventilation
CES	Cummins Engineering Standard
CIB	Customer Interface Box
C.I.D.	Cubic Inch Displacement
CNG	Compressed Natural Gas
CO	Carbon Monoxide

CPL	Control Parts List
cSt	Centistokes
DEF	Diesel Exhaust Fluid
DOC	Diesel Oxidation Catalyst
DPF	Diesel Particulate Filter
ECM	Engine Control Module
EFC	Electronic Fuel Control
EGR	Exhaust Gas Recirculation
EPA	Environmental Protection Agency
ESN	Engine Serial Number
°F	Fahrenheit
ft-lb	Foot-Pound Force
FMI	Failure Mode Indentifier
GVW	Gross Vehicle Weight
Hg	Mercury
hp	Horsepower
H_2O	Water
inHg	Inches of Mercury
in H_2 0	Inches of Water
ICM	Ignition Control Module
IEC	International Electrotechnical Commission

JSA	Job Safety Assessment
km/l	Kilometers per Liter
kPa	Kilopascal
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LTA	Low Temperature Aftercooler
MCRS	Modular Common Rail System
MIL	Malfunction Indicator Lamp
MPa	Megapascal
mph	Miles Per Hour
mpq	Miles Per Quart
N•m	Newton-meter
NOx	Nitrogen Oxides
NG	Natural Gas
O2	Oxygen
OAT	Organic Acid Technology
OBD	On-Board Diagnostics
OEM	Original Equipment Manufacturer
OSHA	Occupational Safety and Health Administration
PCCNet	Power Command Control Network
PID	Parameter Identification Descriptions

PPE	Personal Protective Equipment
ppm	Parts Per Million
psi	Pounds Per Square Inch
PTO	Power Takeoff
QSOL	QuickServe® Online
REPTO	Rear Engine Power Takeoff
RGT	Rear Gear Train
rpm	Revolutions Per Minute
SAE	Society of Automotive Engineers
SCA	Supplemental Coolant Additive
SCR	Selective Catalytic Reduction
STC	Step Timing Control
SID	Subsystem Identification Descriptions
TDC	Top Dead Center
TSB	Technical Service Bulletin
ULSD	Ultra Low Sulfur Diesel
VDC	Volts of Direct Current
VGT	Variable Geometry Turbocharger
VS	Variable Speed
VSS	Vehicle Speed Sensor

Notes

Section E - Engine and System Identification

Section Contents

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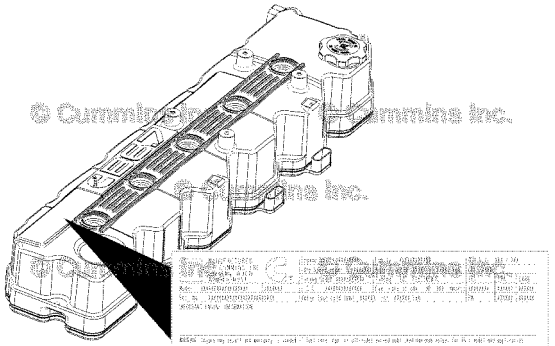
Engine Identification

Engine Dataplate



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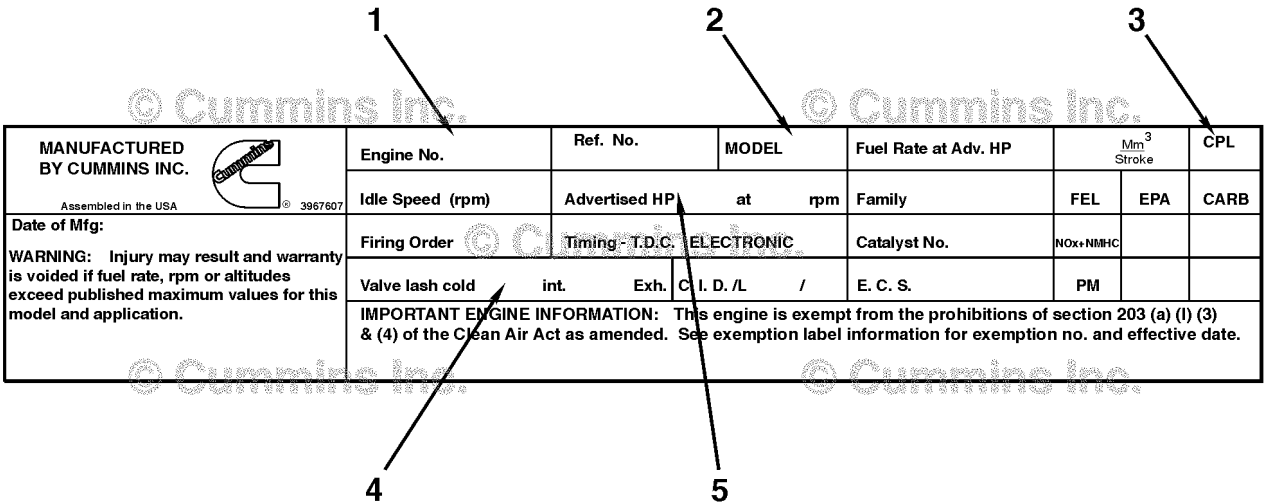
The engine dataplate shows specific facts about an engine. The dataplate is typically located on the engine rocker lever cover, but may also be located on the side of the gear housing. The engine serial number and Control Parts List (CPL) provide data for ordering parts and service. The engine dataplate **must not** be changed unless approved by Cummins Inc.

Have the following engine data available when communicating with a Cummins® Authorized Repair Location. The information on the dataplate is mandatory when sourcing service parts.



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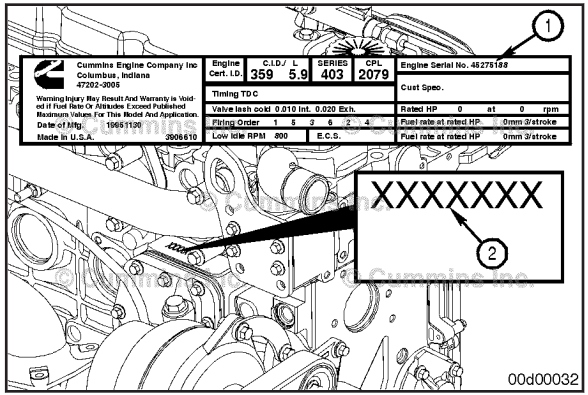
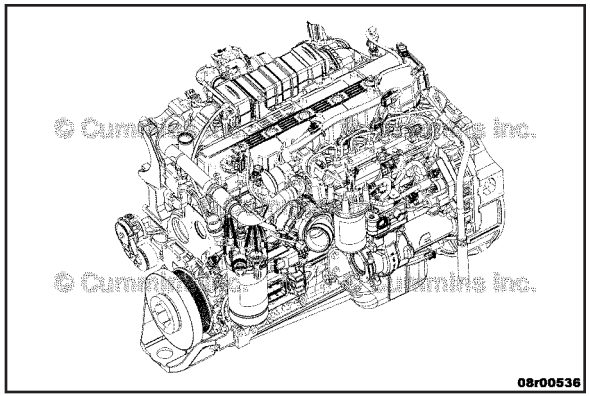
1 Engine serial number
2 Engine model information
3 Control parts list (CPL)

4 Valve lash (overhead) setting

5 Horsepower and rpm rating.

NOTE: If the engine dataplate (1) is **not** legible, the engine serial number (2) can be found on the engine block, on top of the lubricating oil cooler housing. Additional engine information is available by reading the engine control module (ECM) dataplate.

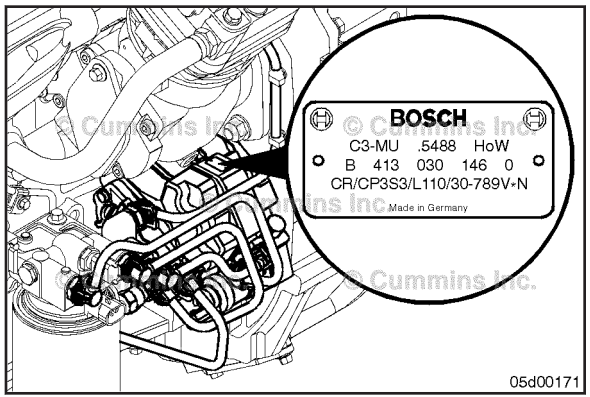




Cummins® Engine Nomenclature

The Cummins® Service Engine Model Identification procedure describes how to use the Cummins® Service Model Name to identify an engine. Refer to Procedure 100-008 in Section E.

The Cummins® Product Technology procedure provides the Cummins® Service Model Name and describes the unique technology used by the engine covered by this manual. Refer to Procedure 100-006 in section E.



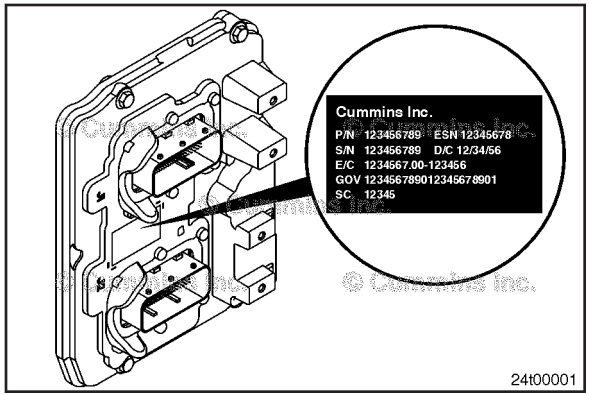
Fuel Injection Pump Dataplate

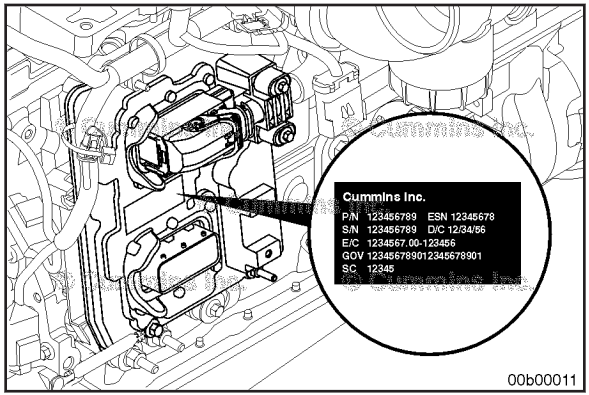
The Bosch™ fuel injection pump dataplate is located on the fuel pump.

The dataplate contains the following information to assist in servicing or replacement:

- Pump serial number
- Cummins® part number
- Factory code
- Bosch™ part number
- Date code.

Engine Control Module Dataplate

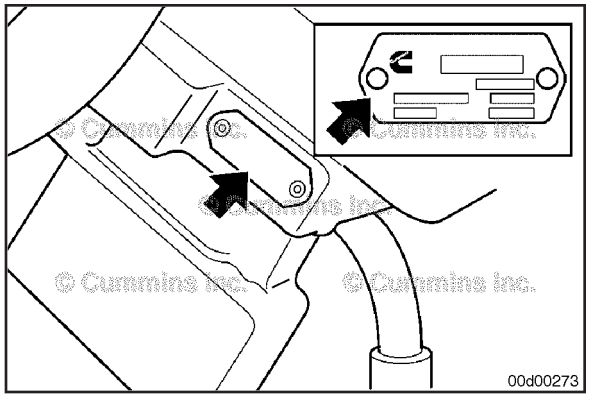




NOTE: Not all engines have ECM dataplates.

Engines covered by this manual are equipped with a CM2450 ECM. A CM2450 ECM has two 96-pin connectors. One of the 96-pin connectors is for inputs and outputs **only**. The second 96-pin connector and the 14-pin connector are for aftertreatment and vehicle inputs and outputs.

NOTE: The presence of an ECM dataplate depends on the manufacturing plant and the date the engine was manufactured. If an ECM dataplate was **not** installed by the manufacturing plant, calibration data can be found on the engine dataplate.



Air Compressor

NOTE: Not all engines are equipped with an air compressor.

The Cummins® branded air compressor dataplate, identified by the Cummins Inc. logo, is typically located on the side of the air compressor. The dataplate contains the following information to assist in servicing or replacement:

- Cummins® part number
- Serial number
- Date code.

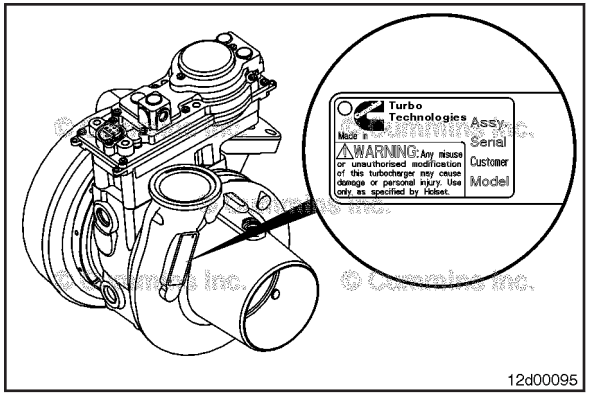
Variable Geometry Turbocharger

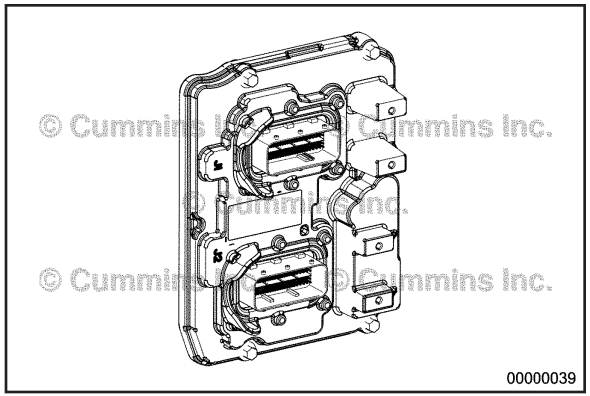
The Holset® variable geometry turbocharger (VGT) dataplate is located on the turbocharger inlet compressor housing.

The dataplate contains the following information to assist in servicing or replacement:

- Cummins® assembly part number
- Serial number
- Customer number
- Model number.

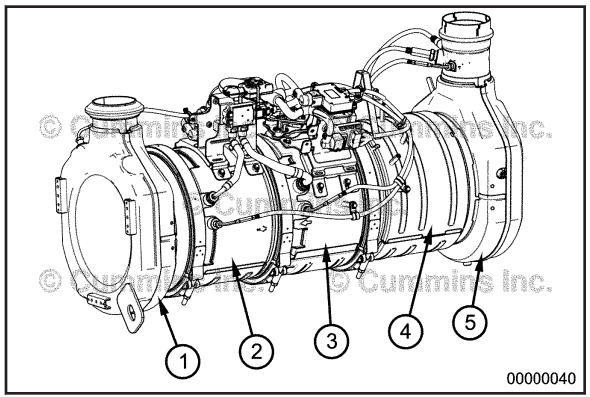
NOTE: The electronic actuator on the VGT is a serviceable component and has a separate dataplate that contains information to assist in servicing or replacement.





Exhaust System

The recommended Cummins® electronic service tool or equivalent can read the aftertreatment assembly part and serial numbers. This information can be found in the Aftertreatment section of the Features and Parameters menu.



The aftertreatment assembly has information laser etched into the canister.

There are several important identification locations on the aftertreatment system.

1 The diesel oxidation catalyst (DOC) part identification

2 The diesel particulate filter (DPF) part identification

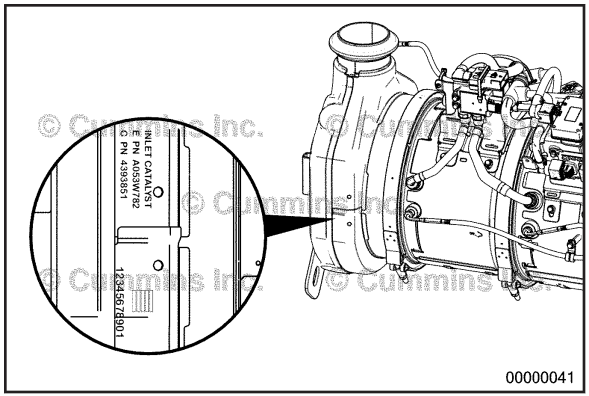
3 The decomposition tube part identification

4 The aftertreatment assembly part identification

5 The selective catalytic reduction (SCR) part identification.

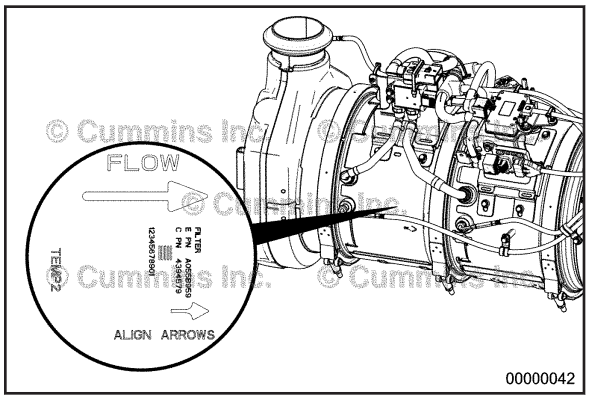
The DOC part identification numbers are located on the side of the module. There are 3 different numbers on the DOC.

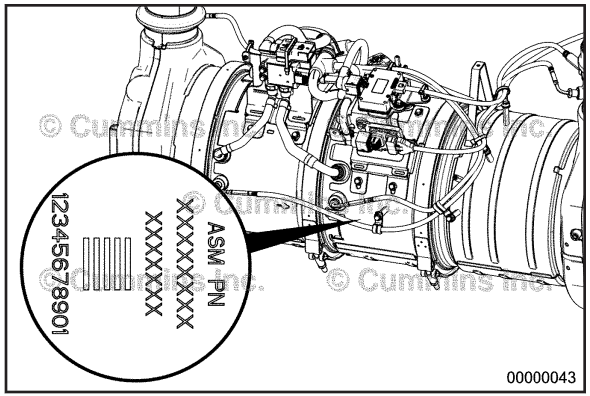
- The Cummins Emission Solutions™ part number (A###A###) (E PN)
- The Cummins® part number (#######) (C PN)
- The DOC serial number (###########).



The DPF part identification numbers are located on the side of the module. There are 3 different numbers on the DPF.

- The Cummins Emission Solutions™ part number (A###A###) (E PN)
- The Cummins® part number (#######) (C PN)
- The DPF serial number (###########).





The decomposition tube part identification numbers are located on the side of the module. There are 6 different numbers in the decomposition tube.

Decomposition Tube Part Identification Numbers

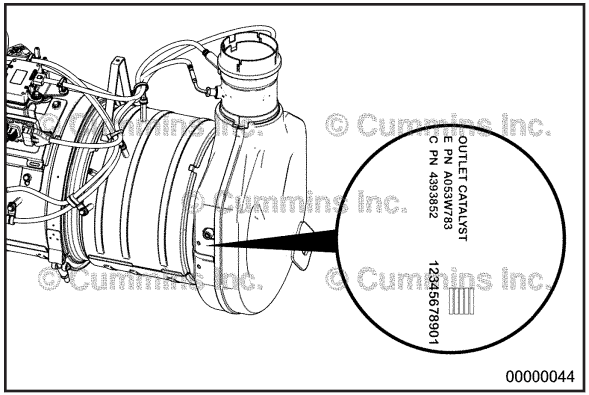
- The Cummins Emission Solutions™ part number (A###A###) (E PN)
- The Cummins® part number (#######) (C PN)
- The decomposition tube serial number (##########)

Aftertreatment System Assembly Part Identification Numbers

- The Cummins Emission Solutions™ part number (A###A###) (E PN)
- The Cummins® part number (#######) (C PN)
- The decomposition tube serial number (##########)

The SCR part identification numbers are located on the side of the module. There are 3 different numbers on the SCR.

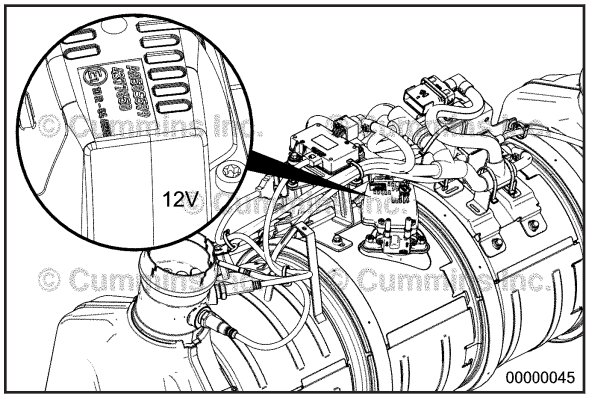
- The Cummins Emission Solutions™ part number (A###A###) (E PN)
- The Cummins® part number (########) (C PN)
- The SCR serial number (############)

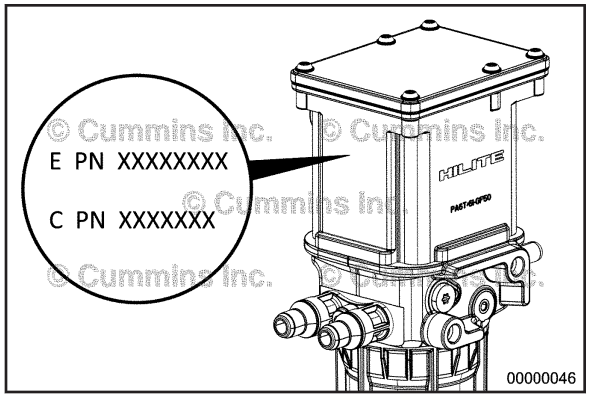


The diesel exhaust fluid (DEF) dosing valve identification is located on the top.

- Cummins Emission Solutions™ part number
- Cummins® part number

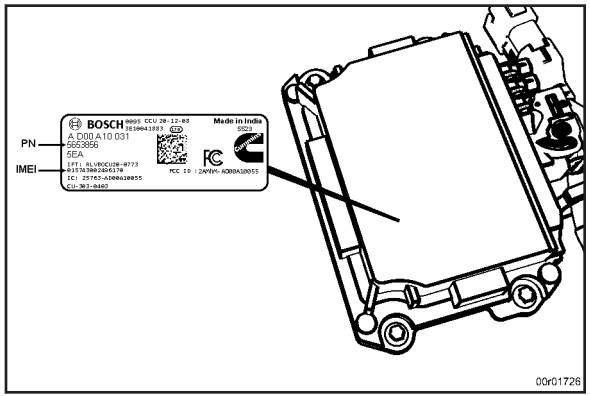
The DEF dosing valve voltage (12V or 24V) identification is located on the side.





The aftertreatment DEF dosing unit identification is located on the side.

- Cummins Emission Solutions™ part number
- Cummins® part number.



The connectivity module has identification information located on the top.

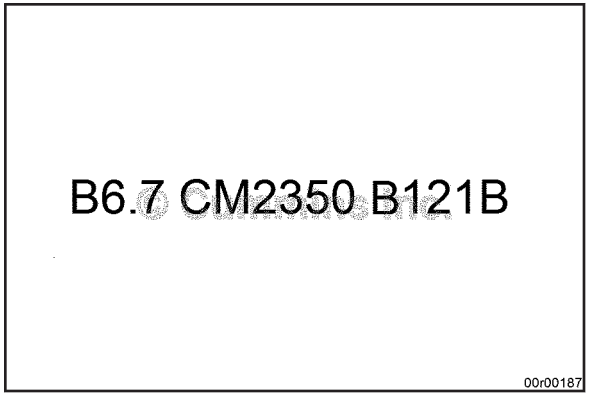
- Acumen™ Connectivity Module International Mobile Equipment Identity (IMEI) (XXXXXXXXXXXXXXX)
- Cummins® part number (XXXXXXX)

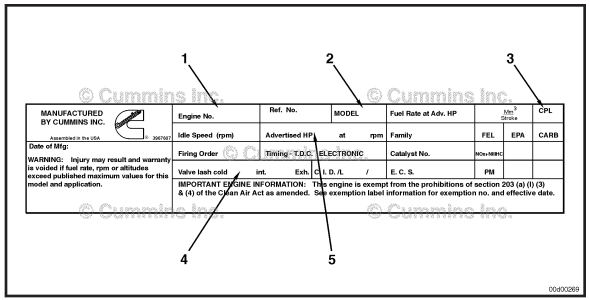
Cummins® Service Engine Model Identification (2017)

General Information

The Cummins® Service Engine Model Identification procedure describes:

- The purpose of the Cummins® Service Model Name.
- How to interpret a Cummins® Service Model Name to identify a Cummins® Engine.





The Cummins® Service Model Name differs from the Cummins® marketing model name. Service model names are more specific and help to match the correct Cummins® service information to the correct engine. Marketing engine model names are more generic and can capture multiple engine variations in the same model name.

Marketing Engine Model Name	Service Model Name
B6.7	B6.7 CM2350 B121B

Marketing engine model names (2) can be found on the engine dataplate, Cummins® brochures, and Cummins® promotional literature.

Examples of Cummins® service information and products that use service model names:

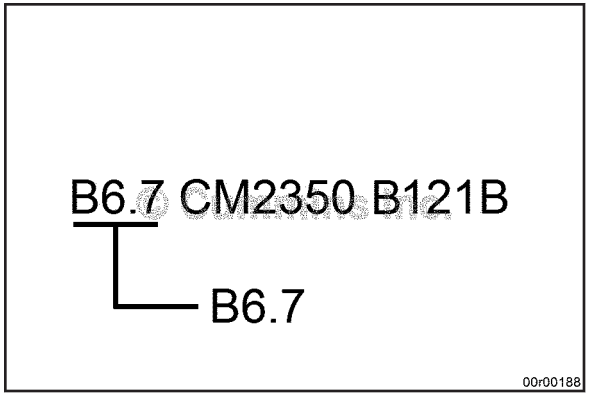
- QuickServe™ Online
- Cummins® electronic service tool
- Owner's Manual
- Operation and Maintenance Manual
- Master Repair Manual
- Service Manual
- Wiring Diagram
- Fault Code Troubleshooting Manual
- Standard Repair Times
- Technical Service Bulletins
- Service Bulletins

The Cummins® Service Model Name begins with the marketing engine model name.

The first two letters of the marketing model may still contain an “IS” or “QS” if the engine is an electronic engine.

“IS” prefix designates an on-highway engine.

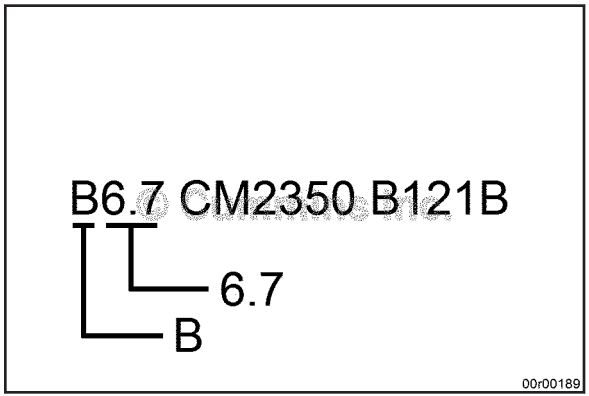
“QS” prefix designates an off-highway engine.

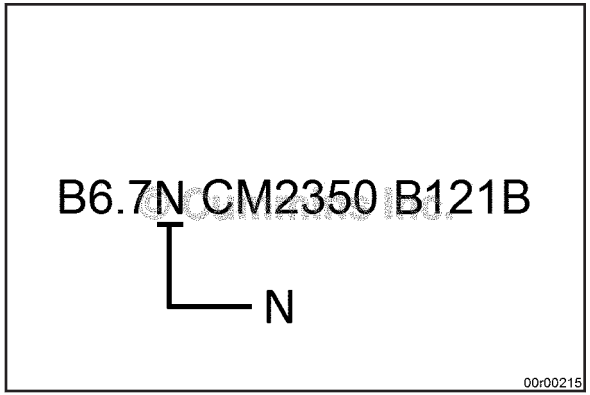


The first letter is the engine platform/series designation followed by the engine liter displacement. For the example shown in the graphic, the engine is a:

B Series engine.

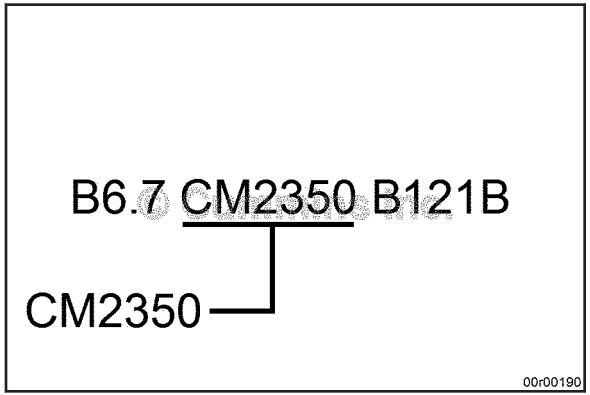
6.7 Liters in Displacement.





If no letter is located after the engine liter displacement information, the engine is fueled by diesel.

If the letter “N” is located after the engine liter displacement information, the engine is fueled by natural gas.

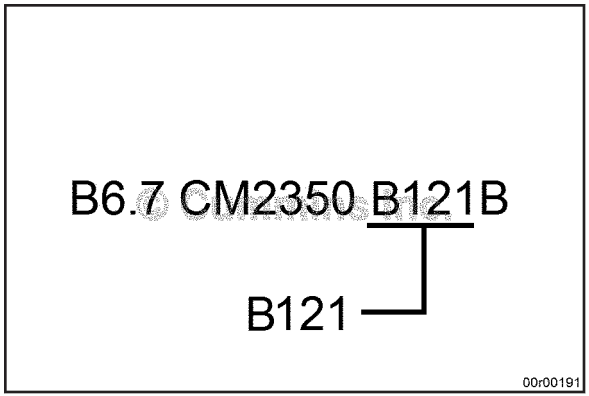


The engine control system is identified with the letters "CM" followed by the control system model number.

The identifier after the control system is a letter and number combination to identify variations between products.

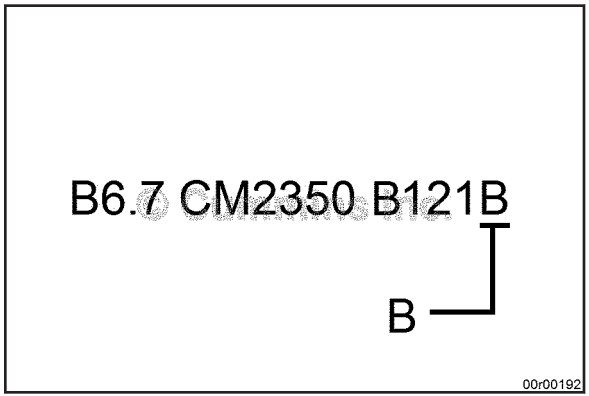
The letter is the engine platform designation.

The number increments as new variations of the engine are released. The first number is 101.



The letter at the end of the suffix identifies the general application for which the product is intended to be used.

- B – Automotive
- C – Industrial
- G – Power Generation/Generator Drive
- M – Marine



Cummins® Product Technology

General Information

The service model name for this product is **B6.7 CM2450 B155B.**

This engine is being released to meet the following emission regulations:

United States and Canada

- Environmental Protection Agency (EPA)
  - 2013 Emission Levels
  - 2021 Greenhouse Gas Requirements
  - 2024 Greenhouse Gas Requirements
- Air Resources Board (ARB)
  - 2013 Emission Levels
  - 2021 Greenhouse Gas Requirements
  - 2024 CARB Legacy provision

This engine is being released to meet the following diagnostic requirements:

- On-Board Diagnostics (OBD)

The Control Parts List(s) (CPL) associated with this product are:

- 5466
- 5467

- 5468
- 5469
- 5470
- 5471
- 5962
- 5963
- 5993
- 5994
- 5995
- 5996

EPA Products:

This engine has the following Agency defined Emissions Control System hardware, which can also be found on the engine dataplate. Use the following procedure for the location of the engine dataplate. Refer to Procedure 100-001 in Section E.

- Charge-Air Cooler (CAC)
- Direct Diesel Injection (DDI)
- Engine Control Module (ECM)
- Exhaust Gas Recirculation (EGR)
- Turbocharger (TC)

- Oxidation Catalyst (OC)
- Periodic Trap Oxidizer (PTOX)
- Selective Catalytic Reduction - Urea (SCR-U)
- Ammonia Oxidizer (AMOX)

This engine uses the following product technology:

Engine

- Number of Cylinders: 6
- Engine Configuration
  - Inline
- Engine Orientation
  - Vertical
- Cylinder Block Material
  - Cast Iron
- Cylinder Head Material
  - Cast Iron
- Valves Per Cylinder
  - Exhaust Quantity: 2
  - Intake Quantity: 2
- Camshaft Location

    - Cylinder Block
- Camshaft Followers/Tappets
    - Sliding Followers/Tappets
- Primary Gear Train Location
    - Rear of the Engine
- Engine Braking
    - Variable Geometry Turbocharger Brake Option
- Accessory Drive Option
- Crankcase Ventilation System
    - Open

Fuel System

- Diesel
- Common Rail Fuel System
    - Bosch® Common Rail Fuel System

Air Handling

- Turbocharger (Single)
    - Variable Geometry
- Charge Air Cooler
- Intake Air Heater

- Engine Intake Throttle Actuator

Exhaust System

- Exhaust Gas Recirculation (EGR)
- Aftertreatment Fuel Injection
  - Internal
- Diesel Oxidation Catalyst (DOC)
- Diesel Particulate Filter (DPF)
  - Full Flow
- Selective Catalytic Reduction (SCR) Catalyst
- UL2 Aftertreatment Diesel Exhaust Fluid (DEF) Dosing System

Electrical Equipment

- Starting System
  - Electric Starting Motor Option
    - 12 VDC
    - 24 VDC
- Charging System (Voltage Options)
  - 12 VDC
  - 24 VDC

Electronic Control System

- Engine Control Module (Single)
  - Control Module: CM2450
- Engine Coolant Level Sensor
- Engine Coolant Temperature Sensor
- Engine Oil Pressure Sensor/Switch
- Crankcase Pressure Sensor
- Camshaft Position Sensor
- Crankshaft Position Sensor
- Bosch® Fuel Rail Pressure Sensor
- Water in Fuel Sensor
- EGR Differential Pressure Sensor
- Front Exhaust Gas Pressure Sensor
- Rear Exhaust Gas Pressure Sensor
- EGR Temperature Sensor
- Intake Manifold Pressure/Temperature Sensor
- Turbocharger Speed Sensor
- Turbocharger Compressor Intake Pressure/Temperature Sensor
- Ambient Air Temperature Sensor
- Aftertreatment Diesel Particulate Filter Differential Pressure Sensor

- Aftertreatment Exhaust Gas Temperature Sensor
- Aftertreatment Diesel Exhaust Fluid Tank Level/Temperature/Quality Sensor
- Aftertreatment Intake NOx Sensor
- Aftertreatment Outlet NOx Sensor
- Aftertreatment Particulate Sensor

Market applications that will use this engine include, but are **not** limited to:

Automotive

- Truck
  - Conventional Truck
- Fire Truck
- Bus
  - Transit Bus
  - Hybrid Bus
  - School Bus
  - Shuttle Bus
- Recreational Vehicle

Section 1 - Operating Instructions

Section Contents

Operating Instructions - Overview

General Information

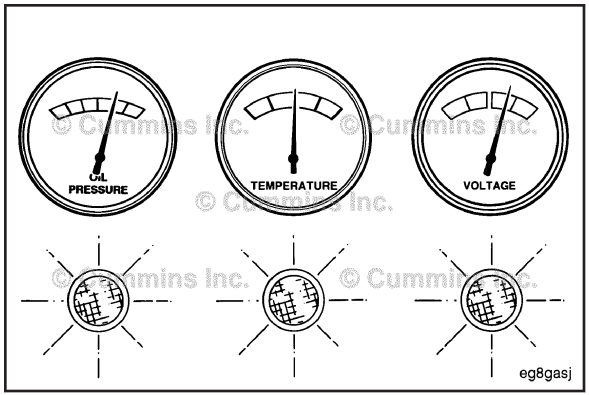
Correct care of your engine will result in longer life, better performance, and more economical operation.

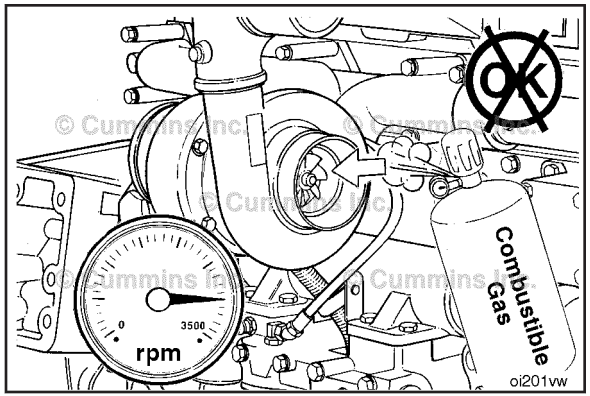
Follow the daily maintenance checks listed in Maintenance Guidelines (Section 2).

The new Cummins® engine associated with this manual does **not** require a "break-in" procedure. This section of the manual provides all of the necessary information required for proper engine operation.

Check the oil pressure indicators, temperature indicators, warning lights, and other gauges daily to verify operation.

Check the oil pressure, coolant temperature, and other engine parameters daily via the OEM front panel to verify operation. Check the panel regularly for any alarm messages. Take appropriate action to rectify the alarm condition, or contact your nearest Cummins® Authorized Repair Location.





⚠WARNING⚠

Do not operate a diesel engine where there are or can be combustible vapors. These vapors can be sucked through the air intake system and cause engine acceleration and over speeding that can result in a fire, an explosion, and extensive property damage. Numerous safety devices are available, such as air intake shutoff devices, to minimize the risk of over speeding where an engine, due to the application, is operating in a combustible environment, such as due to a fuel spill or gas leak. Remember, Cummins Inc. has no way of knowing the use you have for your engine. The equipment owner and operator are responsible for safe operation in a hostile environment. Consult a Cummins® Authorized Repair Location for further information.

△CAUTION△

Do not expose the engine to corrosive chemicals. Corrosive chemicals can damage the engine.

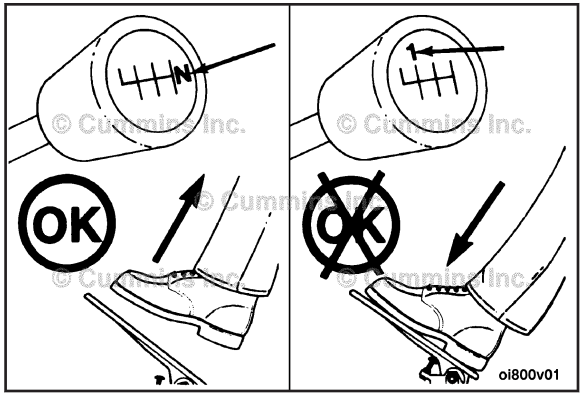
Cummins Inc. recommends the installation of an air intake shutoff device or a similar safety device to minimize the risk of overspeeding when an engine is operating in a combustible environment, such as due to a fuel spill or gas leak.

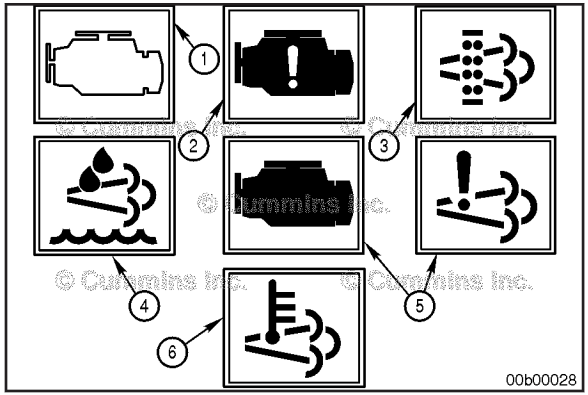
Normal Starting Procedure

Starting

Disengage the driven unit, or if equipped, put the transmission in neutral.

With the accelerator pedal or lever in the idle position, turn the keyswitch to the ON position.





With the key in the ON position, the engine indicator lamps will come on momentarily and then go out. The engine indicator lamps include:

1 WARNING (or CHECK ENGINE) lamp, amber in color

2 STOP (or STOP ENGINE) lamp, red in color

3 AFTERTREATMENT DIESEL PARTICULATE FILTER lamp, amber in color

4 DIESEL EXHAUST FLUID lamp, amber in color

5 MALFUNCTION INDICATOR lamp, amber in color.

Additionally, some engines have an additional lamp, (6) HIGH EXHAUST SYSTEM TEMPERATURE, which is amber in color.

If any of the lamps remain on or begin to flash, refer to Engine Indicator Lamps in Section 1. Refer to Procedure 101-048 in Section 1.

⚠CAUTION⚠

Do not engage the starting motor for more than 30 seconds or damage to the starting motor can result. Wait 2 minutes between each attempt to start (electrical starting motors only).

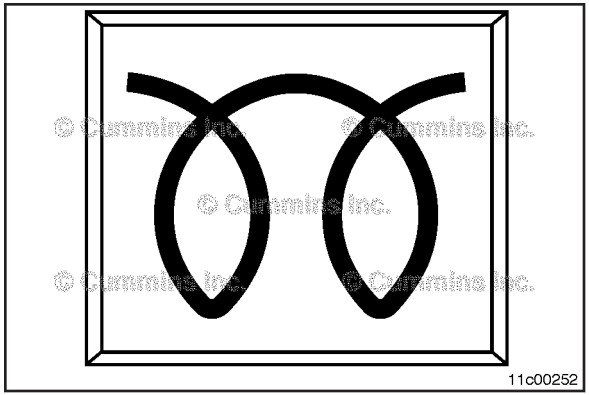
Under cold conditions, the Wait-to-Start lamp (generally a yellow lamp using a symbol similar to the graphic, or the words WAIT TO START) will also illuminate at key ON, and will stay on for a period of up to 30 seconds.

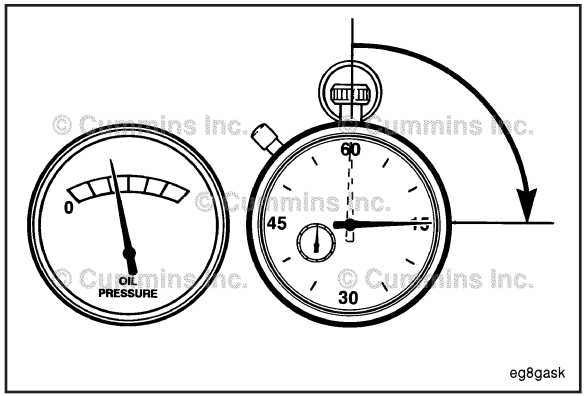
NOTE: The length of time the Wait-to-Start lamp remains illuminated depends on the ambient temperature. The lower the ambient temperature, the longer the lamp will be illuminated.

Once the Wait-to-Start lamp turns off, turn the key to the start position to start the engine.

NOTE: Some engines are equipped with an engine starting motor protection feature. If the starting motor is engaged for 30 or more seconds, without the engine starting, the starter will be locked out from operating, allowing for proper cooling of the starting motor. During this time, the WAIT TO START lamp will flash for 2 minutes. Once the lamp discontinues flashing, the starting motor will be allowed to function.

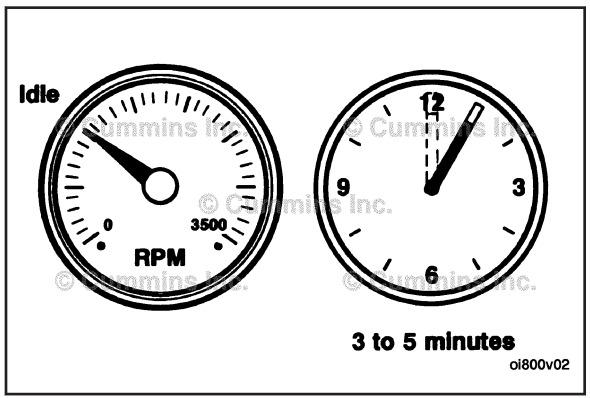
NOTE: Engines equipped with air starting motors require a minimum of 480 kPa [70 psi].





⚠CAUTION⚠

The engine must have adequate oil pressure within 15 seconds after starting. If the WARNING lamp indicating low oil pressure has not gone out or there is no oil pressure indicated on a gauge within 15 seconds, shut the engine OFF immediately to reduce the possibility of engine damage.



Idle the engine for 3 to 5 minutes before operating with a load.

NOTE: After the engine is started, the voltmeter, if equipped, may show a gauge fluctuation under certain engine temperature conditions (both warm and cold). This cycling operation is caused by the post-heat cycle of the intake manifold heater system. The number of cycles and the length of the cycling operation is controlled by the engine control module. The cycling action will cause temporary dimming of the headlamps, interior lamps, and other vehicle electrical accessories.

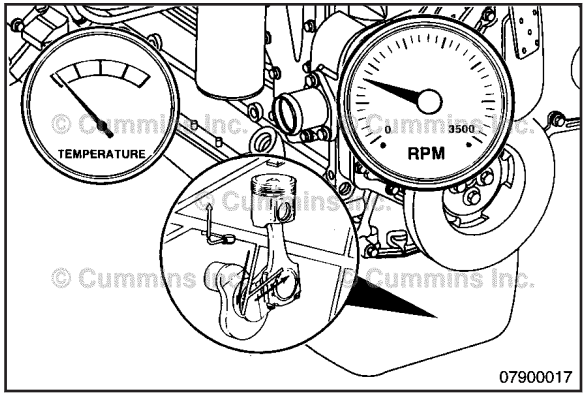
After starting a cold engine, increase the engine speed (rpm) slowly to provide adequate lubrication to the bearings and to allow the oil pressure to stabilize.

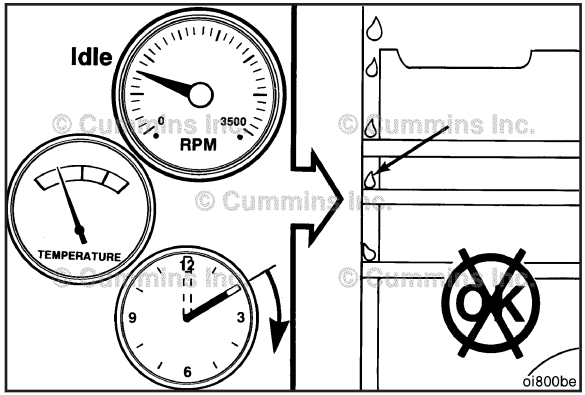
NOTE: For engines equipped with engine warm-up protection feature; this feature limits engine speed and torque following engine start-up until sufficient oil pressure is available to the engine components. This feature reduces the risk of engine part damage due to operating at engine speeds too high or loads before adequate oil pressure is achieved.

Some engines are equipped with a Fast Idle Warm Up feature. When enabled, this feature elevates the idle speed of the engine in cold ambient conditions in order to shorten the time necessary to warm up the engine. When the idle speed is elevated, the engine noise may change. This is normal. To bring the engine back to low idle speed:

- For vehicles equipped with a manual transmission and clutch switch: Depress the clutch pedal.
- For vehicles equipped with a brake switch: Depress the service brake pedal.
- Depress the accelerator pedal.

For more information on the Fast Idle Warm Up feature, contact a Cummins® Authorized Repair Location.





⚠CAUTION⚠

Do not operate the engine at low idle for long periods with engine coolant temperature below the minimum specification in Maintenance Specifications (Section V). This can result in the following:

- Fuel dilution of the lubricating oil
- Carbon buildup in the cylinder
- Cylinder head valve sticking
- Reduced performance.

Jump Starting

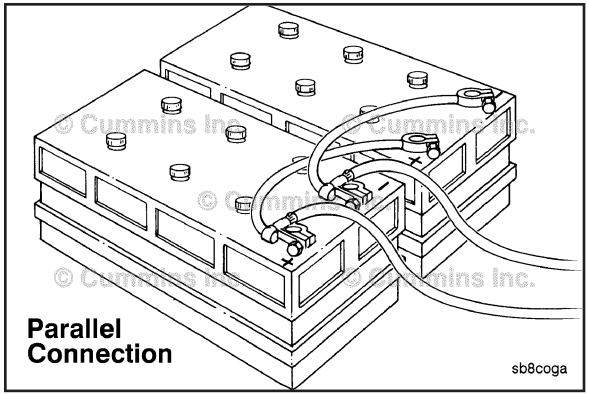
⚠WARNING⚠
Batteries can emit explosive gases. To reduce the possibility of personal injury, always ventilate the compartment before servicing the batteries. To reduce the possibility of arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

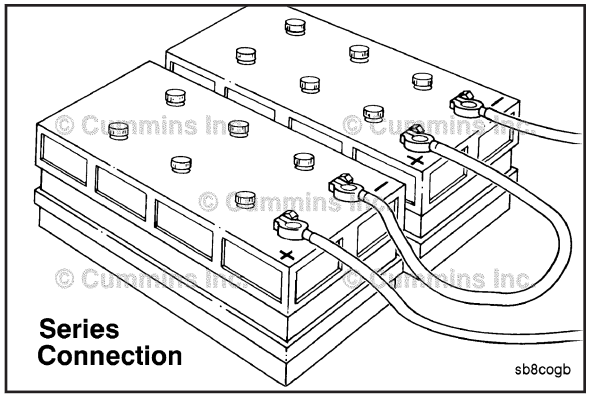
⚠CAUTION⚠
When using jumper cables to start the engine, make sure to connect the cables in parallel: Positive (+) to positive (+) and negative (-) to negative (-). When using an external electrical source to start the engine, turn the disconnect switch to the OFF position. Remove the key before attaching the jumper cables.

⚠CAUTION⚠
To reduce the possibility of damage to engine parts, do not connect the jumper starting or battery charging cable to any fuel system or electronic component.

This illustration shows a typical parallel battery connection. This arrangement doubles the cranking amperage.

NOTE: Always reference the relevant equipment manufacturer service information for jump starting procedures. Failure to follow correct procedures can result in damage to the engine control module and other electrical equipment.





This illustration shows a typical series battery connection. This arrangement, positive (+) to negative (-), doubles the voltage.

NOTE: Always reference the relevant equipment manufacturer service information for jump starting procedures. Failure to follow correct procedures can result in damage to the engine control module and other electrical equipment.

Cold Weather Starting

General Information

Follow the normal starting procedure in this section. If equipped with an intake air heater, the WAIT-TO-START lamp will stay on longer.

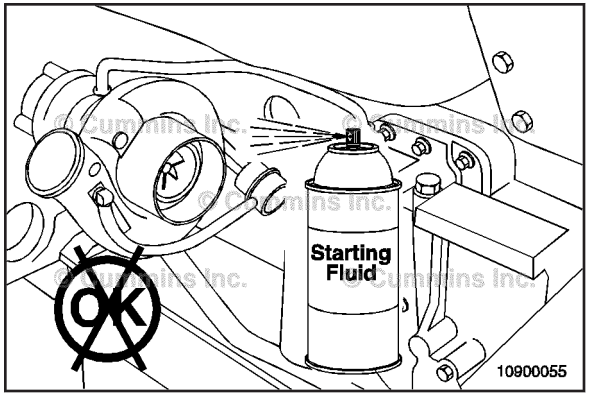
See the equipment manufacturer service information for any additional cold weather starting procedures.

Extreme cold conditions can cause oil pressure delays when using 15W-40 viscosity grade engine lubricating oil. For extreme cold conditions, the use of a different engine lubricating oil viscosity is recommended. Reference Procedure 018-003 in Section V in the appropriate Operation and Maintenance Manual.

Using Starting Aids

⚠WARNING⚠
Do not use starting fluids with this engine. This engine is equipped with an intake air heater: use of starting fluid can cause an explosion, fire, personal injury, severe damage to the engine, and property damage.

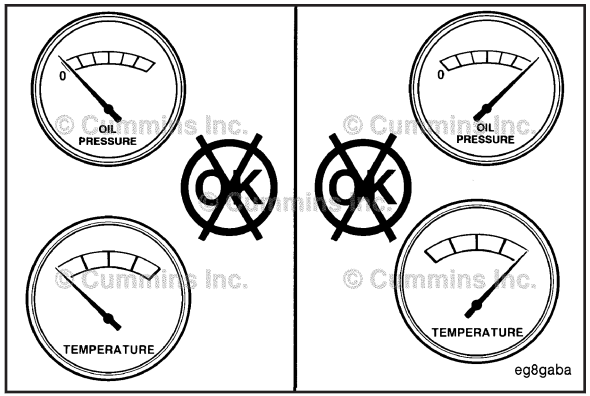
Cold weather starting aids are available for this engine. Contact a Cummins® Authorized Repair Location for more information.



Starting Procedure After Extended Shutdown or Oil Change

General Information

Follow the Normal Starting Procedure in this section. Refer to Procedure 101-014 in Section 1. The engine will run at idle **only** until the minimum oil pressure is detected by the engine control module (ECM).



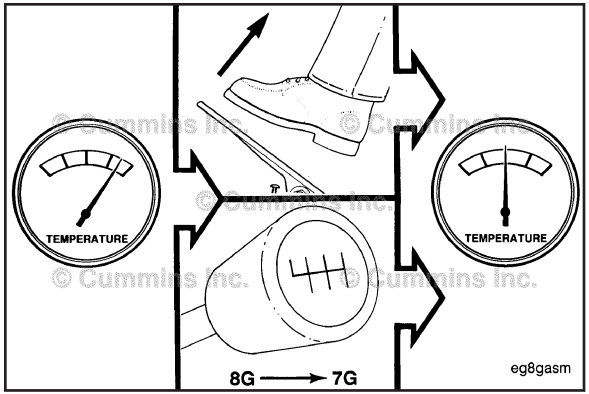
Operating the Engine

Normal

If equipped, monitor the oil pressure and coolant temperature gauges frequently. Refer to Lubricating Oil System specifications and Cooling System specifications, in Maintenance Specifications (Section V) for recommended operating pressures and temperatures. Shut off the engine if any pressure or temperature does **not** meet the specifications.

Continuous operation with engine coolant temperature above or below the engine coolant temperature specifications listed in Maintenance Specifications (Section V) can damage the engine.

If an overheating condition starts to occur, reduce the power output of the engine by releasing the accelerator pedal or lever or shifting the transmission to a lower gear, or both, until the temperature returns to the normal operating range. If the engine temperature does **not** return to normal, shut off the engine, and refer to Troubleshooting Symptoms (Section TS), or contact a Cummins® Authorized Repair Location.



⚠CAUTION⚠

Do not idle for extended periods of time. Excessive idle time can cause poor engine performance.

Do **not** operate internal combustion engines at low idle speed for extended periods of time. This operating condition can lead to poor engine performance. The idle shutdown feature, available on most Cummins® engines, can be programmed to shut the engine down after a period of low idle speed operation with no driver activity. A flashing warning lamp will inform the driver of an impending shutdown. If an engine **must** idle for an extended period of time, operate at fast idle (1000 rpm or greater). The Power Take-Off (PTO) feature, available on most Cummins® engines, can be programmed to adjust engine speed with the use of OEM switches to pre-programmed set points.

Ambient Temperature

0 to -32°C [32 to -25°F]

Use 50-percent ethylene glycol antifreeze and 50-percent water for the engine coolant mixture.

The Diesel fuel **must** have maximum cloud and pour points 6°C [10°F] lower than the ambient temperature in which the engine operates.

-32 to -54°C [-25 to -65°F]

Use 60-percent ethylene glycol antifreeze and 40-percent water for the engine coolant mixture.

The Diesel fuel **must** have maximum cloud and pour points 6°C [10°F] lower than the ambient temperature in which the engine operates.

The cold weather operating aid is required for cold weather situations.

Winterfronts and Shutters

Winterfronts and shutters can be used on a vehicle or equipment to reduce air flow through the radiator core into the engine compartment. This equipment can reduce the time required to warm the engine and help maintain the engine coolant temperature. The engine coolant temperature specifications are in the Maintenance Specification (Section V).

Engine Operating Range

General Information

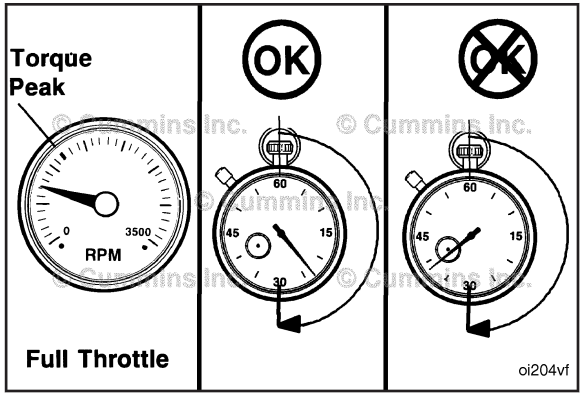
⚠CAUTION⚠

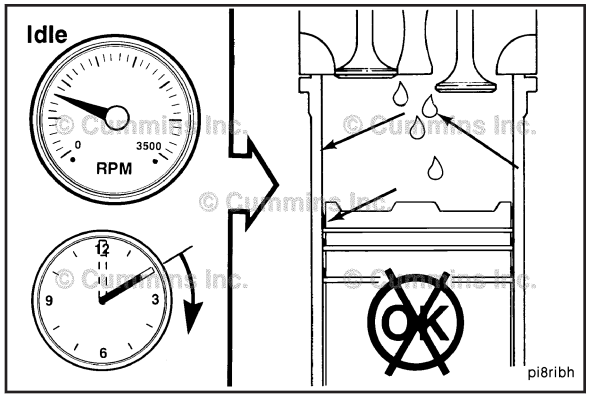
Do not operate the engine at full throttle below peak torque rpm (refer to engine dataplate for peak torque rpm) for more than 30 seconds. Operating the engine at full throttle below peak torque will shorten engine life to overhaul, can cause serious engine damage, and is considered engine abuse.

⚠CAUTION⚠

Do not operate the engine beyond the maximum engine speed. Operating the engine beyond the maximum engine speed can cause severe engine damage. Use proper operating techniques for the vehicle, vessel, or equipment to prevent engine overspeed. The maximum engine speed specification is listed in Maintenance Specifications (Section V).

Cummins® engines are designed to operate successfully at full throttle under transient conditions down to peak torque engine speed. This is consistent with recommended operating practices.





⚠CAUTION⚠

Do not idle the engine for excessively long periods. Long periods of idling, more than 10 minutes, can cause poor engine performance.

Engine Shutdown

General Information

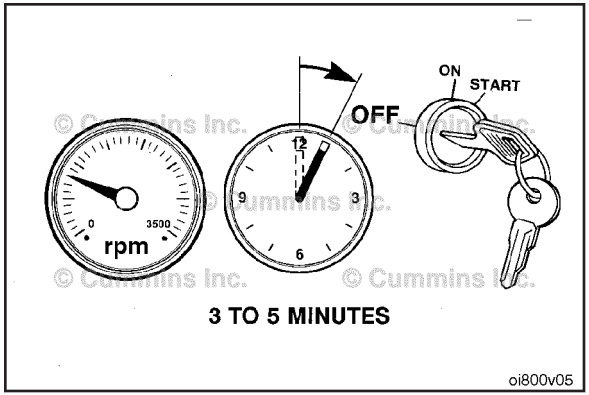
⚠CAUTION⚠

Failure to follow the correct shutdown procedure may result in damage to the turbocharger, if equipped, and shorten the turbocharger life.

Allow the engine to idle 3 to 5 minutes before shutting the engine off after a full-load operation. This allows adequate cool down of pistons, cylinders, bearings, and turbocharger, if equipped.

NOTE: The ECM and DEF system require battery power supply after key off for a period of up to 15 minutes. The DEF system circulates after a hot shut down. If the unswitched battery power supply is disconnected less than 15 minutes after the keyswitch is turned off, there may be damage to the DEF system.

Turn the ignition switch to the OFF position. If the engine does **not** shut down, contact a Cummins® authorized repair location.



Electronic Controlled Fuel System

General Information

The engine control system is an electronically operated fuel control system that also provides many operator and vehicle or equipment features. The base functions of the control system include fueling and timing control, limiting the engine speed operating range between the low- and high-idle set points, and reducing exhaust emissions while optimizing engine performance. The control system uses inputs from the operator and its sensors to determine the fueling and timing required to operate at the desired engine speed.

Engine Control Module Inputs

- The engine control module (ECM) is the control center of the system. It processes all of the inputs and sends commands to the fuel system, vehicle/equipment, and engine control devices.
- The ECM performs diagnostic tests on most of its circuits and will activate a fault code if a problem is detected in one of these circuits. Along with the fault code identifying the problem, a snapshot of engine operating parameters at the time of fault activation is also stored in memory.
- Some fault codes will cause a diagnostic lamp to activate to signal the operator.
- The ECM communicates with service tools and some other vehicle controllers such as transmissions, antilock brake system, and antislip reduction through an SAE J1939 datalink.
- Some vehicles and equipment will have J1939 networks on them that link many of the "smart" controllers together. Vehicle control devices can temporarily command engine speed or torque to perform one of the devices' functions, such as transmission shifting or antilock braking.
- The control system utilizes a number of sensors to provide information on engine operating parameters. Refer to Cummins® Product Technology, Procedure 100-006, for a list of sensors.

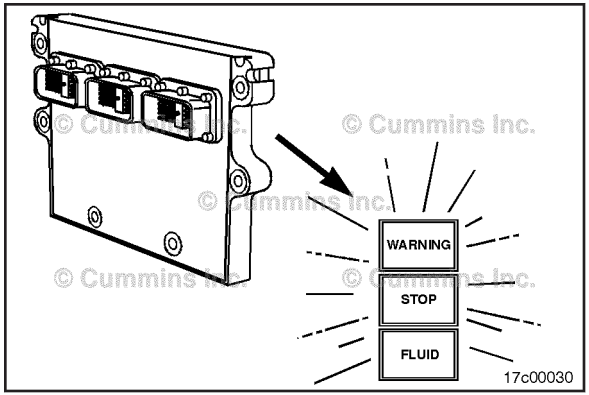
Engine Protection System

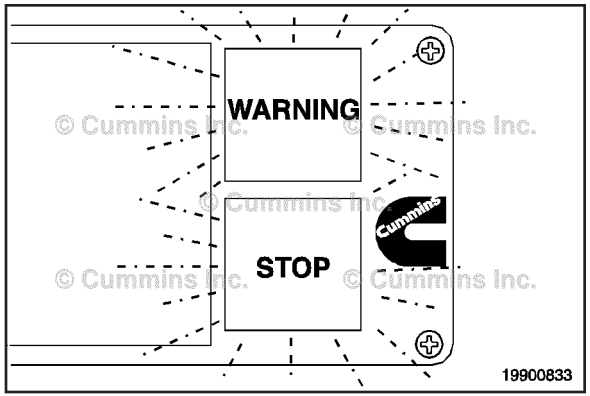
⚠CAUTION⚠

When the red stop lamp is illuminated, the driver/ operator must pull to the side of the road, when it is safe to do so, to reduce the possibility of engine damage.

The engines are equipped with an engine protection system. The system monitors critical engine temperatures and pressures and will log diagnostic faults when an over or under normal operation condition occurs. If an out-of-range condition exists and engine derate action is to be initiated, the operator will be alerted by an in-cab WARNING lamp. The WARNING lamp will blink or flash when out-of-range conditions continue to worsen. When the red STOP lamp is illuminated, the driver **must** pull to the side of the work area, when it is safe to do so, to reduce the possibility of engine damage.

Note : Engine power and speed will be gradually reduced depending on the level of severity of the observed condition. The engine protection system will **not** shut down the engine unless the engine protection shutdown feature has been enabled.





Engine Protection Shutdown

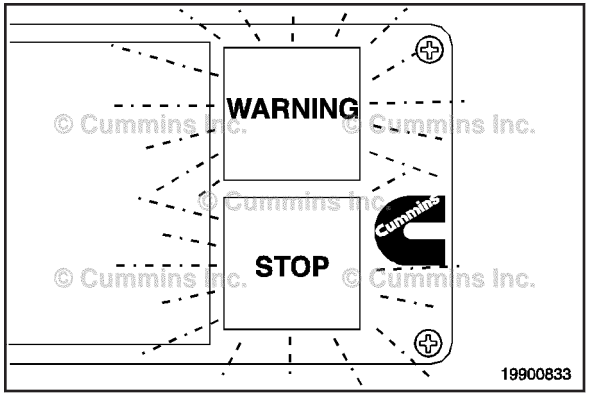
This feature automatically shuts off the engine when the temperature, pressure, and coolant level sensors indicate the engine is operating over or under normal operating conditions.

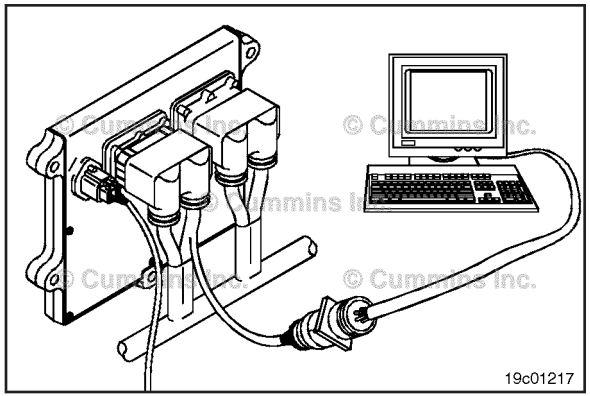
The red STOP lamp in the cab will flash for 30 seconds prior to shutdown to alert the driver.

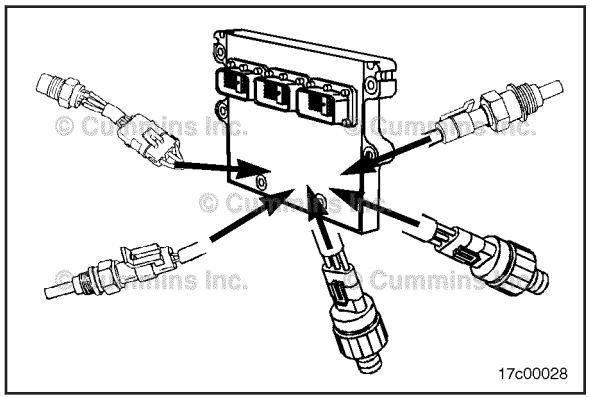
Engine Protection Shutdown/Derate Manual Override

This feature allows the operator to override a pending engine shutdown. Prior to engine shutdown, the red STOP lamp will flash for 30 seconds to notify the operator that the engine is about to shut down. The operator can override the engine shutdown through use of an OEM switch, such as the clutch switch.

If the vehicle is **not** equipped with a clutch switch, then the OEM will provide a dash-mounted switch marked as the ENGINE PROTECTION SHUTDOWN OVERRIDE switch. When the operator triggers this switch while the red lamp is flashing, a timer within the ECM will reset and allow the engine to run for an additional 30 seconds before engine shutdown occurs. Each time the operator triggers the override switch, the timer within the ECM is reset, thus allowing the engine to run for an additional 30 seconds.







Electronic Service Tool Description

The recommended Cummins® electronic service tool or equivalent can be used to:

- Program customer specified information into the ECM (parameter and features).
- Aid in troubleshooting the engine.
- Change the engine power or rated speed calibration.
- Transfer new or update calibration files to the ECM.
- Create and view trip reports, etc.

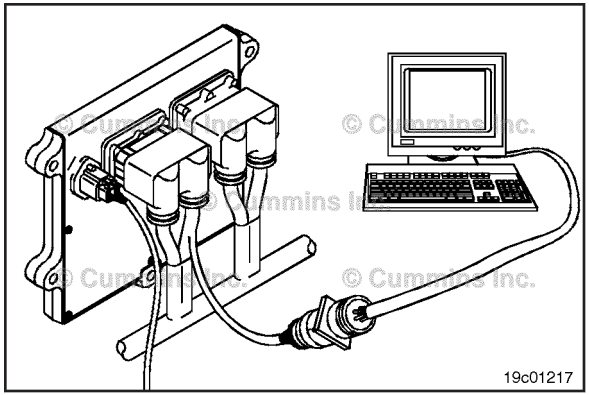
Fault Code Snapshot Data

This data makes up additional fault code information that can be obtained by using an electronic service tool.

The snapshot data records the value or state of the control system sensors and switches at the time a fault occurred. This data is stored for the first occurrence of the fault, since it was last cleared, and for the most recent occurrence. This data can be very valuable when trying to re-create or determine engine operating conditions at the time of a fault.

Engine Monitoring System

The electronic service tool has a monitor mode which is a useful troubleshooting aid that displays the key ECM inputs and outputs. This feature can be used to spot constant or intermittent out-of-range values.



Electromagnetic Interference (EMI)

General Information

Some applications utilize accessories (such as CB radios, mobile transmitters, and so forth), if **not** installed and used correctly, the radio frequency energy generated by these accessories can cause electromagnetic interference (EMI) conditions to exist between the accessory and the Cummins® electronically controlled systems. Cummins Inc. is **not** liable for any performance problems with either the electronically controlled systems or the accessory caused by EMI. EMI is **not** considered by Cummins Inc. to be a system malfunction and therefore is **not** warrantable.

System EMI Susceptibility

Cummins® product has been designed and tested for minimum sensitivity to incoming electromagnetic energy. Testing has shown no performance degradation at relatively high energy levels; however, if very high energy levels are

encountered, then some noncritical diagnostic fault code logging can occur. The electronically controlled systems EMI susceptibility level will protect the systems from most, if **not** all, electromagnetic energy-emitting devices that meet the legal requirements.

System EMI Radiation Levels

Cummins® product has been designed to emit minimum electromagnetic energy. Electronic components are required to pass various Cummins Inc. and industry EMI specifications. Testing has shown that when the systems are properly installed, the systems will **not** interfere with onboard communication equipment or with the vehicle's, equipment's, or vessel's ability to meet any applicable EMI standards and regulated specifications.

If an interference condition is observed, follow the suggestions below to reduce the amount of interference:

1 Locate the transmitting antenna as far away from the electronically controlled systems and as high as possible.

2 Locate the transmitting antenna as far away as possible from all metal obstructions (e.g., exhaust stacks)

3 Consult a representative of the accessory supplier in the area to perform the following:

- Accurately calibrate the device for proper frequency, power output, and sensitivity (both base and remote site devices **must** be properly calibrated)
- Obtain antenna reflective energy data measurements to determine the optimum antenna location
- Obtain optimum antenna type and mounting arrangement for the application
- Verify the accessory equipment model is built for maximum filtering to reject incoming electromagnetic noise.

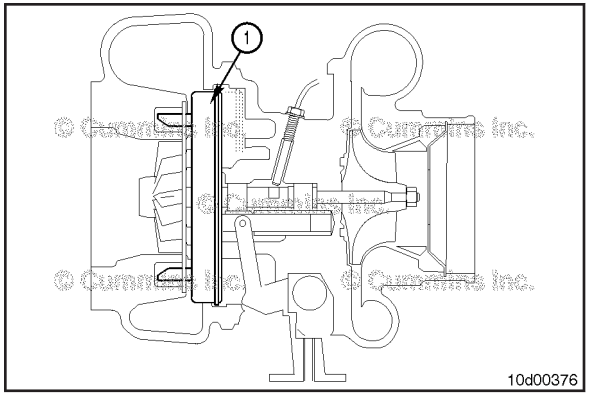
Engine Braking System

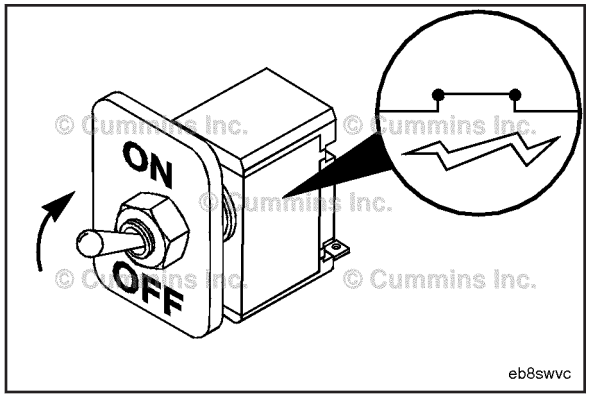
General Information

Engines equipped with a variable geometry turbocharger (VGT) can possibly be equipped with an optional engine exhaust brake feature. The ON/OFF function would be controlled by a switch located on the dash of the vehicle.

This feature, if the vehicle is equipped, allows the VGT to act as an exhaust brake. An engine exhaust brake retards the speed of the engine during motoring conditions to provide additional vehicle braking power and extend the life of the vehicle service brakes.

An engine exhaust brake functions by retarding engine speed by creating high exhaust back pressure. This back pressure is obtained by restricting air flow through the turbine housing of the turbocharger. This restriction through the turbine housing of the turbocharger is created through positioning of the sliding nozzle (1) located internally to the VGT. The position of the sliding nozzle is controlled by the engine control module (ECM).





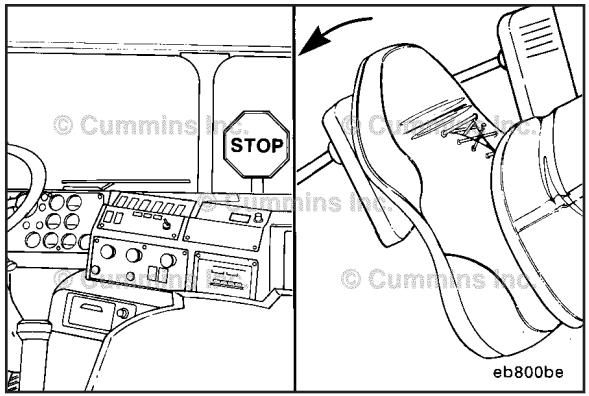
When the engine exhaust brake switch is in the ON position, the ECM monitors inputs (such as accelerator pedal position and engine speed). From these inputs, the ECM determines when to enable the engine exhaust brake feature when the proper braking conditions are present.

Other features/switches like cruise control, can also affect when the engine exhaust brake activates. For more information on how the engine exhaust brake functions, refer to the equipment manufacturer service information or contact a Cummins® Authorized Repair Location.

NOTE: The exhaust brake can **only** be activated when the accelerator pedal is at its low idle position. With the throttle at low idle position, fueling commands to the cylinders will **not** detract from the braking power of the brake system.

NOTE: The engine exhaust brake is designed to assist the vehicle service brakes when slowing the vehicle to a stop.

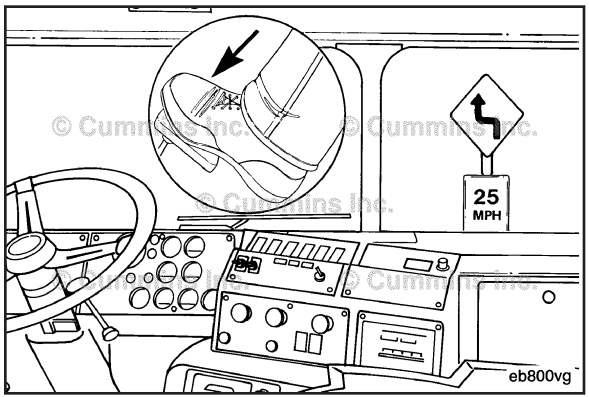
Service brakes will be required to bring the vehicle to a stop.

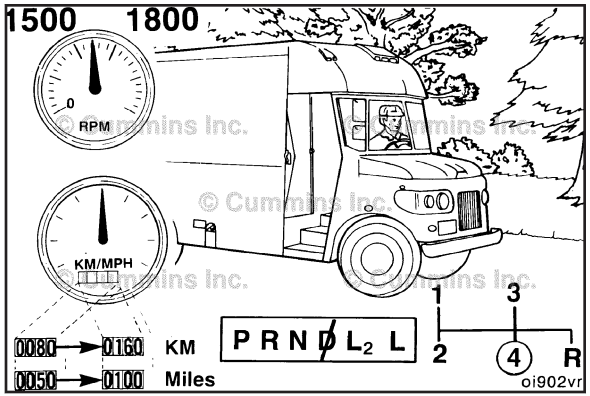


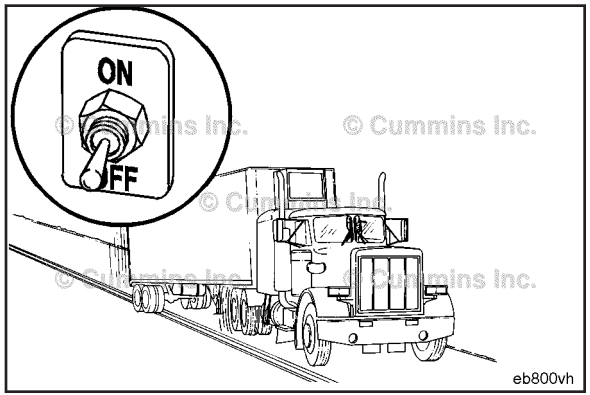
⚠ WARNING ⚠

To reduce the possibility of personal injury or property damage, always be prepared to use the vehicle service brakes for emergency stopping. The safe control speed of a vehicle will vary with the size of the load, the type of load, the grade, and the road conditions.

Vehicle service brakes **must** be used when additional braking power is required.







⚠CAUTION⚠

Exceeding governed engine speed can cause engine damage.

The optimum braking power of the engine exhaust brake is reached at rated engine speed. Correct gear selection, therefore, is critical.

NOTE: Typically, on vehicles equipped with automatic transmissions, the ECM and the transmission will determine the correct gear selection. Refer to the equipment manufacturer service information for further information.

Turn the engine exhaust brakes OFF on slick roads. Using the engine exhaust brake on wet or slippery roads can cause over-braking, especially on vehicles with light loads or single-drive axles. Stopping distance can increase, or the vehicle can skid or jackknife.

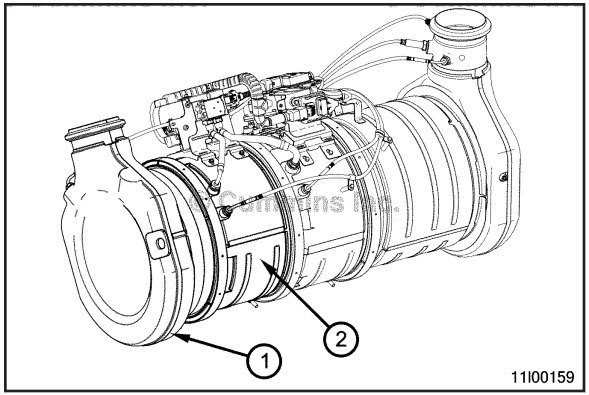
Unique Operating Characteristics of an Engine with Aftertreatment Diesel Particulate Filter

General Information

The particulate filter system of the aftertreatment system is composed of two main sections. These sections are:

1 The aftertreatment diesel oxidation catalyst (DOC). The aftertreatment DOC is used to oxidize fuel in the exhaust in order to create heat for the regeneration process.

2 The aftertreatment diesel particulate filter (DPF). The aftertreatment DPF captures the soot and ash from the engine exhaust.



Soot is composed of the partially burned particles of fuel that occur during normal engine operation (black smoke).

Ash is composed of the partially burned particles of engine oil that occur during normal engine operation.

Over time, both soot and ash accumulate in the aftertreatment DPF and **must** be removed. Soot is removed by a process called regeneration. Ash is removed by removing the aftertreatment DPF and cleaning it at specified intervals.

There are many factors that determine how ash accumulates in an aftertreatment DPF, such as duty cycle and engine health. How ash accumulates in an aftertreatment DPF influences the effectiveness of the different types of ash cleaning processes.

Air-only cleaning:

Air-**only** cleaning uses compressed air to remove excess ash from the DPF. This process pushes air in reverse of the exhaust flow to remove the excess ash and soot from the DPF. The entire process typically takes about 45 minutes.

Air-only cleaning can remove ash that is loosely packed in and **not** bonded to the DPF. Air-**only** cleaning is typically a lower cost DPF maintenance cleaning process, but it is less capable of removing densely packed ash or ash that is bonded to the DPF.

Liquid cleaning (most effective):

Liquid cleaning uses some type of liquid, such as water or chemicals, to help remove the bond between the ash and the DPF substrate. This is a longer cleaning process that can take up to several hours. There are different types of liquid that DPF cleaning suppliers can use.

- As opposed to air-**only**, liquid cleaning is more effective to loosen ash; however, ash can create a strong bond with the DPF substrate. In this case, water-**only**, or water combined with air, is **not** sufficient to clean all types of ash that can accumulate in the DPF. Two readily available suppliers in the market that provide liquid cleaning are:
- Clean Diesel Specialists (CDS)https://cleandieselspecialists.com/
- Emission Cooling Solutions (ECS)https://www.dpfrenu.com/

- Liquid with organic chemicals is even more effective at breaking the bonds ash develops with the DPF substrate. An organic based chemical is safe to use and helps provide the best opportunity of breaking the ash bonds. When combined with air, it can effectively remove most ash that accumulates in DPFs. Some readily available suppliers in the market that provide this type of service are:
- Emission Cooling Solutions (ECS).https://www.dpfrenu.com/
- Ceramex North America works primarily with dealers and fleets and can clean DPFs at its centralized location in Springfield, MO. https://ceramexnorthamerica.com/
- FSX Inc. offers filter cleaning services to OEMs at its centralized location in Granite Falls, Washington.https://www.fsxinc.com/Equipment/map.html
- FSX Inc. currently **only** offers filter cleaning services on a smaller scale to regional customers (primarily serving the Washington/Oregon region).

Each customer needs to evaluate the best option to maintain its DPFs and which cleaning process supports its business needs. DPF maintenance **must** be completed **only** by appropriately trained personnel.

DPF maintenance and warranty guidelines :

Maintaining Cummins® product is the customer’s responsibility.

If there's a fault code other than 5383 related to a DPF for an out of warranty repair event, the customer should go to a Cummins® authorized service provider for diagnostics and repairs to identify the root cause of the issue. If 5383 is the **only** DPF-related code present, the customer can choose where to have the DPF cleaned.

If the DPF is within a Cummins® warranty coverage (base, extended, emissions, new or ReCon Parts) period, and any DPF related fault codes are present, the customer **must** go to a Cummins® authorized service provider for diagnostics and repairs to identify the root cause of the issue. The authorized service provider will file the warranty claim to Cummins® if the root cause of failure is warrantable.

Chemical and heavy metal waste disposal:

⚠ WARNING ⚠

The material captured in a partial flow diesel particulate filter and/or a diesel particulate filter may contain elevated concentrations of metals. Primarily zinc, molybdenum, and possibly polynuclear aromatic hydrocarbons, that may be regulated. These materials must be characterized, handled, and disposed of according to applicable local regulations. In addition, due to the presence of the above-listed chemicals and other potentially toxic components such as oxides of calcium, zinc, phosphorous, silicon, sulfur, and iron, exhaust filter maintenance must be completed only by appropriately trained personnel.

Disclaimer:

Cummins® has provided this document for information purposes **only**; it is **not** intended as a substitute for professional advice and it does **not** constitute a solicitation, endorsement, or offer by Cummins® or any third-party cleaning company to buy or sell any product or services. Cummins® provides no warranty or representation and disclaims all warranties and conditions, whether express or implied, of merchantability, fitness for a particular purpose, or non-infringement, and all responsibility and liability for the services or products provided by third-party cleaning companies and/or for any reliance on the content of the information included herein. Under no circumstances will Cummins® be responsible or liable for any claims, damages, losses, expenses, costs or liabilities (including, without limitation, any direct or indirect damages for loss of profit, business interruption, or loss of information) resulting directly or indirectly from the use or inability to use the third-party cleaning companies and/or reliance on the content of the information included herein.

Equipment with an aftertreatment system has three additional indicator lamps on the dashboard. Two of the additional lamps, along with the check engine lamp, alert the operator of the status of the aftertreatment diesel particulate filter. The third additional indicator lamp indicates the position of the regeneration permit switch.

NOTE: Use the following procedure for additional information about the engine indicator lamps. Refer to Procedure 101-048 in Section 1.

Ultra low sulfur diesel fuel is required for an engine equipped with an aftertreatment DPF. If ultra low sulfur diesel fuel is **not** used, the aftertreatment system can be damaged.

NOTE: Use the following procedure for additional information about the fuel recommendations and specifications required for use in the engine being serviced. Refer to Procedure 018-002 in Section V.

To maximize the maintenance intervals of the aftertreatment diesel particulate filter, Cummins Inc. requires the use of a lubricating engine oil meeting the specifications in the following procedure. Refer to Procedure 018-003 in Section V.

NOTE: Use the following procedure for additional information about the lubricating oil recommendations and specifications. Refer to Procedure 018-003 in Section V.

NOTE: Use the following procedure for information on the Routine Maintenance Schedule, which provides the aftertreatment diesel particulate filter cleaning intervals. Refer to Procedure 359-001 in Section 3.

Aftertreatment Warm Up

The aftertreatment warm-up function is used to help prevent the buildup of water condensation in the aftertreatment system during extended idle operation.

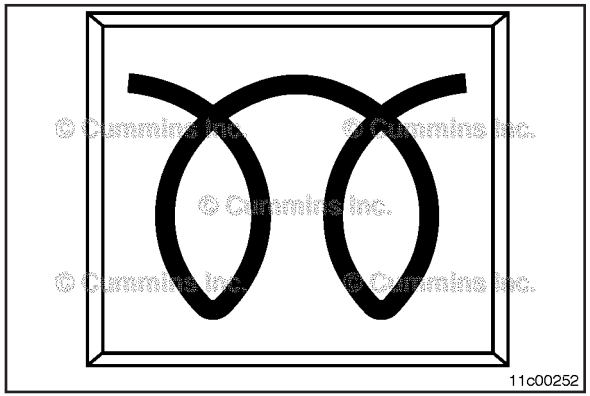
After approximately one hour of engine idle operation, the engine speed will increase to 1000 to 1100 rpm, and remain at this speed for 10 minutes. During this time, the aftertreatment system is warmed up enough to evaporate any water that has condensed in the system.

The aftertreatment warm-up function can be stopped by depressing the throttle, clutch, or brake pedal. If the engine continues to idle, the aftertreatment warm-up function will try again to raise the idle speed until the aftertreatment temperatures are suitable.

Engine Indicator Lamps

General Information

The following engine indicator lamps cover **only** the lamps controlled by the engine control module (ECM). The equipment manufacturer can provide additional indicator lamps. Please reference the equipment owners manual for additional lamp information.



Wait to Start Lamp

The WAIT TO START lamp illuminates when the intake air heater needs to warm the intake air prior to starting the engine.

The time for the WAIT TO START lamp to be on will vary, depending on the ambient air temperature. See Normal Starting Procedure in Section 1. Refer to Procedure 101-014 in Section 1.

The WAIT TO START lamp can look like:

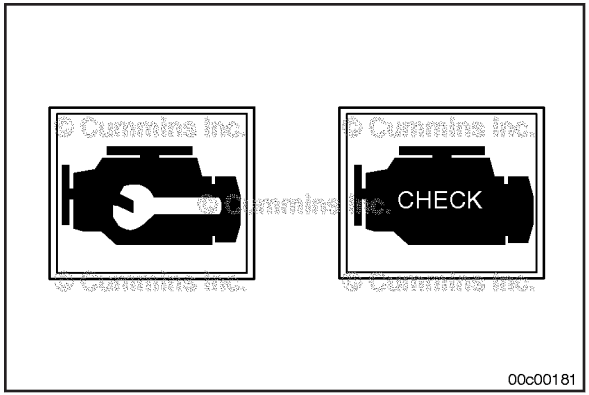
- The words WAIT TO START spelled out
- A symbol similar to the graphic illustrated
- The color of the symbol or words can vary, based on the manufacturer of the vehicle, but will typically be red or amber.

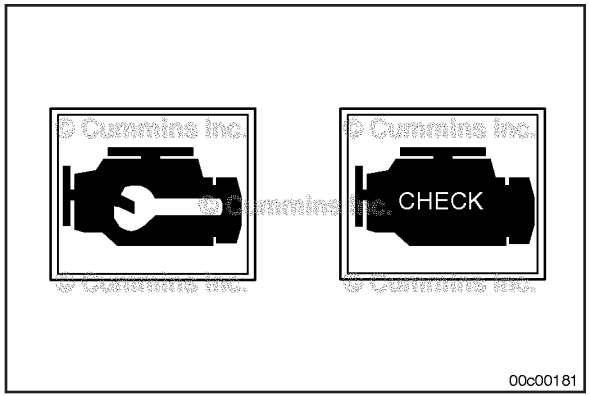
Check Engine Lamp

The CHECK ENGINE lamp illuminates to indicate the driver **must** arrange for service soon. Vehicle may still be operated until the end of the shift.

The CHECK ENGINE lamp is amber, and can look like:

- The words WARNING or CHECK ENGINE spelled out
- A symbol of an engine, similar to the graphic illustrated.
- Low engine lubricating oil level, if equipped with an engine lubricating oil level sensor.





Engine Maintenance Lamp

Another function of the CHECK ENGINE lamp is to flash for 30 seconds at key ON to indicate a maintenance condition. This flashing function is referred to as the MAINTENANCE lamp. The MAINTENANCE lamp can flash for the following reasons:

- Maintenance required, if the Maintenance Monitor feature is enabled
- Water in fuel detected
- Coolant level low
- Diesel exhaust fluid tank level low
- Fuel filter restricted
- Aftertreatment regeneration inhibit switch activated and preventing regeneration
- Maintenance of the crankcase breather element required, if enabled in the calibration
- Maintenance of the aftertreatment diesel particulate filter require, if enabled in calibration.

The lamp will turn off if no other condition exists.

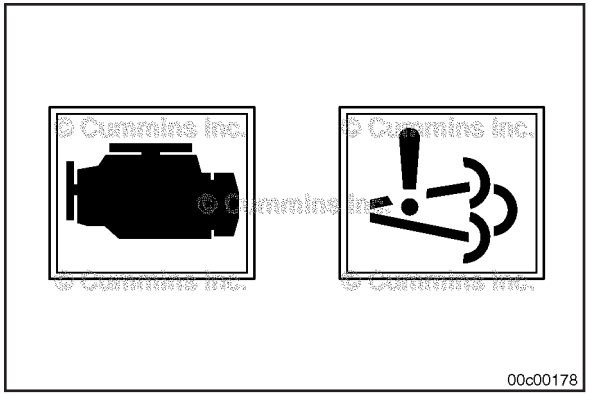
Malfunction Indicator Lamp

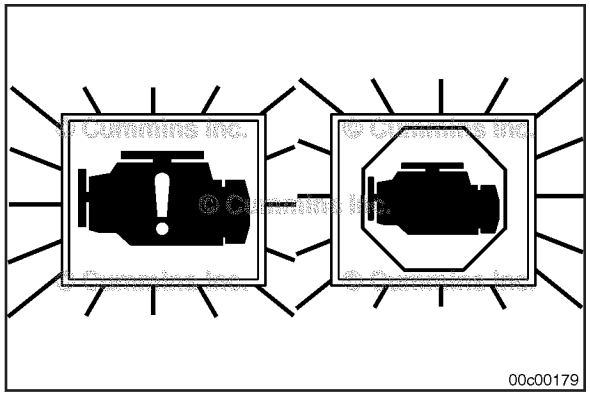
The MALFUNCTION INDICATOR LAMP (MIL) is amber, and can look like:

- A symbol of an engine, similar to the illustration.
- A symbol of exhaust flow featuring an exclamation point, similar to the illustration.

For applications equipped with on-board diagnostic (OBD), the emissions control system monitors and reports malfunctions that impact the emissions control devices. If the OBD system detects such a malfunction, the OBD system illuminates the MIL. Service **must** be scheduled at earliest convenience. Vehicle may still be operated until scheduled service.

The MIL can be illuminated along with any of the engine indicator lamps. It is **not** used to indicate an engine protection or maintenance required condition.





Stop Engine Lamp

The STOP ENGINE lamp indicates, when illuminated, the need to stop the engine as soon as it can be safely done. The engine **must** remain shut down until the engine can be repaired.

For engines with the Engine Protection Shutdown feature enabled, if the STOP ENGINE lamp begins to flash, the engine will automatically shut down after 30 seconds. The flashing STOP engine lamp alerts the operator to the impending shutdown.

The STOP ENGINE lamp is red in color, and can look like:

- The words STOP or STOP ENGINE spelled out
- A symbol of an engine with an exclamation point in the center, similar to the graphic illustrated.

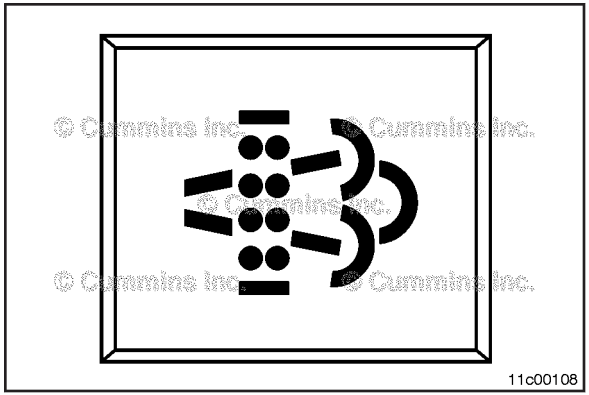
Aftertreatment Diesel Particulate Filter Lamp

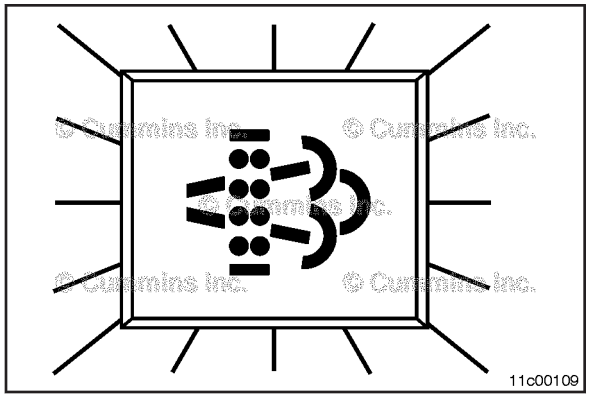
The AFTERTREATMENT DIESEL PARTICULATE FILTER lamp indicates, when illuminated or flashing, that the aftertreatment diesel particulate filter (DPF) requires regeneration.

An illuminated AFTERTREATMENT DIESEL PARTICULATE FILTER lamp indicates that the aftertreatment DPF needs to be regenerated at the next changing opportunity. This can be accomplished by:

1. Changing to a more challenging duty cycle, such as highway driving, for at least 20 minutes
2. Performing a stationary regeneration. Follow the instructions in Unique Operating Characteristics of an Engine with Aftertreatment, in Section 1.

NOTE: Stationary regeneration is considered a normal maintenance practice and is **not** covered by Cummins Inc. warranty.

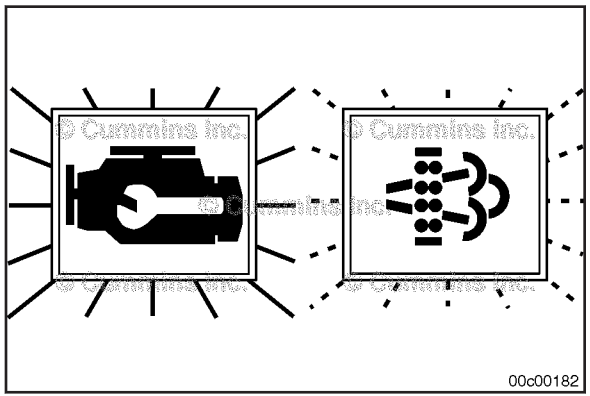




A flashing AFTERTREATMENT DIESEL PARTICULATE FILTER lamp indicates that the aftertreatment DPF needs to be regenerated at the next possible opportunity. Engine power may be reduced automatically.

When this lamp is flashing, the operator should:

1. Change to a more challenging duty cycle, such as highway driving, for at least 20 minutes
2. Performing a stationary regeneration. Follow the instructions in Unique Operating Characteristics of an Engine with Aftertreatment, in Section 1.

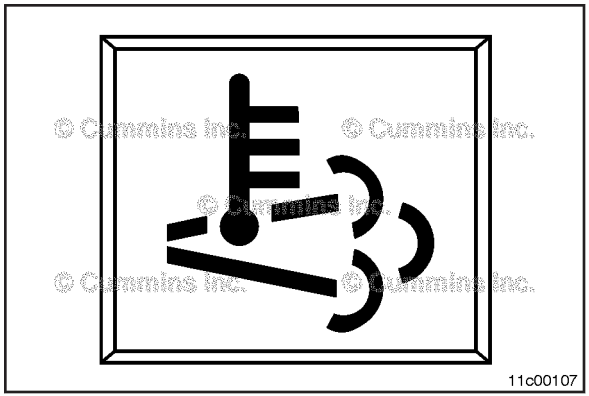


A flashing AFTERTREATMENT DIESEL PARTICULATE FILTER lamp combined with an illuminated WARNING or CHECK ENGINE lamp indicates that the aftertreatment diesel particulate filter needs to be regenerated immediately. Engine power will be reduced automatically.

When these lamps are illuminated, a stationary regeneration is required. Follow the instructions in Unique Operating Characteristics of an Engine With Aftertreatment, in Section 1.

NOTE: If a stationary regeneration is **not** performed, the STOP ENGINE lamp will illuminate and the vehicle will need to be taken to a Cummins® Authorized Repair Location.

High Exhaust System Temperature Lamp



WARNING

When this lamp is illuminated, the exhaust gas temperature could reach 800°C [1500°F], which is hot enough to ignite or melt common materials, and to burn people.

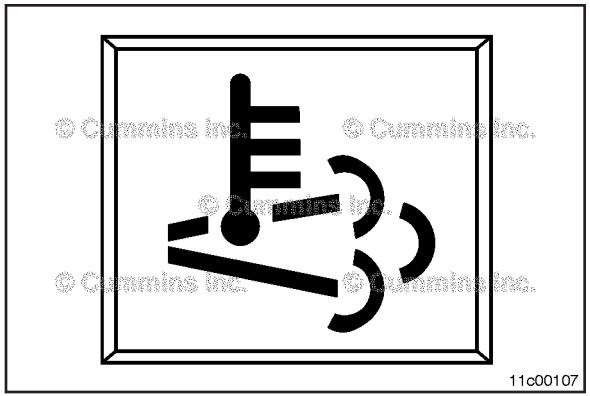
The HIGH EXHAUST SYSTEM TEMPERATURE lamp indicates, when illuminated, that exhaust temperatures are high due to regeneration of the aftertreatment DPF. The lamp could illuminate during normal engine operation or during regeneration.

NOTE: The equipment manufacturer service information determines whether or **not** the HIGH EXHAUST SYSTEM TEMPERATURE lamp is installed on the vehicle. The equipment manufacturer service information also specifies the temperatures, vehicle speeds, and other conditions at which the lamp illuminates. Reference the equipment manufacturer service information for additional information regarding this lamp.

When this lamp is illuminated, be sure the exhaust pipe outlet is **not** directed at any surface or material that can melt, burn, or explode.

- Keep the exhaust outlet away from people and anything that can burn, melt, or explode.
- Nothing within 0.6 m [2 ft] of the exhaust outlet.
- Nothing that can burn, melt, or explode within 1.5 m [5 ft] (such as gasoline, wood, paper, plastics, fabric, compressed gas containers, or hydraulic lines).
- In an emergency, turn the engine off to stop the flow of exhaust.

NOTE: The HIGH EXHAUST SYSTEM TEMPERATURE lamp does **not** signify the need for any kind of vehicle or engine service. It merely alerts the vehicle operator to high exhaust temperatures. It will be common for the HIGH EXHAUST SYSTEM TEMPERATURE lamp to illuminate on and off during normal vehicle operation as the engine completes regeneration.



High Exhaust System Temperature Lamp

WARNING

When this lamp is illuminated, the exhaust gas temperature could reach 800°C [1500°F], which is hot enough to ignite or melt common materials, and to burn people.

The HIGH EXHAUST SYSTEM TEMPERATURE lamp indicates, when illuminated, that exhaust temperatures are high due to regeneration of the aftertreatment DPF. The lamp could illuminate during normal engine operation or during a manual (non-mission) regeneration.

NOTE: The OEM specifies the temperatures, equipment speeds, and other conditions at which the lamp illuminates. Reference the equipment manufacturer service information for additional information regarding this lamp.

When this lamp is illuminated, be sure the exhaust pipe outlet is **not** directed at any surface or material that can melt, burn, or explode.

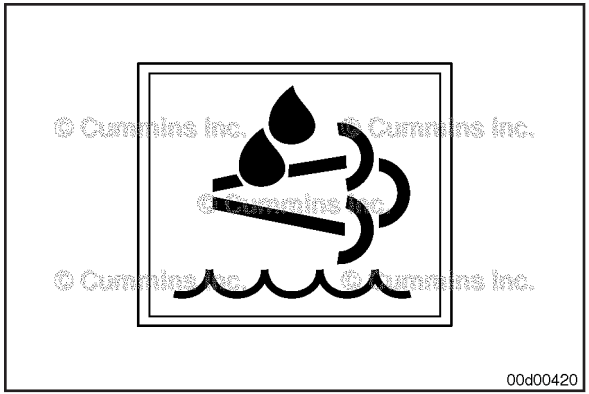
- Keep the exhaust outlet away from people and anything that can burn, melt, or explode.
- Nothing within 0.6 m [2 ft] of the exhaust outlet.
- Nothing that can burn, melt, or explode within 1.5 m [5 ft] (such as gasoline, wood, paper, plastics, fabric, compressed gas containers, or hydraulic lines).
- In an emergency, turn the engine off to stop the flow of exhaust.

NOTE: The HIGH EXHAUST SYSTEM TEMPERATURE lamp does **not** signify the need for any kind of equipment or engine service. It merely alerts the equipment operator to high exhaust temperatures. It will be common for the HIGH EXHAUST SYSTEM TEMPERATURE lamp to illuminate on and off during normal equipment operation as the engine completes regeneration.

Aftertreatment Diesel Exhaust Fluid Lamp

The AFTERTREATMENT DIESEL EXHAUST FLUID lamp indicates, when illuminated or flashing, that the diesel exhaust fluid (DEF) level is low.

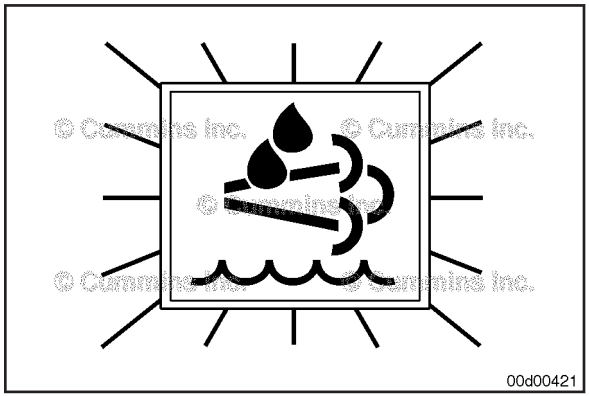
An illuminated AFTERTREATMENT DIESEL EXHAUST FLUID lamp indicates that the DEF level has fallen below the initial warning level. This can be corrected by filling the DEF tank with DEF.

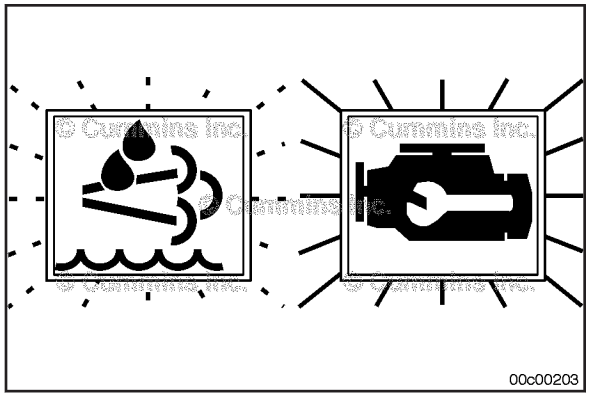


A flashing AFTERTREATMENT DIESEL EXHAUST FLUID lamp indicates that the DEF level has fallen below the critical warning level. The engine power will have a mild derate. This can be corrected by filling the DEF tank with DEF.

NOTE: It is recommended that the DEF tank be filled completely full of DEF in order to correct any fault conditions.

Other events that can cause the flashing AFTERTREATMENT DIESEL EXHAUST FLUID lamp are incorrect DEF type or tampering of the SCR system have been detected for more than one hour. The engine power will have a mild derate.





An illuminated or flashing AFTERTREATMENT DIESEL EXHAUST FLUID lamp combined with an illuminated WARNING or CHECK ENGINE lamp indicates that the DEF level has fallen below the initial derate level. The engine power will be limited automatically. This can be corrected by filling the DEF tank with DEF.

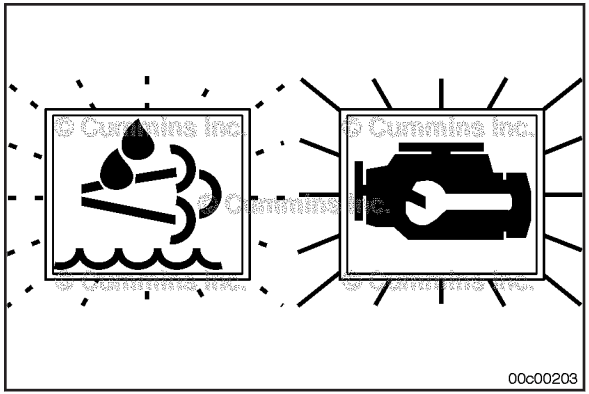
Other events that can cause an illuminated or flashing AFTERTREATMENT DIESEL EXHAUST FLUID lamp combined with an illuminated WARNING or CHECK ENGINE lamp are incorrect DEF type or tampering has been detected for more than five hours.

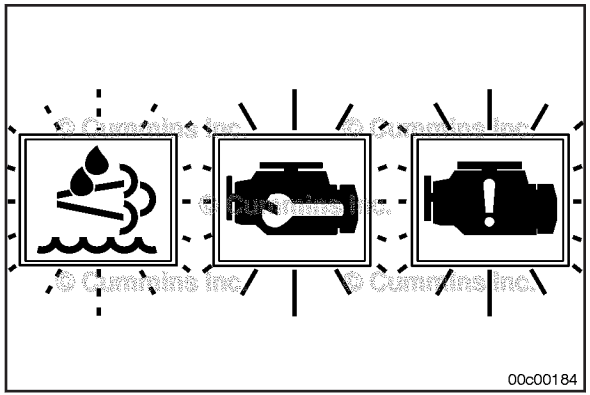
NOTE: It is recommended that the DEF tank be filled completely full of DEF in order to correct any fault conditions.

Allowing the DEF tank to become empty will cause the aftertreatment DEF dosing system to lose prime. A loss of prime condition may cause fault codes to become active.

NOTE: On OBD certified products, the MIL may become illuminated for a loss of prime condition.

NOTE: It is recommended that the DEF tank be filled completely full of DEF in order to correct any fault conditions.





If the engine has been shut down or has idled for an extended period of time after the DEF tank has been emptied, the STOP ENGINE lamp will also be illuminated along with the flashing AFTERTREATMENT DIESEL EXHAUST FLUID lamp and illuminated CHECK ENGINE lamp. The engine power will continue to be limited automatically. The vehicle speed will also be limited to 5 mph.

NOTE: Some emergency vehicles may perform differently from the description above.

NOTE: To remove the 5 mph speed limit, the DEF tank **must** be filled to at least 10 percent volume of the tank.

NOTE: It is recommended that the DEF tank be filled completely full of DEF in order to correct any fault conditions.

NOTE: The MIL may also be illuminated.

Unique Operating Characteristics of an Engine with Airless Selective Catalytic Reduction (SCR)

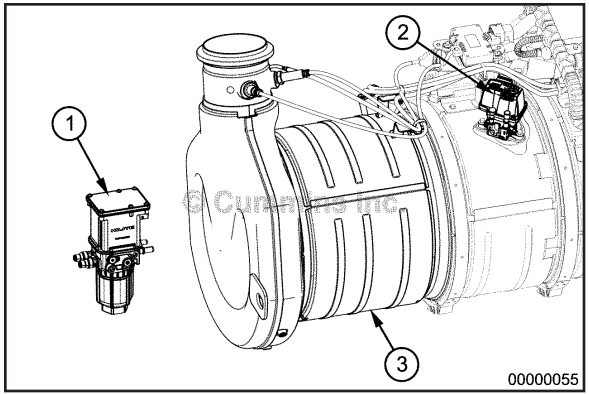
General Information

The SCR system is used to decrease the nitrogen oxides (NOx) emissions from the vehicle tailpipe. The system is composed of several main components:

1 Aftertreatment diesel exhaust fluid (DEF) dosing unit

2 Aftertreatment DEF dosing valve

3 Aftertreatment SCR catalyst.



NOTE: It is unlawful to tamper with, modify, or remove any component of the SCR system. It is also unlawful to use DEF that does **not** meet the specifications provided or to operate the vehicle/equipment with no DEF.

DEF is required for an engine equipped with a SCR system. DEF is a fluid that is sprayed into the exhaust gas prior to the aftertreatment SCR catalyst. The DEF vaporizes and decomposes to form carbon dioxide and ammonia. The ammonia reacts with the NOx emissions over the aftertreatment SCR catalyst to form nitrogen and water.

DEF:

- may have a slight ammonia smell
- is colorless
- is non-toxic and non-polluting
- is non-flammable.

Urea is naturally occurring and is biodegradable.

See the following procedure for DEF specifications. Refer to Procedure 018-026 in Section V.

NOTE: Cummins Inc. supplies the aftertreatment DEF dosing unit, aftertreatment DEF dosing valve, and the aftertreatment SCR catalyst. The vehicle manufacturer supplies the DEF tank, the DEF lines, the DEF tank temperature, level, and quality sensors.

The aftertreatment DEF dosing unit pumps DEF from the DEF tank to the aftertreatment DEF dosing valve. The aftertreatment DEF dosing unit is coolant heated and contains a filter that is a maintenance item.

See the following procedure for the aftertreatment DEF dosing unit filter maintenance interval. Refer to Procedure 359-001 in Section 3.

The aftertreatment DEF dosing valve is DEF cooled, and sprays DEF into the exhaust.

The aftertreatment SCR catalyst uses DEF to reduce the NOx emissions in the engine exhaust to nitrogen and water. The aftertreatment SCR catalyst itself requires no maintenance.

A vehicle with SCR is equipped with an additional lamp on the dashboard. This is the aftertreatment DEF lamp. This lamp, along with the CHECK ENGINE lamp and STOP ENGINE lamp, alerts the operator to the level of DEF in the tank. As the DEF tank level approaches empty, the aftertreatment DEF lamp illuminates and engine power is reduced. Attempting to operate the vehicle with no DEF in the tank will result in the vehicle speed being limited to 8 kmh [5 mph].

See the following procedure for additional information on the aftertreatment diesel fluid lamp and associated engine derates. Refer to Procedure 101-048 in Section 1.

DEF is sprayed into the exhaust when the temperature in the aftertreatment SCR catalyst reaches approximately 250°C [482°F]. The amount of DEF consumed differs from vehicle to vehicle, as DEF consumption depends on engine speed and load.

Even though DEF freezes at approximately -12°C [11°F], the SCR system is designed to be frozen and thawed. The DEF tank is heated by engine coolant and the DEF lines and aftertreatment DEF dosing unit are electrically heated. No operator interaction is needed when operating in cold temperatures; heating and thawing are controlled automatically by the engine control module (ECM).

After turning the keyswitch OFF on a vehicle with SCR, a pumping sound will possibly be heard from beneath the vehicle. This sound is the aftertreatment DEF dosing unit recirculating DEF through the system and returning it to the tank. This is normal system operation. The recirculation process may take up to 15 minutes to complete. Do **not** disconnect the vehicle batteries during this process to reduce the possibility of system damage.

Under certain conditions (cold or very dry), water condensation, in the form of water vapor, can be seen coming from the vehicle tailpipe. This is normal operation and will clear within a few minutes of normal vehicle operation.

Unique Operating Characteristics of an Engine with On-Board Diagnostic

General Information

The engines supported by this manual are required to meet Environmental Protection Agency (EPA) Heavy Duty (HD) On-Board Diagnostics (OBD) regulations. EPA HD OBD is required for all U.S. vehicles with a gross vehicle weight over 6350 kg [14,000 lb].

OBD exists to make sure the engine is operating within emissions limits. OBD continuously monitors the engine and aftertreatment system to detect malfunctions that adversely affect emissions. Once a malfunction is detected, a malfunction indicator lamp (MIL) illuminates to inform the driver of the malfunction and a fault code, which identifies the likely malfunction, is stored in the engine control module (ECM).

An OBD system operates in a manner very similar to the traditional Cummins® diagnostic system. Both systems store fault codes, induce derates when required to protect the engine and aftertreatment from further damage, and illuminate dashboard lamps. These fault codes are used by the service channel for troubleshooting and repair.

The differences between an OBD system and the traditional Cummins® diagnostic system are that an OBD system:

- illuminates the malfunction indicator lamp (MIL)
- detects deteriorated components and systems (**not** just total malfunctions)
- performs multiple trip diagnostics.

Multiple trip diagnostics are malfunctions that **must** occur in multiple consecutive trips before the MIL is illuminated. A trip is a condition or operating state the engine **must** operate for the OBD fault code to gather information and determine if a malfunction has occurred. The MIL turns on when an OBD fault code is logged, and in most cases, it requires three trips without a malfunction occurrence to clear the lamp.

Reference the On-Board Diagnostics (OBD) for EPA/ARB Certified Engines, Service Bulletin 2883408, for additional OBD information.

For more information on the MIL and what the operator **must** do when the MIL illuminates, reference the following procedure. Refer to Procedure 101-048 in Section 1.

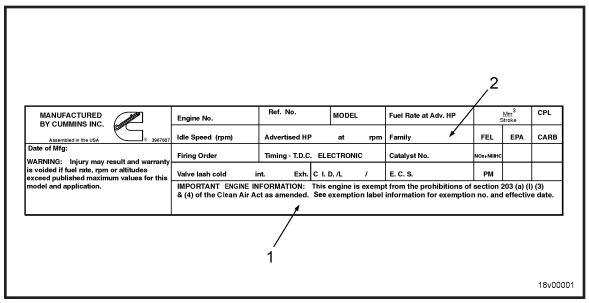
Maintenance Monitor Reset

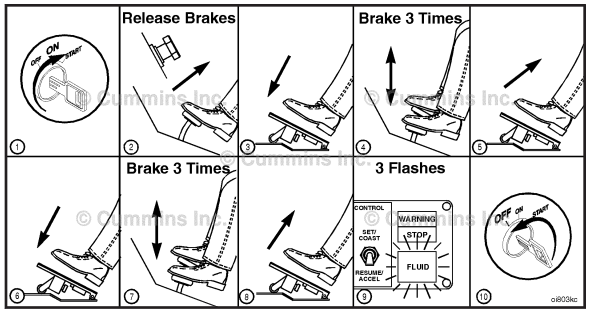
Reset

After Lubricating Oil Change

- If the diagnostics are enabled, the CHECK ENGINE lamp will appear when the lubricating oil change interval has been reached.
- Use the following steps to reset the CHECK ENGINE lamp after changing the lubricating oil.

To determine the engines model year, reference the emission year (1) on the engine dataplate. Another reference is the first digit of the Family (2) on the engine dataplate. M=2021, N=2022, P=2023, R=2024.





For Model Year 2021 through Model Year 2023, the maintenance monitor can be reset using an electronic service tool, or by following steps 1 through 10. Steps 3 through 8 **must** be done within 12 seconds for the maintenance monitor to be reset. The diagnostic switch **must** be in the OFF position and the vehicle air system **must** be fully charged.

1 Turn the keyswitch ON (engine **must not** be operating).

2 Verify brakes are released (service and trailer brakes).

3 Hold throttle pedal at 100 percent throttle.

4 Press and release service brake three times.

5 Release throttle pedal.

6 Depress and hold throttle pedal at 100 percent throttle again.

7 Press and release service brake three more times.

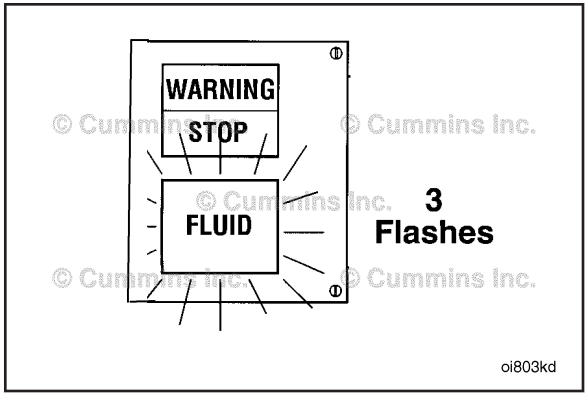
8 Release throttle pedal.

9 The light will flash three times.

10 Turn the keyswitch OFF.

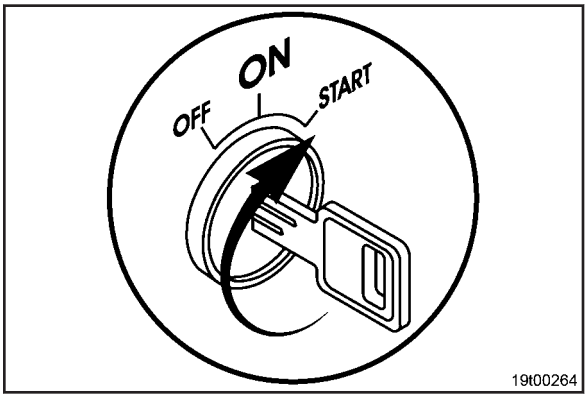
As soon as the throttle pedal is released (step 8), the engine protection lamp will flash three quick flashes. This means the reset command has been received and the maintenance monitor will reset its distance (miles or kilometers), and time (hours) to zero the next time the keyswitch is turned off (step 10).

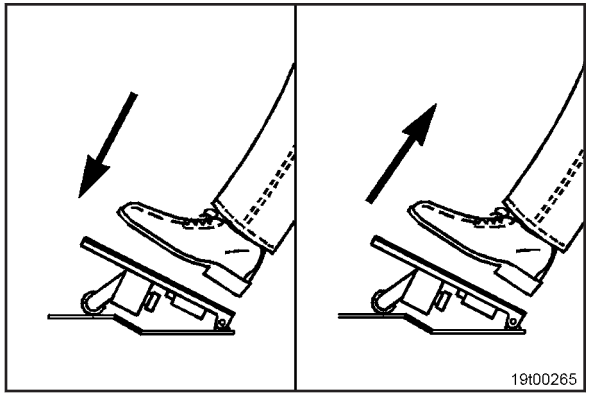
NOTE: If the engine protection lamp does **not** flash three times after the throttle pedal is released on step 8 above, the maintenance monitor reset sequence **must** be performed again.



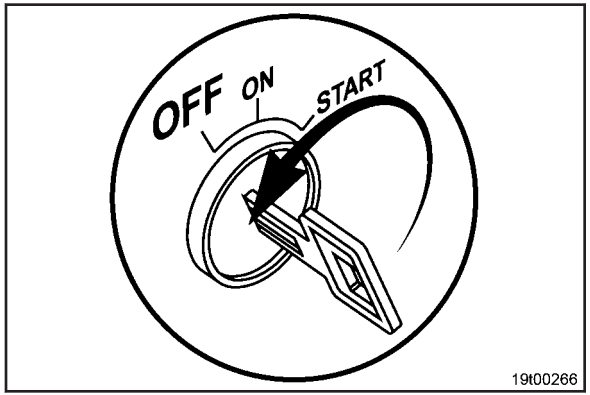
For Model Year 2024 and newer, the maintenance monitor can be reset using an electronic service tool, or by following steps 1 through 3. Steps 1 through 3 **must** be done within 10 seconds for the maintenance monitor to be reset.

1 Turn keyswitch to ON position (do **not** start engine).





2. Fully depress and release the throttle pedal 3 times within 10 seconds from key on (brake pedal **not** pressed).



3. Turn keyswitch to OFF position.

Unique Operating Characteristics of an Engine with a Connectivity Module

General Information

Cummins® existing and future support of engines through digital tools and features is enabled by Cummins Acumen®, a Telematic Service Provider, or an OEM module. The features offered through the connectivity module can be different based on the given hardware and software versions.

Digital tools and features include, but are **not** limited to:

- Continuous monitoring and diagnosis of system fault alerts
- Predictive service insights
- Over-the-air calibration and parameter updates
- Optimized maintenance and performance

More information can be found here:

NOTE: https://www.cummins.com/parts-and-service/digital-products-and-services

Notes

Section 2 - Daily Maintenance

Section Contents

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Daily Maintenance Guidelines

General Information

This section contains procedures that support daily maintenance tasks. Cummins Inc. recommends that the product be maintained according to the Daily Maintenance Schedule in this section.

Equipment and components supplied by manufacturers other than Cummins Inc. can impact the performance and reliability of the product if **not** correctly maintained.

If your product is equipped with a component or accessory **not** manufactured or supplied by Cummins Inc., see the maintenance recommendations provided by the component manufacturer.

Use the “Maintenance Record Form” provided in this section to record completed maintenance tasks.

For detailed information or assistance, contact your local Cummins® Authorized Repair Location.

Daily Maintenance Schedule

General Information

Preventative maintenance begins with day-to-day awareness of the system. Prior to engine operation, check for the following:

- Excessive oil, coolant, or fuel consumption.
- Leaks.
- Loose or damaged parts.
- Worn or damaged belts.

- Worn or damaged wiring harnesses.
- Any change in system appearance.
- Odor of fuel.
- Odor of electronic devices.

When operating the engine, listen for any unusual system noises which can indicate service is required.

Take appropriate action to rectify any abnormalities or contact a Cummins® Authorized Repair Location.

Schedule

The following daily maintenance schedule lists inspections and procedures which **must** be performed on a daily basis to properly maintain the engine.

Daily Maintenance

- Air Intake Piping - Check
- Fan, Cooling - Check
- Crankcase Breather Tube - Check
- Air Tanks and Reservoirs - Drain
- Coolant Level - Check
- Fuel-Water Separator - Drain
- Lubricating Oil Level - Check
- Aftertreatment Exhaust Piping - Check
- Diesel Exhaust Fluid (DEF) Level - Check.

Section 3 - Routine Maintenance

Section Contents

Routine Maintenance Guidelines

General Information

This section contains procedures that support routine maintenance tasks. Cummins Inc. recommends that the product be maintained according to the Routine Maintenance Schedule in this section.

Some maintenance procedures require special tools. The Tool Requirements procedure lists the special tools required to perform maintenance procedures listed in this section.

Use the “Routine Maintenance Record Form” provided in this section to record completed maintenance tasks.

For detailed information or assistance, contact your local Cummins® Authorized Repair Location.

Schedule

The routine maintenance schedule provides maintenance intervals and the corresponding procedures that should be performed in order to properly maintain this product.

Intervals marked in the schedule **only** apply to Cummins Inc. components.

Equipment and components supplied by manufacturers other than Cummins Inc. can impact the performance and reliability of the product if **not** correctly maintained. If your product is equipped with a component or accessory **not** manufactured or supplied by Cummins Inc., see the maintenance recommendations provided by the component manufacturer.

Cummins Inc. products are customized for end users. Customer selectable options listed in the routine maintenance schedule or maintenance monitor system might **not** be on your product. Verification of the components installed on your product can be necessary prior to performing maintenance. For detailed information or assistance, contact your local Cummins® Authorized Repair Location.

The maintenance schedule provides guidance on servicing items supplied by component manufacturers through the use of the following statements:

- The statement “See equipment manufacturer service information” indicates the equipment manufacturer service information should be referenced for maintenance information.
- The statement “If equipped” indicates if the item is on your product, the item should be serviced at the marked interval.
- The statement “See component manufacturer service information” indicates the component manufacturer service information should be referenced for maintenance information.

Multiple intervals can be marked for one maintenance item. The first marked interval indicates a first service event or break-in requirement for that item. The second marked interval indicates the routine service interval which should be followed for that item.

The end of the maintenance schedule does **not** indicate the end of required maintenance. Continue performing maintenance events at the indicated routine intervals throughout the life of the product.

Perform maintenance at whichever interval occurs first. At each scheduled maintenance interval, perform all previous maintenance checks that are due for scheduled maintenance.

Routine Maintenance Tool Requirements

General Information

The following is a list of special service tools required for some maintenance operations:

Tool Part Number	Description
3375045	Torque wrench (0 to 175 ft-lb)
5299073	Engine barring gear

Tool Part Number	Description
5299853	Engine barring tool
3400157	Filter wrench
3400158	Filter wrench
CC-2602 (Fleetguard® Part Number)	Coolant test kit
CC-2609 (Fleetguard® Part Number)	Coolant test kit
CC-2806 (Fleetguard® Part Number)	Refractometer
ST-1293	Belt Tension Gauge (V-belts)

Contact the nearest Cummins® Authorized Repair Location for the required service tools.

Routine Maintenance Schedule

Schedule

Perform maintenance at whichever interval occurs first. At each scheduled maintenance interval, perform all previous maintenance checks that are due for scheduled maintenance.

Multiple intervals may be marked for one maintenance item. The first marked interval indicates a first service event or break-in requirement for that item. The second marked interval indicates the routine service interval which should be followed for that item.

The end of the maintenance schedule does not indicate the end of required maintenance. Continue performing maintenance events at the indicated routine intervals throughout the life of the product.

Routine Maintenance Schedule

Kilometers x 1000		12	24	48	96	241.5	480					
Miles x 1000		**7.5**	**15**	**30**	**60**	**150**	**300**					
Hours		**250**	**500**	**1000**	**2000**	**5000**	**6750**					
Months		**3**	**6**	**12**								
Procedure	**Step**											
Air Cleaner Restriction	Check	X										
Batteries	Check		X									
Battery Cables and Connections	Check		X									
Radiator Pressure Cap	Check		X									
Lubricating Oil and Filters	Change	See the Lubricating Oil System Intervals Procedure. Refer to Procedure 359-003 in Section 3.										
Fuel Filter (Spin-On Type)	Change	See the Fuel Filter Intervals Procedure. Refer to Procedure 359-008 in Section 3.										
Cooling System	Flush	See the Coolant Intervals Procedure. Refer to Procedure 359-025 in Section 3										
Drive Belt, Cooling Fan	Check			X								
Cooling Fan Belt Tensioner	Check			X								
Air Compressor Discharge Lines	Check			X								

Kilometers x 1000		**12**	**24**	**48**	**96**	**241.5**	**480**					
Miles x 1000		**7.5**	**15**	**30**	**60**	**150**	**300**					
Hours		**250**	**500**	**1000**	**2000**	**5000**	**6750**					
Months		**3**	**6**	**12**								
Vibration Damper, Viscous	Check				X							
Engine Cleaning	Clean	See the Engine Cleaning Intervals procedure. Refer to Procedure 359-015 in Section 3.										
Radiator Hoses	Check				X							
Overhead Set	Adjust					X						
Air Intake Connection	Clean	See Air Intake Connection Intervals procedure. Refer to Procedure 359-029 in Section 3.										
Aftertreatment Diesel Particulate Filter	Clean	See Aftertreatment Diesel Particulate Filter Intervals procedure. Refer to Procedure 359-006 in Section 3.										
Aftertreatment Diesel Exhaust Fluid Dosing Unit Filter	Change						X					

Routine Maintenance Record Form

Maintenance Data

Maintenance Record	
Product Serial No.:	Product Model:

Owner's Name:	Equipment Model/Number:

Key to table headings:
A = Date
B = Schedule km [Miles], Hours or Time Interval
C = Actual km [Miles], Hours or Time
D = Maintenance Check Performed
E = Check Performed By
F = Comments

A	B	C	D	E	F

Lubricating Oil System Intervals

Oil Drain Intervals

⚠CAUTION⚠

Selecting the incorrect oil drain interval for the engine will reduce engine life.

⚠CAUTION⚠

Extending the oil and filter change interval beyond the recommended interval will decrease engine life due to corrosion, deposits, and wear.

⚠CAUTION⚠

Use of the incorrect lubricating oil filter will reduce engine life.

⚠CAUTION⚠

If maintenance monitor settings change, perform the change during an oil drain event. If the settings are changed in the middle of a lubricating oil and filter change interval, manually keep track of the current interval.

A high-quality lubricating oil that meets Cummins Engineering Standard CES 20086 (CK-4) **must** be used. Refer to Procedure 018-003 in Section V to identify the correct lubricating oil for your engine and operating conditions.

Lubricating oil filters **must** be changed when the lubricating oil is changed. Refer to Procedure 018-024 in Section V to identify the correct lubricating oil filter for the engine.

Maintaining the correct lubricating oil and filter change interval is a vital factor in preserving the integrity of an engine. See the following table to determine the maximum recommended lubricating oil change and lubricating oil filter change intervals. Lubricating oil and lubricating oil filter drain intervals are based on lubricating oil capacity and fuel economy. Drain the lubricating oil and change the lubricating oil filter according to engine distance or engine run time from the table below or 18 months, whichever comes first.

If maintenance monitor is enabled, use the following procedure in the B6.7 CM2450 B155B Service Manual, Bulletin 5613229. Refer to Procedure 019-711 in Section 19 to correctly enable and setup maintenance monitor feature.

If vehicle duty cycle is changed before an oil drain interval while using manual mode, see Table 1.

Table 1, Fuel Economy

Total Lubricating Oil Capacity (Oil Pan and Oil Filter)	Engine Distance or Run Time	Severe < 6 mpg (<2.6 km/liter)	Normal[1] 6 -10 mpg (2.6-4.3 km/liter)	Light[1] > 10 mpg (>4.3 km/liter)
19.5 quarts (18.5 liters)	Miles	12,000	25,000	30,000
	Kilometers	19,000	40,000	48,000
	Hours	900	1000	1,000

Table 1, Fuel Economy				
Total Lubricating Oil Capacity (Oil Pan and Oil Filter)	**Engine Distance or Run Time**	**Severe < 6 mpg (<2.6 km/liter)**	**Normal[1] 6 -10 mpg (2.6-4.3 km/liter)**	**Light[1] > 10 mpg (>4.3 km/liter)**
16 quarts (15.1 liters)	Miles	10,000	20,000	25,000
	Kilometers	16,000	32,000	40,000
	Hours	650	750	850

1 If combined percent idle time plus power takeoff (PTO) time is greater than 40 percent for Normal or Light intervals, use the next lower drain interval. For Severe interval, use the published drain interval regardless of the combined idle time plus PTO time.

If the total lubricating oil capacity is **not** known:

a Contact a Cummins® Distributor/Dealer

b Search the specific engine serial number on parts.cummins.com. In the parts catalog-option view refer to the engine oil (LO) option notes.

c Determine the capacity of the lubricating oil pan option for the engine being serviced. Use QuickServe™ Online and the engine serial number. Refer to Procedure 018-017 in Section V.

NOTE: If the equipment is using a remote lubricating oil tank in which lubricating oil is continuously circulated (**not** a lubricating oil make-up tank), the lubricating oil in the remote tank **must** be changed when the lubricating oil in the lubricating oil pan is changed.

Lubricating oil drain intervals may be extended further by enrolling in Cummins® Oil Guard.

For more information regarding engine lubricating oil analysis, see Section 4 of the Fluids for Cummins® Products Service Manual, Bulletin 5411406.

Aftertreatment Diesel Particulate Filter Intervals

General Information

Diesel particulate filters fill with ash over time and require service. Ash accumulation is variable and based on many duty cycle factors. To optimize maintenance costs, it is recommended to use the maintenance lamp as an indicator for DPF maintenance. When the system detects the DPF will soon need to be serviced due to ash accumulation fault code 5383 will become active (shown in table 1) and will display the engine maintenance lamp on the vehicle dash, if equipped. Service must be scheduled at earliest convenience. The vehicle may continue to be operated until the scheduled service is completed.

NOTE: If service of the DPF is delayed for an extended period of time, progressive mission disabling faults may occur.

Use the following procedure for maintenance lamp behavior descriptions. Refer to Procedure 101-048 in Section 1.

Table 1: Maintenance Fault Code

Maintenance Item	Cummins® Fault Code Number	Fault Code Description
Aftertreatment DPF	5383	Aftertreatment 1 Diesel Particulate Filter Ash Load Percent - Data Valid But Above Normal Operating Range - Least Severe Level. The aftertreatment DPF requires cleaning or replacement.

Alternately, table 2 may be used for customers that prefer a predictable maintenance schedule. Upon reaching the hours or miles listed in Table 2 the DPF must be serviced at the next service event.

Table 2: Diesel Particulate Filter (DPF) Maintenance Intervals
All Applications
6500 hours
200,000 miles

The following conditions require more frequent DPF maintenance:

- Use of engine lubricating oil that does not meet API CK-4. Refer to Procedure 018-003 in Section V.
- Excessive oil consumption.
- Frequent or extended use of engine brakes.
- Extended idle.

NOTE: The maintenance lamp for the aftertreatment DPF is not a user selectable feature or parameter in the recommended Cummins® electronic service tool or equivalent.

All aftertreatment DPFs requiring ash cleaning **must** be cleaned by appropriately trained personnel. Unauthorized cleaning methods can **not** be used to clean the aftertreatment DPF. Refer to Procedure 101-047 in Section 1.

Fuel Filter Intervals

General Information

Fuel filter change intervals are based on the following:

- Application

⚠CAUTION⚠

Extending the fuel filter change interval beyond recommended will decrease engine life due to corrosion, depositions, and wear.

See Tables 1 and 2 below for fuel filter change intervals.

Table 1, Pressure Side Fuel Filter (Primary)			
Kilometers	**Miles**	**Hours**	**Months**
96,000	60,000	2,000	18

Table 2, Suction Side Fuel Filter (Prefilter with Water in Fuel Sensor)[1]			
Kilometers	**Miles**	**Hours**	**Months**
96,000	60,000	2,000	18

[1]Interval is based on fuel filters that meet requirements. Refer to Procedure 018-024 in Section V. The equipment/vehicle original equipment manufacturer (OEM) may use a non-Cummins branded stage 1 fuel filter. See equipment manufacturer service information for interval details.

Engine Cleaning Intervals

General Information

Engine Cleaning intervals are based on the following:

- Application

⚠CAUTION⚠

Extending the engine cleaning interval beyond recommendations noted below will decrease engine life as a result of premature rust, corrosion, deposits, and wear.

Perform maintenance at whichever interval occurs first. Continue performing maintenance events at the indicated routine intervals throughout the life of the product. Steam is the recommended method of cleaning a dirty engine or a piece of equipment. Refer to Procedure 000-009 in Section 3.

See Tables 1 and 2 below for engine cleaning intervals.

Table 1, Standard Operation (All Applications Excluding Table 2)			
Kilometers	Miles	Hours	Months
96,000	60,000	2000	24

Table 2, Extreme Operation (Example: Snowplow, Street Sweeper, Refuse Applications with Exposure to Road Salt, Chemicals, Debris Accumulation of ¼ inch Thickness)[1]			
Kilometers	Miles	Hours	Months
12,000	7,500	250	3

[1]Applications, where dirt or debris accumulates to 1/4" in less than the specified period, can require more frequent cleaning to prevent engine damage.

Coolant Intervals

General Information

There are multiple procedures in this manual for properly maintaining the cooling system:

- This procedure identifies the coolant and filter interval.

- The Cooling System procedure provides guidance for coolant replacement. Refer to Procedure 008-018 in Section 3.
- Use the Coolant Recommendations and Specifications procedure for coolant testing and analysis to identify the proper coolant and additives that are needed for the engine. Refer to Procedure 018-004 in Section V.

Coolant Interval

⚠CAUTION⚠

Make sure that the coolant filters are also considered when servicing the cooling system. Some coolant filters add SCA to the cooling system. An elevated concentration of SCA will damage the engine.

See the following table to determine the coolant intervals.

Table A		Glycol Check			SCA		Coolant Replacement
Coolant Type	**Additive Type**	**Interval (hrs)**	**Test Strip**	**Refractometer**	**Interval (hrs)**	**Test Strip**	**Interval (hrs)**
Conventional	SCA	500	CC2602 CC2602A CC2602B CC2602M CC2602AM	CC2806	500	CC2602 CC2602A CC2602B CC2602M CC2602AM	1500
Hybrid	SCA						4000
Hybrid	Organic			CC8998	N/A*	N/A	4000
ELC/OAT	Organic				N/A	N/A	6000
*If extender is used, follow coolant manufacturer's guideline							

Definitions:

- ELC – Extended Life Coolant
- OAT – Organic Additive Technology

If the glycol concentration or SCA is found to be out of specification, Refer to Procedure 018-004 in Section V to identify the repair action needed.

NOTE: If the engine is equipped with a coolant filter please refer to the Coolant Filter section of this procedure as part of the cooling system maintenance. This is important when considering that some coolant filters also contribute to the SCA in the coolant.

If the coolant replacement interval has been reached and coolant life will **not** be extended with testing, Refer to Procedure 008-018 in Section V for proper draining, flushing, and filling instructions.

Coolant replacement intervals can be extended through the use of test strips or lab testing. See the Coolant Testing portion of this procedure for information on extending coolant intervals.

Coolant Filter

⚠CAUTION⚠

Coolant filter maintenance and selection is important to the cooling system. Selecting the correct filter is important to the cooling system health. If an incompatible filter is selected engine damage could occur.

NOTE: Not all engines are equipped with a coolant filter.

See the following table to determine the maximum recommended coolant filter change intervals in hours.

Table B

Coolant Type	Coolant Filter Type	SCA Additive in filter	Interval (hrs)
Conventional or Hybrid	Standard	Yes	500

Table B			
Coolant Type	**Coolant Filter Type**	**SCA Additive in filter**	**Interval (hrs)**
Conventional or Hybrid	ESI	Yes	4000
Conventional or Hybrid or ELC/OAT	ESI	No	4000
ESI - Extended Service Interval			

If the coolant filter **must** be replaced:

- For coolant filter selection and part number. Refer to Procedure 018-024 in Section V.
- For important SCA considerations when selecting the coolant filter. Refer to Procedure 018-004 in Section V.

Coolant Testing

See the following table to determine the coolant testing interval to extend the coolant replacement interval beyond the replacement interval shown in Table A.

If test results exceed the coolant replacement limits, then coolant **must** be replaced. See Section 5 of the Fluids for Cummins® Products Service Manual, Bulletin 5411406.

The recommended testing interval in the table below are to be completed after the recommended coolant replacement interval in Table A.

For example: If the vehicle is equipped with an ELC/OAT organic coolant. The recommended replacement interval is 6000 hours, therefore testing to extend the life of the coolant should be completed at 7000 hours, 8000 hours, etc.

Table C		SCA / Glycol Check	Coolant Replacement Check		
Coolant Type	**Additive Type**	**Interval (hrs)**	**Interval (hrs)**	**Test Strip**	**Lab Test Kit**
Conventional	SCA	See Table A	1000	CC2718	CC2700
Hybrid	SCA				CC2706
Hybrid	Organic				
ELC/OAT	Organic				

NOTE: Laboratory testing of the coolant is recommended to make sure the coolant meets all of the specifications to ensure optimum cooling system health.

Additional details on Cooling System maintenance can be found in Section 5 of the Fluids for Cummins® Products Service Manual, Bulletin 5411406.

Air Intake Connection Intervals

General Information

Air intake connection ports can fill with soot over time and require service. Soot accumulation is variable and based on many duty cycle factors. To optimize maintenance costs, clean the exhaust gas entrance ports and exhaust gas recirculation (EGR) differential pressure horizontal and vertical ports in the air intake connection at the service intervals below.

If service of the air intake connection is delayed for an extended period of time, progressive mission disabling faults can occur.

Upon reaching the time or distance listed in Table 1, the air intake connection **must** be cleaned at the next service event. Each subsequent cleaning **must** be performed per the intervals listed in Table 2. For example, if first cleaning

was performed at 160,934 kilometers [100,000 miles], the second cleaning should be performed at 241,402 kilometers [150,000 miles] after the first cleaning i.e. at 402,336 kilometers [250,000 miles].

Table 1, Air Intake Connection Maintenance Intervals – First Cleaning
All Applications
3000 hours
160,934 kilometers [100,000 miles]

Table 2, Air Intake Connection Maintenance Intervals – Subsequent Cleanings
All Applications
4500 hours
241,402 kilometers [150,000 miles]

Reference Service Bulletin, Exhaust Gas Recirculation (EGR) System Intake Air Connection Inspection and Cleaning Guidelines, Bulletin 5579934 for more details.

Section L - Service Literature

Section Contents

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Additional Service Literature

General Information

The following publications can be purchased:

Additional Service Literature	
5613227	B6.7 CM2450 B155B Owners Manual
5613228	B6.7 CM2450 B155B Operation and Maintenance Manual
5613229	B6.7 CM2450 B155B Service Manual
5613230	B6.7 CM2450 B155B Wiring Diagram
5613231	B6.7 CM2450 B155B Fault Code Manual
2883408	On-Board Diagnostics (OBD) for EPA/ARB Certified Engines
3379000	Air for Your Engine
3379009	Operation of Diesel Engines in Cold Climates
3379214	Lubricating Oil Consumption and Acceptable Limits
3666475	Camshaft and Tappet Reuse Guidelines
3810451	Bearing Corrosion
4021378	Multiplexing Troubleshooting
4021566	Diesel Exhaust Fluid Specifications for Cummins® Selective Catalytic Reduction Systems
4021567	Cummins Inc. Inspection of Diesel Engines Subjected to Flooding Conditions

Additional Service Literature	
4021600	Aftertreatment Diesel Oxidation Catalyst and Aftertreatment Diesel Particulate Filter Reuse Guidelines
4021673	Automatic and Automated Manual Transmission, Fan, Gear Down Protection Setup and Troubleshooting
4021686	Advanced Engine Performance Troubleshooting Techniques
4325971	Aftertreatment Diesel Exhaust Fluid Dosing and Selective Catalytic Reduction System Reuse Guidelines
5411406	Fluids for Cummins® Products Service Manual
5467581	Aftertreatment Selective Catalytic Reduction (SCR) Reuse Guidelines

Service Literature Ordering Location

Contact Information

Service literature can be obtained from the appropriate location listed below:

- Any Cummins® Distributor
- Iron Mountain Fulfillment Services
  - Help Desk (U.S.): 1-800-646-5609
  - Help Desk (Outside U.S.): 1-630-283-2420
  - Email: CECOteam@ironmountain.com
- QuickServe® Online Store
  - https://store.cummins.com

Cummins Customized Parts Catalog

General Information

Cummins is pleased to announce the availability of a parts catalog compiled specifically for you. Unlike the generic versions of parts catalogs that support general high volume parts content; Cummins Customized catalogs contain only the new factory parts that were used to build your engine.

The catalog cover, as well as the content, is customized with you in mind. You can use the catalog in your shop, at your worksite, or as a coffee table book in your RV or boat. The cover contains your name, company name, address, and telephone number.

This new catalog was designed to provide you with the exact information you need to order parts for your engine. This catalog will be valuable for customers that do **not** have easy access to Cummins QuickServe Online.

Additional Features of the Customized Catalog include:

- Engine Configuration Data
- Table of Contents
- Separate Option and Parts Indexes
- Service Kits (when applicable)
- ReCon Part Numbers (when applicable)

Ordering the Customized Parts Catalog

Ordering by Telephone

- North American Distributors, Original Equipment Manufacturers and Cummins Factory personnel order by calling Iron Mountain Fulfillment Services (IMFS) at 1-800-646-5609.

- International Distributors and Original Equipment Manufacturers order the CPC from their regional Cummins Parts Distribution Centers (PDC).
- International PDC orders are called into Iron Mountain at (++) 630-283-2420.
- Retail Credit Card Orders require a 2 step ordering process.

Ordering On-Line

Access the Cummins QSOL store at https://store.cummins.com

- Find the Customized Parts Catalog button located on the left of the homepage
- Select format. Your Price is also shown here
- Finalize Shopping Cart and Check Process as described on the website

North America call Iron Mountain Fulfillment Services (IMFS) at 800-646-5609, International customers call (++) 630-283-2420. Provide IMFS the catalog detail as described on the website. This step is required until we have our On Line form available.

Required information needed for your Customized Parts Catalog Order.

- Customer Name
- Street Address
- Company Name (optional)
- Telephone Number
- Credit Card Number
- Cummins Engine Serial Number (located on the engine data plate)

Unfortunately **not** all Cummins Engines can be supported by Customized Parts Catalogs. Engines older than 1984 or newer than 3 months might **not** have the necessary parts information to compile a catalog. We will contact you if this condition occurs and explain why we are unable to fill your order.

Customized Parts Catalogs are produced specifically for a single customer. Therefore, the catalogs are **not** returnable for a refund. If we make an error and your catalog is **not** useable, we will correct that error by sending you a new catalog.

Section S - Service Assistance

Section Contents

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Service Assistance

General Information

To contact the nearest Cummins® Authorized Repair Location, utilize the Service Locator at www.cummins.com.

Cummins Inc. provides a 24-hour, toll free telephone number to aid in technical and emergency service when a Cummins® Authorized Repair Location can **not** be reached or is unable to resolve an issue with a Cummins® product.

U.S. and Canada

- 1-800-CUMMINS™ (1-800-286-6467)

Mexico

- 01-800-CUMMINS (2866467)
- Email: contacto.mexico@cummins.com

Australia/New Zealand

- For Australia: 1-800-CUMMINS (1800 286 646)
- For New Zealand: 0-800-CUMMINS (0800 286 646)
- Email: marketingsouthpac@cummins.com

Brazil

- 0800 CUMMINS (0800 286 6467)
- Email: falecom@cummins.com

Europe

- From the UK, Ireland, Germany, France, and the Netherlands - Freephone: 00 8000 2866467

- Email: emea.customerassistance@cummins.com

China

- 400 810 5252 or (+86) 400 810 5252
- Email: customersupport@cummins.com

India

- 800 210 2525
- Email: powermaster-India@cummins.com

Russia

- Primary: +7 495 926 8624
- Alternate: +7 962 943 1211

For All Other Areas:

- +44 (0) 1327 886464

Routine Service and Parts

General Information

Personnel at Cummins Authorized Repair Locations can assist you with the correct operation and service of your system. Cummins has a worldwide service network of more than 5,000 Distributors and Dealers who have been trained to provide sound advice, expert service, and complete parts support. Check the telephone directory, refer to the directory in this section, or the Service Locator at www.cummins.com for the nearest Cummins Authorized Repair Location.

Section V - Maintenance Specifications

Section Contents

General Engine

Specifications

Listed below are the general specifications for this engine.

Horsepower..... Refer to engine dataplate
Bore and Stroke..... 107 mm [4.21 in] X 124 mm [4.88 in]
Displacement..... 6.7 liters [409 C.I.D.]
Firing Order..... 1-5-3-6-2-4
Approximate Engine Dry Weight (without standard accessories)..... 522 kg [1151 lb]
Crankshaft Rotation (viewed from the front of the engine)..... **Clockwise**
Valve Clearance:
Intake..... 0.254 mm [0.010 in]
Exhaust..... 0.660 mm [0.026 in]
Maximum Overspeed Capability (15 seconds maximum)..... 4200 rpm
Minimum Ambient Air Temperature for Unaided Cold Start..... -12.2°C [10°F]
Typical Engine Cranking Speed..... 120 rpm
Engine Idle Speed..... Minimum 700 rpm to Maximum 900 rpm

Fuel System

Specifications

For performance and fuel rate values, see the Engine Data Sheet.

Maximum Fuel Inlet Restriction (vacuum)*.....305 mm-hg [12 in-hg]
Rail Pressure Operating Range..... 250 to 1800 bar [3626 to 26,107 psi]
Fuel Pressure Range at Fuel Filter Inlet and Outlet (Engine Cranking).....207 to 500 kPa [30 to 72.5 psi]
Fuel Pressure Range at Fuel Filter Inlet and Outlet (Engine Running).....207 to 652 kPa [30 to 94.5 psi]
Maximum Pressure Drop across Fuel Filter..... 81 kPa [11.7 psi]
Maximum Fuel Drain Line Restriction..... 19 kPa [2.7 psi]
Maximum Fuel Inlet Temperature.....80°C [176°F]

* Inlet restriction measured at the fuel gear pump inlet.

Lubricating Oil System

Specifications

Oil Pressure
- Low Idle (minimum allowed)..... 69 kPa [10 psi]
- At Rated Speed (minimum allowed)..... 207 kPa [30 psi]

Oil Regulating Valve Opening Pressure Range.....448 kPa [65 psi] to 517 kPa [75 psi]
Oil Filter Differential Pressure to Open Bypass.....345 kPa [50 psi]
Lubricating Oil Capacity of Standard Engine (Standard Lubricating Oil Pan)
- Lubricating Oil Pan **Only** .....14.2 liters [15 U.S. qt]
- Total Engine Lubricating Oil Capacity (Lubricating Oil Pan + Lubrication Oil Filter) ..... 15.1 liters [16 U.S. qt]

Lubricating Oil Filter Capacity..... 0.950 liters [1 U.S. qt]
Lubricating Oil Capacity of Standard Engine (High Capacity Lubricating Oil Pan)
- Lubricating Pan **Only** ..... 17.2 liters [18.5 U.S. qt]
- Total Engine Lubricating Oil Capacity (Lubricating Oil Pan + Lubrication Oil Filter)..... 18.5 liters [19.5 U.S. qt]

Lubricating Oil Filter Capacity..... 0.950 liters [1 U.S. qt]
Maximum Lubricating Oil Temperature.....138°C [280°F]

NOTE: If the type/oil capacity of each lubricating oil pan is **not** known:

- Contact a Cummins® Distributor/Dealer
- Search the specific engine serial number on parts.cummins.com. In the parts catalog-option view, refer to the engine oil (LO) option notes.
- Determine the capacity of the lubricating oil pan option for the engine being serviced by using QuickServe™ Online and the engine serial number.

- Fill the lubricating oil pan to the smallest lubricating oil pan capacity listed for the engine being serviced. Then add 0.95 liters [1 U.S. qt] of lubricating oil at a time until it reaches the high mark on the dipstick. Record the number of liters/quarts added, so the capacity is known the next time the lubricating oil is drained.

Cooling System

Specifications

Coolant Capacity (Includes block, cylinder head, water pump volute, EGR cooler, and EGR plumbing)....11.5 liters [3.0 U.S. gal]
Standard Modulating Thermostat - Range..... 79 to 95°C [175 to 203°F]
Maximum Allowed Operating Temperature..... 107°C [225°F]
Minimum Recommended Operating Temperature..... 71°C [160°F]
Minimum Recommended Pressure Cap..... 103 kPa [15 psi]
Maximum Recommended Pressure Cap..... 172 kPa [25 psi]

Filter Specifications

General Information

Cummins Filtration™, which produces Fleetguard® products, is a division of Cummins Inc. Fleetguard® filters are developed through joint testing at Cummins Inc. and are standard on new Cummins® engines. Cummins Inc. recommends their use.

Fleetguard® products meet all Cummins® Source Approval Test standards to provide the quality filtration necessary to achieve the engine's design life. If other brands are substituted, the purchaser **must** insist on products that the supplier has tested to meet Cummins Inc. high-quality standards.

Cummins Inc. can **not** be responsible for problems caused by non-genuine filters that do **not** meet Cummins Inc. performance or durability requirements.

Filter Part Numbers

Lubricating Oil Filter	
Cummins® Part Number	3937736
Fleetguard® Part Number	LF3970

Fuel Filter (Primary)	
Cummins® Part Number	5526400
Fleetguard® Part Number	FF63041NN

Fuel Filter (Prefilter with Water in Fuel Sensor)[1]	
Cummins® Part Number	5528103
Fleetguard® Part Number	FS20121

[1]The fuel filter (prefilter with water in fuel sensor) could be original equipment manufacturer (OEM) supplied.

Aftertreatment Diesel Exhaust Fluid (DEF) Dosing Unit Filter Kit	
Cummins® Part Number	5312532

The suction-side fuel filter must have the following characteristics:

- Water separating
- 10 micron rating
- Water in fuel sensor with shunt resistor
- Water drain valve
- Engine-mounted or chassis-mounted

The equipment/vehicle original equipment manufacturer (OEM) may use a non-Cummins® branded filter. See equipment manufacturer service information for details. Filters recommended by the OEM must meet Cummins Inc. requirements.

The pressure-side filter must have the following characteristics:

- 5 micron rating
- Engine-mounted or chassis-mounted

Fuel Recommendations and Specifications

Fuel Recommendations

⚠WARNING⚠

Do not mix gasoline, alcohol, or gasohol with diesel fuel. This mixture can cause an explosion.

⚠CAUTION⚠

Due to the precise tolerances of diesel injection systems, it is extremely important that the fuel be kept clean and free of dirt or water. Dirt or water in the system can cause severe damage to both the fuel pump and the fuel injectors.

⚠CAUTION⚠

Lighter fuels can reduce fuel economy or possibly damage fuel system components.

⚠CAUTION⚠

Do not use diesel fuel blended with lubricating oil in engines equipped with an aftertreatment system. Service intervals for aftertreatment systems will be reduced.

Cummins Inc. recommends the use of ASTM number 2D fuel. The use of number 2D diesel fuel will result in optimum engine performance.

⚠CAUTION⚠

Ultra-low sulfur diesel fuel is required for correct operation of the aftertreatment system. If ultra-low sulfur diesel fuel is not used, the aftertreatment system could possibly be damaged.

The engine has been optimized for use with an aftertreatment system to meet the 2007 U.S. Environmental Protection Agency (EPA) regulations. In order to meet these regulations, ultra-low sulfur diesel fuel is required for correct

operation of the aftertreatment system. If ultra-low sulfur diesel fuel is **not** used, the aftertreatment system could possibly be damaged.

Ultra-low sulfur diesel fuel, also defined by ASTM S-15, is defined as diesel fuel **not** exceeding 0.0015 (15 ppm) mass percent sulfur content. There is **no** acceptable substitute.

At operating temperatures below 0°C [32°F], acceptable performance can be obtained by using blends of number 2D and number 1D.

The following chart lists acceptable fuel types for this engine.

Acceptable Fuels - Cummins® Fuel System									
Number 1D Diesel(1) (2)	**Number 2D Diesel(2)**	**Number 1K Kerosene**	**Jet-A**	**Jet-A1**	**JP-5**	**JP-8**	**Jet-B**	**JP-4**	**CITE**
OK	OK	**NOT** OK	**NOT** OK	**NOT** OK	**NOT** OK	**NOT** OK	**NOT** OK	**NOT** OK	**NOT** OK
48-34(3)	40-24(3)	50-35(3)	51-37(3)	51-37(3)	48-36(3)	51-37(3)	57-45(3)	57-45(3)	57-45(3)

1 Any adjustment to compensate for reduced performance with a fuel system using alternate fuel is **not** warrantable.

2 Winter blend fuels, such as those found at commercial fuel dispensing outlets, are combinations of number 1D and number 2D diesel fuel, and are acceptable.

3 British thermal unit (BTU) Content/Degree API Gravity - Low API gravity fuels have a higher thermal energy content (BTU). As a general rule, there is a 3 to 5 percent decrease in BTU content for every 10 degree increase in API gravity; there is also a 0.7 degree API gravity increase with an increase in fuel temperature. This decrease

in energy content equates roughly to the same percentage of power loss. Use of fuels with higher API gravity will cause higher than normal fuel consumption.

NOTE: Cummins Inc. recommends that the cetane number of diesel fuel be a minimum of 45 for engines that are expected to operate at temperatures below 0°C [32°F] and a minimum of 42 for engines that are operated at temperatures above 0°C [32°F].

NOTE: The use of diesel fuel with a lower than recommended cetane number can cause hard starting, instability, and excessive white smoke. To maintain satisfactory operation at low ambient temperatures, it is important to specify diesel fuel of the correct cetane number.

NOTE: Cummins Inc. requires all permissible fuels to have adequate fuel lubricity. This means the BOCLE number is 3100 or greater as measured by ASTM specification D6078, Scuffing Load Ball On Cylinder Evaluator (SLBOCLE). Lubricity can also be measured by ASTM specification D6079, ISO 12156, High Frequency Reciprocating Rig (HFRR), in which the fuel **must** have a wear scar diameter of 0.45 mm [0.02 in] or less.

For information on alternative fuels, such as biodiesel, and additional information for fuel recommendations and specifications, see Section 1 of the Fluids for Cummins® Products Service Manual, Bulletin 5411406.

Lubricating Oil Recommendations and Specifications

General Information

⚠CAUTION⚠

Extending the oil and filter change interval beyond the recommendations will decrease the engine life due to factors such as corrosion, deposits, and wear.

⚠CAUTION⚠

API classification FA-4, CES 20087 is not approved for this engine. Engine damage may occur if used.

The use of high quality engine oils, combined with appropriate oil drain and lubricating oil filter change intervals, is a critical factor in maintaining engine performance and durability. Extending the oil and filter change interval beyond the recommendations will decrease engine life due to factors such as corrosion, deposits, and wear. Determine which oil drain interval to use for an application. Refer to Procedure 359-003 in Section 3.

NOTE: If engine oil and drain interval recommendations are ignored, warranty could be affected. The responsibility is with the owner to follow the guidelines.

Normal Engine Operation

- For normal engine operation Cummins Inc. recommends the use of a high quality 10W-30 viscosity heavy duty engine lubricating oil that meets the requirements of Cummins® Engineering Specification (CES) 20086 (such as Valvoline Premium Blue One Solution™ Gen2).

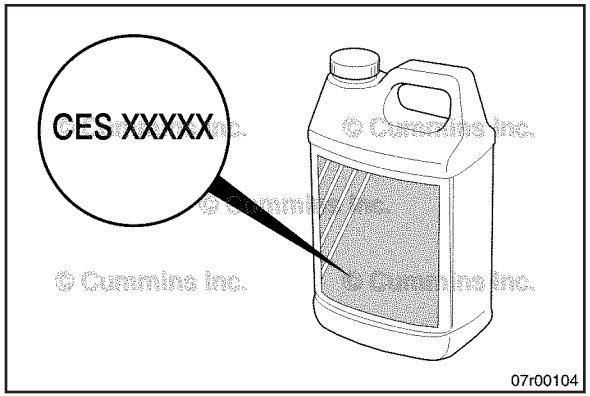
Severe Engine Operation

- For severe applications, the engine is compatible with 15W-40 viscosity heavy duty oil that meets the requirements of CES 20086 (Such as Valvoline Premium Blue One Solution™ Gen2.
- The use of a fuel economy oil such as an API FA-4 oil, CES 20087, is **not** approved for this engine.

Cold Weather Operation

- For cold weather applications the engine is compatible with 5W-40 viscosity heavy duty engine lubricating oil that meets the requirements of CES 20086 (such as Valvoline™ Premium Blue™ Extreme).

For further details and an explanation of engine lubricating oils for Cummins® engines, see Section 4 of the Fluids for Cummins® Products Service Manual, Bulletin 5411406.



Lubricating oil meeting the applicable CES can be identified by the following methods.

1 Reference the label on the backside of the lubricating oil container.

2 Contact the lubricating oil manufacturer.

3 Reference the list of registered lubricating oils for each CES. Visit QuickServe® Online (quickserve.cummins.com). Use the following internet link:https://quickserve.cummins.com/qs3/qsol/service/serviceproducts/oil_registration.html

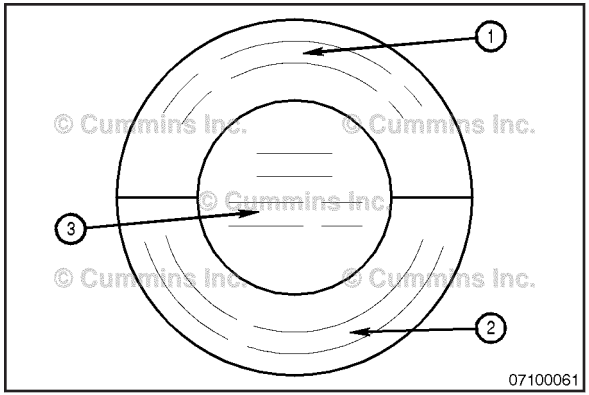
The API service symbols are shown in the accompanying illustration.

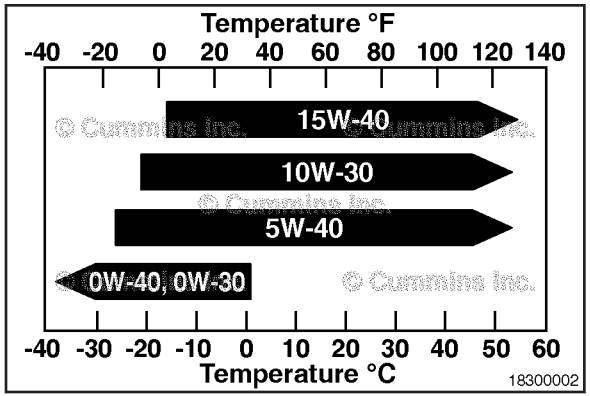
1 The upper half of the symbols display the appropriate oil categories.

2 The lower half contains words to describe additional oil information.

3 The center section identifies the SAE oil viscosity grade.

American Petroleum Institute (API) Classification[1]	Cummins® Engineering Specification (CES)
CK-4	CES 20086
[1] Cummins Inc. recommends engine lubricating oils that meet the applicable Cummins® Engineering Standard(s) (CES). The classification provided is for reference **only**.	





Ambient Temperature Recommendations

- Oil viscosity **must** be chosen according to the typical climate conditions experienced by the user. See the accompanying chart.

10W-30

- Use of 10W-30 is recommended for normal engine operation and provides the best wear protection.

15W-40

- 15W-40 is compatible for improved engine durability at extremely high ambient temperatures

5W-40

- Use of 5W-40 is approved for colder ambient temperatures to improve oil flow during start up.

0W-40, 0W-30

- Use of 0W-40 and 0W-30 synthetic oils that meet API CK-4 certification can be used in operations where the ambient temperature **never** exceeds 0°C (32°F). 0W-40 and 0W-30 oils do **not** offer the same level of protection against fuel dilution as do higher multigrade oils. Higher cylinder wear can be experienced when using 0W-40 or 0W-30 oils in high-load situations.

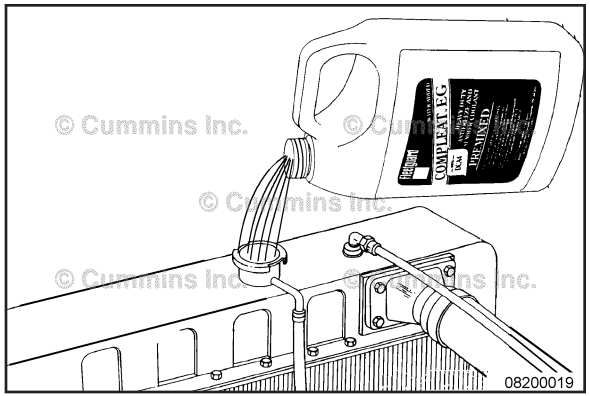
AfterMarket Oil Additive Usage

Cummins Inc. does **not** recommend the use of aftermarket oil additives. High-quality CES approved engine lubricating oils are very sophisticated, with precise amounts of additives blended into the lubricating oil to meet stringent requirements.

Aftermarket lubricating oil additives are **not** necessary to enhance engine oil performance, and in some cases they can reduce the finished oil's ability to protect the engine.

New Engine Break-in Oils

Special "break-in" engine lubricating oils are **not** recommended for new or rebuilt Cummins® engines. Use the same type of oil during the break-in as is used in normal operation.



Coolant Recommendations and Specifications

Heavy Duty

Coolant / Antifreeze

WARNING

Do not remove the pressure cap from a hot engine. Wait until coolant temperature is below 50°C [120°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

For new vehicles, check with the original equipment manufacturer (OEM) on the type of coolant (ethylene glycol, propylene glycol, Organic Acid Technology (OAT), glycerin, etc.) used for the first fill. This will assist in understanding how to maintain the coolant properly.

Cummins Inc. recommends either a premixed, heavy duty coolant, or a mixture of high-quality water and heavy duty conventrated coolant when filling the cooling system. Coolant used **must** meet either Cummins® Engineering Standard (CES) 14603 or CES 14439.

A list of coolants that meet the appropriate CES for the engine can be obtained from a local Cummins® distributor or can be found on at the QuickServe® Online (QSOL) weblink below:

NOTE: https://quickserve.cummins.com/qs3/qsol/service/serviceproducts/coolant_registration.html

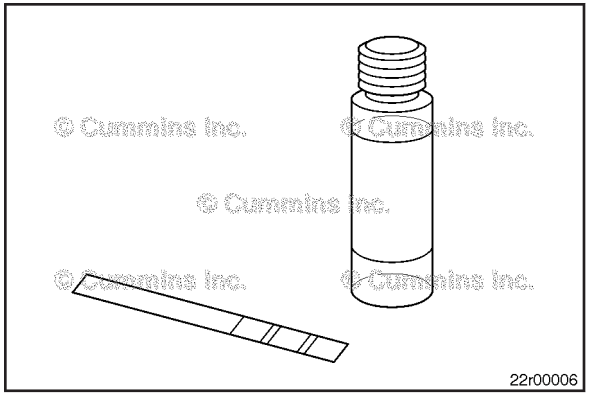
Cummins Inc. recommends Cummins Filtration™ antifreeze coolants.

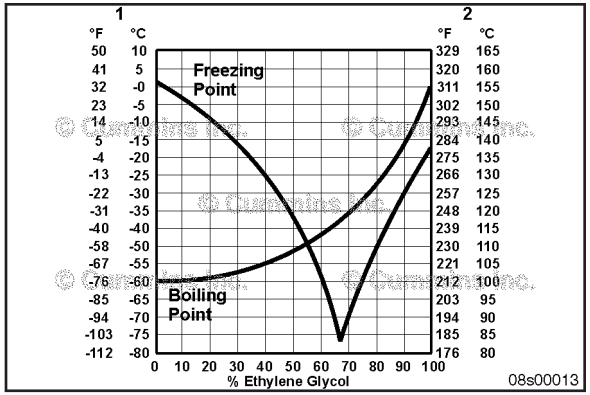
If **not** using premixed coolant, see Section 5 of the Fluids for Cummins® Products Service Manual, Bulletin 5411406.

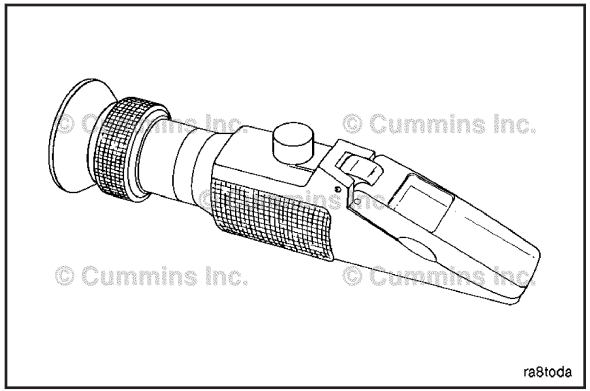
High-quality water is important for cooling system performance. Excessive levels of calcium and magnesium contribute to scaling problems, and excessive levels of chlorides and sulfates cause cooling system corrosion. Water used to prepare coolant from concentrate must meet the requirements listed in the table below. For more information on water quality requirements, see Section 5 of the Fluids for Cummins® Products Service Manual, Bulletin 5411406.

Use Fleetguard® Water-Chek™ test strips, CC2609, to check the water quality. Instructions are included with the test kit.

Water Quality	
Calcium Magnesium (hardness)	Maximum 170 ppm as ($CaCO_3$ + $MgCO^3$)
pH	5.5 to 9.9 (min/max)
Calcium Magnesium (hardness)	Maximum 170 ppm as ($CaCO_3$ + $MgCO^3$
Chloride	40 ppm as (Cl)
Sulfur	100 ppm as (SO_4)







Heavy duty antifreeze **must** be mixed with good-quality water at a 50/50 ratio (40 to 60 percent working range). A 50/50 mixture of antifreeze and water gives a -36°C [-33°F] freezing point and a 108°C [226°F] boiling point, which is adequate for locations in North America. The actual lowest freezing point of ethylene glycol antifreeze is at 68 percent. Using higher concentrations of antifreeze will raise the freezing point of the solution and increase the possibility of a silica gel problem.

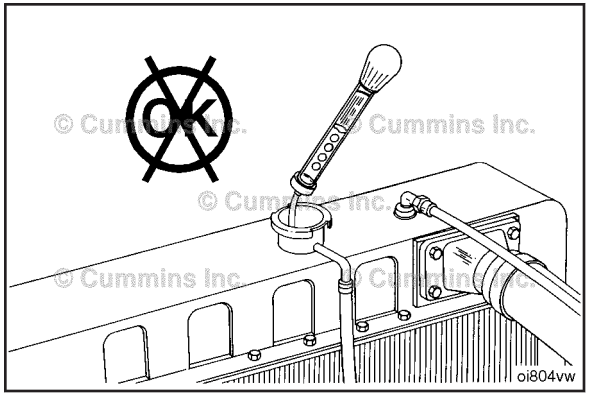
Column 1 in the graphic is the Freezing Point Temperature Scale.

Column 2 in the graphic is the Boiling Point Temperature Scale.

A refractometer is the preferred tool for measuring the freezing point of the coolant accurately. Use Fleetguard® refractometer, Part Number C2800 or CC2806. For glycerin coolants, use Part Number CC36049.

NOTE: Fleetguard® coolant test strips, Part Number CC2602, can also be used to check the freezing point.

Do **not** use a floating ball hydrometer. The use of floating ball hydrometers can give an incorrect reading.



Glycol Concentration

Cummins Inc. requires a glycol/antifreeze concentration between 40 to 60 percent by volume unless different glycol/antifreeze concentrations are specifically approved. In arctic conditions (-32°C to -54°C [-25°F to - 65°F]) as defined in Service Bulletin, Operation of Diesel Engines in Cold Climates, Bulletin 3379009, Cummins Inc. recommends the use of a 60 percent ethylene glycol coolant for arctic specifications. Ethylene glycol concentration is **not** to exceed 68 percent in arctic conditions.

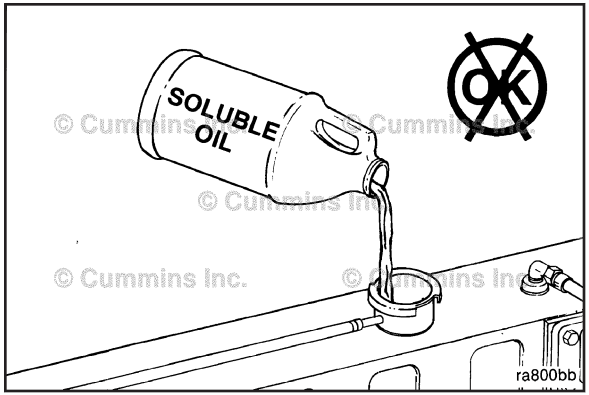
Table 1 - Glycol Concentration

Concentration	Out of Range Actions
40 to 60 Percent	Drain a portion of coolant and replace with 50/50 coolant to get back in the 40 to 60 percent glycol range.
	Under-concentration of glycol occurs when filling or topping off with straight water or over-diluted coolant.
	Over-concentration of glycol occurs in high heat situations where there is some water evaporation from the cooling system or when filling or topping off with improperly diluted coolant.

Cooling System Soluble Oils

Do **not** use soluble oils in the cooling system. The use of soluble oils will:

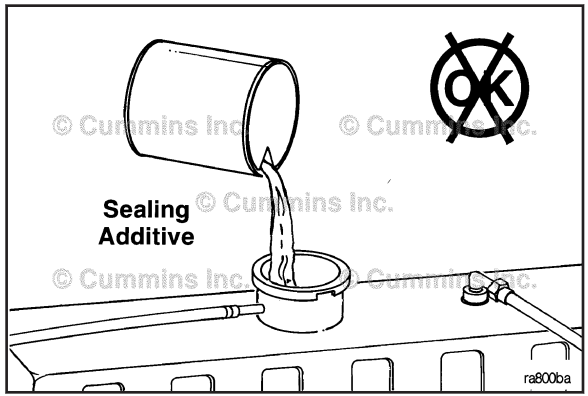
- corrode brass and copper
- damage heat transfer surfaces
- damage seals and hoses.



Cooling System Sealing Additives

Do **not** use sealing additives in the cooling system. The use of sealing additives will:

- build up in coolant low-flow areas
- plug the radiator and oil cooler
- possibly damage the water pump seal.



Coolant Replacement Requirements

⚠WARNING⚠

Coolant is toxic. Keep away from children and pets. If not reused, dispose of in accordance with local environmental regulations.

Replace the coolant **only** if the replacement limits are exceeded. Refer to Procedure 359-025 in Section 3.

NOTE: Dispose of used coolant and antifreeze in accordance with federal, state, and local laws and regulations.

Diesel Exhaust Fluid Recommendations and Specifications

General Information

⚠ WARNING ⚠

It is unlawful to tamper with or remove any component of the aftertreatment system. It is also unlawful to use a Diesel Exhaust Fluid (DEF) that does not meet the specifications provided or to operate the vehicle/ equipment with no Diesel Exhaust Fluid (DEF).

⚠ WARNING ⚠

Diesel Exhaust Fluid (DEF) contains urea. Do not get the substance in your eyes. In case of contact, immediately flush eyes with large amounts of water for a minimum of 15 minutes. Do not swallow internally. In the event the diesel exhaust fluid is ingested, contact a physician immediately. Reference the Materials Safety Data Sheet (MSDS) for additional information.

△ CAUTION △

Never attempt to create Diesel Exhaust Fluid (DEF) by mixing agricultural grade urea with water. Agricultural grade urea does not meet the necessary specifications required and the aftertreatment system may be damaged.

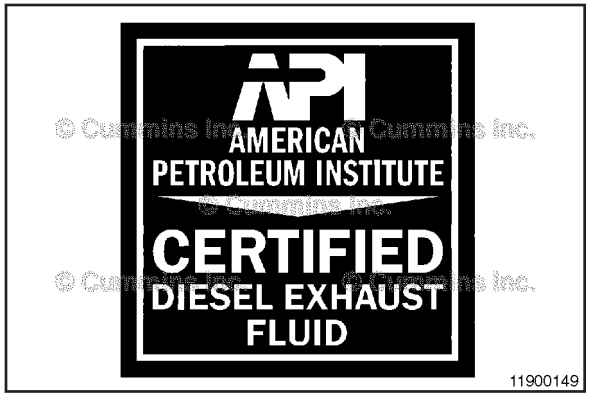
Cummins Inc. requires the use of Diesel Exhaust Fluid (DEF) meeting ISO 22241-1. There is NO acceptable substitute.

NOTE: Some locations may reference the DIN 70070 standard. Diesel Exhaust Fluid (DEF) specification limits of this standard are identical to ISO 22241-1.

Cummins Inc. is **not** responsible for failures or damage resulting from what Cummins Inc. determines to be abuse or neglect, including but **not** limited to: operation without correctly specified Diesel Exhaust Fluid (DEF); lack of maintenance of aftertreatment; improper storage, or shutdown practices; unauthorized modifications of the engine and

aftertreatment. Cummins Inc. is also **not** responsible for failures caused by incorrect Diesel Exhaust Fluid (DEF) or by water, dirt or other contaminants in the Diesel Exhaust Fluid (DEF).

For further details and discussion of Diesel Exhaust Fluid (DEF) for Cummins® engines. Refer to the Diesel Exhaust Fluid (DEF) Specifications for Cummins® Selective Catalytic Reduction (SCR) Systems, Service Bulletin Number 4021566.

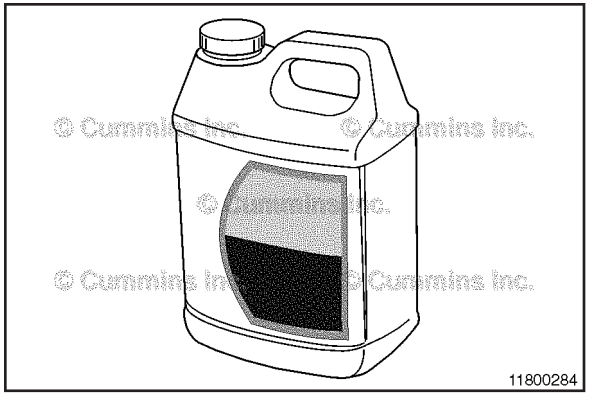


For engines using Selective Catalytic Reduction (SCR) operating in the United States and Canada, Cummins Inc. strongly recommends that the Diesel Exhaust Fluid (DEF) used be certified by the American Petroleum Institute (API). A symbol will be indicated on the container/ dispensing system as shown.

Use the correct Diesel Exhaust Fluid (DEF). Cummins Inc. recommends the use of Fleetguard® Diesel Exhaust Fluid (DEF). Fleetguard® carries different quantity options from small to bulk containers.

For customers located in the United States and Canada, for assistance locating Diesel Exhaust Fluid (DEF), contact the Cummins® Customer Assistance Center: 1-800 DIESELS (1-800-343-7357).

For customers outside of the United States and Canada, contact the local Cummins® authorized repair location for assistance in locating Diesel Exhaust Fluid (DEF).



The following are other common names used for Diesel Exhaust Fluid (DEF):

- Urea
- AUS 32 (Aqueous Urea Solution 32)
- AdBlue
- NOx Reduction Agent
- Catalyst Solution
- DEF

Regardless of what the Diesel Exhaust Fluid (DEF) is called, the Diesel Exhaust Fluid (DEF) **must** meet the specifications as outlined in the General Information section of this procedure.

Storage

NOTE: The following information is for reference and is to be used as a guideline **only**. There are many factors that determine Diesel Exhaust Fluid (DEF) shelf life, with temperature and duration being two of the major determining contributors. If in doubt, check the concentration of the Diesel Exhaust Fluid (DEF), refer to the Test step of this procedure, or replace the fluid with known quality Diesel Exhaust Fluid.

Diesel Exhaust Fluid has a limited shelf life, both in the vehicle's diesel exhaust fluid tank and in storage/bulk/transportation containers.

The following conditions are ideal for maintaining DEF quality and shelf life during prolonged transportation and storage:

- Storage temperature between -5°C and 25°C [23°F and 77°F]
- Store in sealed containers to avoid contamination

- Avoid direct sunlight

In these conditions, DEF has a minimum expected shelf life of 18 months. If stored at higher temperatures for extended periods of time, the shelf life will be reduced by approximately 6 months for every 5°C [9°F] above the highest storage temperature listed above.

Long term storage in a vehicle (in excess of 6 months) is **not** recommended. If long term storage is necessary, perform periodic testing of the Diesel Exhaust Fluid to verify the concentration does **not** fall out of specification. Follow the Test step of this procedure.

To assist in preventing Diesel Exhaust Fluid from deteriorating when stored in the vehicles DEF tank, locate and plug the tanks venting to seal the tank exposure to the atmosphere.

Handling

Diesel Exhaust Fluid is **not** harmful to handle, but can be corrosive to certain materials over time. Such as carbon steels, iron, zinc, nickel, copper, aluminum and magnesium.

- **Only** use approved containers to transport and store Diesel Exhaust Fluid. Containers made of polyethylene and polypropylene are recommended.
- If Diesel Exhaust Fluid is spilled, rinse and clean immediately with water.
- Avoid prolonged contact with skin. In case of contact, wash with immediately with soap and water. If **not** washed immediately, when the diesel exhaust fluid dries, a white film will be left that can be more difficult to wash off.

Spilled Diesel Exhaust Fluid if left to dry or wiped away with a cloth**only** will leave a white residue. Failure to clean the spilled Diesel Exhaust Fluid can result in an incorrectly diagnosed leak of the Diesel Exhaust Fluid Dosing system.

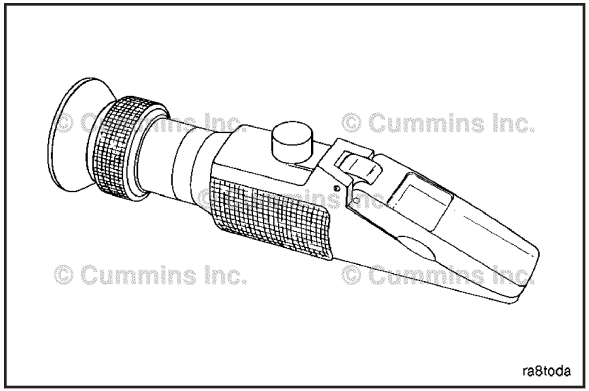
Before using containers, funnels, etc. that will be used to dispense, handle or store Diesel Exhaust Fluid, wash thoroughly to remove any contaminants and then rinse with distilled water.

Do **not** use tap water to rinse components that will be used to deliver diesel exhaust fluid. Tap water will contaminate the Diesel Exhaust Fluid. If distilled water is**not** available, rinse with tap water and then rinse with Diesel Exhaust Fluid.

Disposal

If disposing of Diesel Exhaust Fluid (DEF), **always** check with the local authority regulations on proper disposing process and requirements.

Test



Having the correct concentration of Diesel Exhaust Fluid is critical to the engine and aftertreatment system performing correctly.

To test the concentration of the Diesel Exhaust Fluid, use the Cummins® Diesel Exhaust Fluid Refractometer, service tool part number 4919554. Follow the instructions provided with the service tool.

Percent Urea Concentration: 32.5 +/- 0.7%

The specification listed above takes into consideration the refractometer tool tolerances, varibility, and calibration when measuring Diesel Exhaust Fluid concentration.

If the Diesel Exhaust Fluid concentration is found to be outside of this specification, drain the Diesel Exhaust Fluid tank, flush with distilled water and fill with new and/or known good Diesel Exhaust Fluid. Recheck the Diesel Exhaust Fluid concentration.

Concentration of the Diesel Exhaust Fluid should be checked when:

- The vehicle has been stored for an extended period of time.
- Water is suspected to have been added to the Diesel Exhaust Fluid tank.

Contamination/Incorrect Fluid

⚠CAUTION⚠

Never add water or any other fluid besides what is specified to the Diesel Exhaust Fluid (DEF) tank. The aftertreatment system may be damaged.

In the event that the incorrect fluid is added to the Diesel Exhaust Fluid tank, such as, but **not** limited to:

- Water
- Diesel Fuel
- Hydraulic Fluid
- Coolant
- Windshield Washer Fluid

Contact a local Cummins® authorized repair location to determine the appropriate repair direction.

If **only** water has been added to the Diesel Exhaust Fluid (DEF) tank, drain the Diesel Exhaust Fluid (DEF) tank, flush with distilled water and refill with new and/or known good Diesel Exhaust Fluid (DEF). Check the Diesel Exhaust Fluid (DEF) concentration after completing the refill, follow to the Test step of this procedure.

Freezing

⚠CAUTION⚠

Do not add any chemicals/additives to the Diesel Exhaust Fluid in an effort to prevent freezing. If chemicals/additives are added to the Diesel Exhaust Fluid, the aftertreatment system may be damaged.

Diesel Exhaust Fluid will freeze around -11°C [12°F]. The diesel exhaust fluid system on the vehicle is designed to accommodate this temperature and does **not** require any intervention by the vehicle operator.

The Operating the Engine (101-015) procedure in Section 1 of the Owners and Operation and Maintenance Manual will provide information on proper cold weather set up for your engine/vehicle.

Notes

Section W - Warranty

Section Contents

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B/B6.7/ISB Engines For EPA 2017 And Newer United States And Canada Automotive

Coverage

Products Warranted

This Warranty applies to new EPA 2017 and newer B/B6.7 and ISB Series diesel Engines sold by Cummins and delivered to the first user on or after October 1, 2016, that are used in automotive on-highway applications in the United States* or Canada with the following exceptions. Cummins provides different Warranty Coverage for Engines used in fire apparatus truck and crash truck, bus and coach and recreational vehicle applications.

Base Engine Warranty

This Warranty covers any failures of the Engine which result, under normal use and service, from a defect in material or factory workmanship (Warrantable Failure). This Coverage begins with the sale of the Engine by Cummins and ends three years after the date of delivery of the Engine to the first user.

Engine aftertreatment components included in the Cummins Critical Parts List (CPL) and marked with a Cummins part number are covered under Base Engine Warranty.

Additional Coverage is outlined in the Emission Warranty section.

These Warranties are made to all Owners in the chain of distribution and Coverage continues to all subsequent Owners until the end of the periods of Coverage.

Cummins Responsibilities

Cummins will pay for all parts and labor needed to repair the damage to the Engine resulting from a Warrantable Failure.

Cummins will pay for the lubricating oil, antifreeze, filter elements, belts, hoses and other maintenance items that are not reusable due to the Warrantable Failure.

Cummins will pay for reasonable labor costs for Engine removal and reinstallation when necessary to repair a Warrantable Failure.

Cummins will pay reasonable costs for towing a vehicle disabled by a Warrantable Failure to the nearest authorized repair location. In lieu of the towing expense, Cummins will pay reasonable costs for mechanics to travel to and from the location of the vehicle, including meals, mileage and lodging, when the repair is performed at the site of the failure.

Owner Responsibilities

Owner is responsible for the operation and maintenance of the Engine as specified in the applicable Cummins Operation and Maintenance Manual. Owner is also responsible for providing proof that all recommended maintenance has been performed.

Before the expiration of the applicable Warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility.

Service locations are listed on the Cummins Worldwide Service Locator at cummins.com.

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items provided during Warranty repairs unless such items are not reusable due to the Warrantable Failure.

Owner is responsible for communication expenses, meals, lodging and similar costs incurred as a result of a Warrantable Failure.

Owner is responsible for non-Engine repairs and for "downtime" expenses, cargo damage, fines, all applicable taxes, all business costs and other losses resulting from a Warrantable Failure.

Limitations

Engines with an emissions certification listed below must be operated using only diesel fuel having no more than the corresponding maximum sulfur content. Failure to use the specified fuel as listed in the Cummins Fuel Bulletin #3379001 Table 1 (Cummins Inc. Required Diesel Fuel Specifications) can damage the Engine and aftertreatment system within a short period of time. This damage could cause the Engine to become inoperable and failures

attributable to the use of incorrect fuels will be denied Warranty Coverage. Fuel specifications also need to comply with local fuel regulations (EN590 for Europe and ASTM D975 for North America) for Warranty eligibility.

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:	
EPA 2007/2010/2013/2017/2021 /2024	max. 15 parts per million
EPA Tier 4 Interim / Final / Stage V in North America	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
EU Stage IV 2011	max. 15 parts per million
EU Stage V	max. 10 parts per million
Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine.

Any unauthorized modifications to the aftertreatment system could negatively effect emissions certification and void the Warranty.

Cummins is also not responsible for failures caused by incorrect oil or fuel or by water, diesel exhaust fluid, catalytic reagent, dirt or other contaminants in the fuel, oil, diesel exhaust fluid, catalytic reagent or intake air system.

Failures resulting in excessive oil consumption are covered for the duration of the Coverage or 100,000 miles (160,935 kilometers) or 7,000 hours from the date of delivery of the Engine to the first user, whichever of the three

occurs first. Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failures of belts and hoses supplied by Cummins are covered during the first year from the date of delivery of the Engine to the first user or the duration of the Warranty, whichever occurs first.

Parts used to repair a Warrantable Failure may be new Cummins parts, Cummins approved rebuilt parts or repaired parts. Cummins is not responsible for failures resulting from the use of parts not approved by Cummins.

A new Cummins or Cummins approved rebuilt part used to repair a Warrantable Failure assumes the identity of the part it replaced and is entitled to the remaining Coverage hereunder.

Cummins Inc. reserves the right to interrogate Electronic Control Module (ECM) data for purposes of failure analysis.

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

THIS WARRANTY AND THE EMISSION WARRANTY SET FORTH HEREINAFTER ARE THE SOLE WARRANTIES MADE BY CUMMINS IN REGARD TO THESE ENGINES. CUMMINS MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Emission Warranty

Products Warranted

This Emission Warranty applies to new B and ISB Series diesel, LPG, compressed or liquid natural gas fueled Engines marketed by Cummins that are used in the United States* or Canada in vehicles designed for transporting persons or property on a street or highway. This Warranty applies to Engines delivered to the first user on or after October 1, 1996.

Coverage

Cummins warrants to the first user and each subsequent purchaser that the Engine is designed, built and equipped so as to conform at the time of sale by Cummins with all U.S. federal emission regulations applicable at the time of manufacture and that it is free from defects in material or factory workmanship which would cause it not to meet these regulations within the longer of the following periods: (A) Five years or 100,000 miles (160,935 kilometers) of operation, whichever occurs first, as measured from the date of delivery of the Engine to the first user, or (B) The Base Engine Warranty.

If the vehicle in which the Engine is installed is registered in the state of California, a separate California Emission Warranty also applies.

Limitations

Engines with an emissions certification listed below must be operated using only diesel fuel having no more than the corresponding maximum sulfur content. Failure to use the specified fuel as listed in the Cummins Fuel Bulletin #3379001 Table 1 (Cummins Inc. Required Diesel Fuel Specifications) can damage the Engine and aftertreatment system within a short period of time. This damage could cause the Engine to become inoperable and failures attributable to the use of incorrect fuels will be denied Warranty Coverage. Fuel specifications also need to comply with local fuel regulations (EN590 for Europe and ASTM D975 for North America) for Warranty eligibility.

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:	
EPA 2007/2010/2013/2017/2021 /2024	max. 15 parts per million
EPA Tier 4 Interim / Final / Stage V in North America	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
EU Stage IV 2011	max. 15 parts per million
EU Stage V	max. 10 parts per million

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:

Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

Failures, other than those resulting from defects in material or factory workmanship, are not covered by this Warranty.

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine.

Any unauthorized modifications to the aftertreatment system could negatively effect emissions certification and void the Warranty.

Cummins is also not responsible for failures caused by incorrect oil or fuel or by water, diesel exhaust fluid, catalytic reagent, dirt or other contaminants in the fuel, oil, diesel exhaust fluid, catalytic reagent or intake air system.

Cummins is not responsible for non-Engine repairs, "downtime" expenses, cargo damage, fines, all applicable taxes, all business costs or other losses resulting from a Warrantable Failure.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

* United States includes American Samoa, the Commonwealth of Northern Mariana Islands, Guam, Puerto Rico and the U.S. Virgin Islands.

Worldwide Fire Apparatus/Crash Trucks

Coverage

Products Warranted

This Warranty applies to new diesel Engines sold by Cummins and delivered to the first user on or after April 1, 2007, that are used in fire apparatus truck and crash truck* applications Worldwide.

Base Engine Warranty

The Base Engine Warranty covers any failures of the Engine which result, under normal use and service, from a defect in material or factory workmanship (Warrantable Failure). This Coverage begins with the sale of the Engine by Cummins and ends five years or 100,000 miles (160,934 kilometers), whichever occurs first, after the date of delivery of the Engine to the first user.

Engine aftertreatment components included in the Cummins Critical Parts List (CPL) and marked with a Cummins part number are covered under Base Engine Warranty.

Additional Coverage is outlined in the Emission Warranty section.

These Warranties are made to all Owners in the chain of distribution and Coverage continues to all subsequent Owners until the end of the periods of Coverage.

Cummins Responsibilities

Cummins will pay for all parts and labor needed to repair the damage to the Engine resulting from a Warrantable Failure.

Cummins will pay for the lubricating oil, antifreeze, filter elements, belts, hoses and other maintenance items that are not reusable due to the Warrantable Failure.

Cummins will pay for reasonable labor costs for Engine removal and reinstallation when necessary to repair a Warrantable Failure.

Cummins will pay reasonable costs for towing a vehicle disabled by a Warrantable Failure to the nearest authorized repair location. In lieu of the towing expense, Cummins will pay reasonable costs for mechanics to travel to and from the location of the vehicle, including meals, mileage and lodging, when the repair is performed at the site of the failure.

Owner Responsibilities

Owner is responsible for the operation and maintenance of the Engine as specified in Cummins Operation and Maintenance Manuals. Owner is also responsible for providing proof that all recommended maintenance has been performed.

Before the expiration of the applicable Warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility. Except for Engines disabled by a Warrantable Failure, Owner must also deliver the Engine to the repair facility.

Service locations are listed on the Cummins Worldwide Service Locator at cummins.com.

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items provided during Warranty repairs unless such items are not reusable due to the Warrantable Failure.

Owner is responsible for communication expenses, meals, lodging and similar costs incurred as a result of a Warrantable Failure.

Owner is responsible for non-Engine repairs and for "downtime" expenses, cargo damage, fines, all applicable taxes, all business costs and other losses resulting from a Warrantable Failure.

Limitations

Engines with an emissions certification listed below must be operated using only diesel fuel having no more than the corresponding maximum sulfur content. Failure to use the specified fuel as listed in the Cummins Fuel Bulletin #3379001 Table 1 (Cummins Inc. Required Diesel Fuel Specifications) can damage the Engine and aftertreatment system within a short period of time. This damage could cause the Engine to become inoperable and failures attributable to the use of incorrect fuels will be denied Warranty Coverage. Fuel specifications also need to comply with local fuel regulations (EN590 for Europe and ASTM D975 for North America) for Warranty eligibility.

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EPA Tier 4 Interim / Final / Stage V in North America	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
EU Stage IV 2011	max. 15 parts per million
EU Stage V	max. 10 parts per million
Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine.

Any unauthorized modifications to the aftertreatment system could negatively effect emissions certification and void the Warranty.

Cummins is also not responsible for failures caused by incorrect oil, fuel or diesel exhaust fluid or by water, dirt or other contaminants in the fuel, oil or diesel exhaust fluid.

Alternators and starters are covered for the first two years from the date of delivery of the Engine to the first user, or the expiration of the Base Engine Warranty, whichever occurs first.

Failures resulting in excessive oil consumption are not covered beyond the duration of the Coverage or 100,000 miles (160,934 kilometers) or 7,000 hours from the date of delivery of the Engine to the first user, whichever of the three

occurs first. Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failures of belts and hoses supplied by Cummins are not covered beyond the first year from the date of delivery of the Engine to the first user or the duration of the Warranty, whichever occurs first.

Parts used to repair a Warrantable Failure may be new Cummins parts, Cummins approved rebuilt parts or repaired parts. Cummins is not responsible for failures resulting from the use of parts not approved by Cummins.

A new Cummins or Cummins approved rebuilt part used to repair a Warrantable Failure assumes the identity of the part it replaced and is entitled to the remaining Coverage hereunder.

Cummins Inc. reserves the right to interrogate Electronic Control Module (ECM) data for purposes of failure analysis.

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

THIS WARRANTY AND THE EMISSION WARRANTY SET FORTH HEREINAFTER ARE THE SOLE WARRANTIES MADE BY CUMMINS IN REGARD TO THESE ENGINES. CUMMINS MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Emission Warranty

Products Warranted

This Emission Warranty applies to new Engines marketed by Cummins that are used in the United States** or Canada in vehicles designed for transporting persons or property on a street or highway. This Warranty applies to Engines delivered to the first user on or after September 1, 1992.

Coverage

Cummins warrants to the first user and each subsequent purchaser that the Engine is designed, built and equipped so as to conform at the time of sale by Cummins with all U.S. federal emission regulations applicable at the time of

manufacture and that it is free from defects in material or factory workmanship which would cause it not to meet these regulations within the longer of the following periods: (A) Five years or 100,000 miles (160,934 kilometers) of operation, whichever occurs first, as measured from the date of delivery of the Engine to the first user or (B) The Base Engine Warranty.

If the vehicle in which the Engine is installed is registered in the state of California, a separate California Emission Warranty also applies.

Limitations

Engines with an emissions certification listed below must be operated using only diesel fuel having no more than the corresponding maximum sulfur content. Failure to use the specified fuel as listed in the Cummins Fuel Bulletin #3379001 Table 1 (Cummins Inc. Required Diesel Fuel Specifications) can damage the Engine and aftertreatment system within a short period of time. This damage could cause the Engine to become inoperable and failures attributable to the use of incorrect fuels will be denied Warranty Coverage. Fuel specifications also need to comply with local fuel regulations (EN590 for Europe and ASTM D975 for North America) for Warranty eligibility.

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:	
EPA 2007/2010/2013/2017/2021/2024	max. 15 parts per million
EPA Tier 4 Interim / Final / Stage V in North America	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
EU Stage IV 2011	max. 15 parts per million
EU Stage V	max. 10 parts per million
Euro 4/5	max. 50 parts per million

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:

Euro 6	max. 10 parts per million

Failures, other than those resulting from defects in material or factory workmanship, are not covered by this Warranty.

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine.

Any unauthorized modifications to the aftertreatment system could negatively affect emissions certification and void the Warranty.

Cummins is also not responsible for failures caused by incorrect oil, fuel or diesel exhaust fluid or by water, dirt or other contaminants in the fuel, oil or diesel exhaust fluid.

Cummins is not responsible for non-Engine repairs, "downtime" expenses, cargo damage, fines, all applicable taxes, all business costs or other losses resulting from a Warrantable Failure.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

* Airport operated crash trucks and fire department operated trucks employed to respond to fires, hazardous material releases, rescue and other emergency-type situations.

** United States includes American Samoa, the Commonwealth of Northern Mariana Islands, Guam, Puerto Rico and the U.S. Virgin Islands.

All Engines Worldwide All Bus (Except U.S./Canada Diesel Powered School Buses)

Coverage

Products Warranted

This Warranty applies to new diesel, LPG, compressed or liquid natural gas fueled Engines sold by Cummins and delivered to the first user on or after January 1, 1999, that are used in all bus categories Worldwide (except U.S./Canada diesel powered school buses).

Base Engine Warranty

The Base Engine Warranty covers any failures of the Engine which result, under normal use and service, from a defect in material or factory workmanship (Warrantable Failure). This Coverage begins with the sale of the Engine by Cummins and ends two years after the date of delivery of the Engine to the first user.

Engine aftertreatment components included in the Cummins Critical Parts List (CPL) and marked with a Cummins part number are covered under the Base Engine Warranty.

Extended Major Components Warranty

The Extended Major Components Warranty applies to all Engines except B and ISB Series Engines and covers Warrantable Failures of the Engine cylinder block, camshaft, crankshaft, connecting rods and Cummins fan clutch (Covered Parts).

Bushing and bearing failures are not covered.

This Coverage begins with the expiration of the Base Engine Warranty and ends three years or 300,000 miles (482,804 kilometers) or 10,800 hours of operation, whichever occurs first, after the date of delivery of the Engine to the first user.

Emission Warranty

Additional Coverage is outlined under the Emission Warranty.

These Warranties are made to all Owners in the chain of distribution and Coverage continues to all subsequent Owners until the end of the periods of Coverage.

Cummins Responsibilities

During The Base Engine Warranty

Cummins will pay for all parts and labor needed to repair the damage to the Engine resulting from a Warrantable Failure.

Cummins will pay for the lubricating oil, antifreeze, filter elements, belts, hoses and other maintenance items that are not reusable due to the Warrantable Failure.

Cummins will pay for reasonable labor costs for Engine removal and reinstallation when necessary to repair a Warrantable Failure.

Cummins will pay reasonable cost for towing a disabled vehicle, or where mandated by local legislation, to the nearest authorized repair location when caused by a Warrantable Failure. In lieu of towing expense due to a Warrantable Failure, Cummins will pay reasonable cost for mechanics to travel to and from the location of the vehicle, including meals, mileage and lodging, when the repair is performed at the site of the failure.

During The Extended Major Components Warranty

Cummins will pay for the repair or, at its option, replacement of the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered Part.

Owner Responsibilities

During The Base Engine Warranty

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items replaced during Warranty repairs unless such items are not reusable due to the Warrantable Failure.

During The Extended Major Components Warranty

Owner is responsible for the cost of all labor needed to repair the Engine, including the labor to remove and reinstall the Engine. When Cummins elects to repair a part instead of replacing it, Owner is not responsible for the labor needed to repair the part.

Owner is responsible for the cost of all parts required for the repair except for the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered Part.

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items replaced during the repair.

During The Base Engine And Extended Major Components Warranties
Owner is responsible for the operation and maintenance of the Engine as specified in the applicable Cummins Operation and Maintenance Manuals. Owner is also responsible for providing proof that all recommended maintenance has been performed.

Before the expiration of the applicable Warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility. Except for Engines disabled by a Warrantable Failure during the Base Engine Warranty, the Owner must also deliver the Engine to the repair facility.

Service locations are listed on the Cummins Worldwide Service Locator at cummins.com.

Owner is responsible for communication expenses, meals, lodging and similar costs incurred as a result of a Warrantable Failure.

Owner is responsible for non-Engine repairs and for "downtime" expenses, fines, cargo damage, all applicable taxes, all business costs and other losses resulting from a Warrantable Failure.

Limitations

Engines with an emissions certification listed below must be operated using only diesel fuel having no more than the corresponding maximum sulfur content. Failure to use the specified fuel as listed in the Cummins Fuel Bulletin #3379001 Table 1 (Cummins Inc. Required Diesel Fuel Specifications) can damage the Engine and aftertreatment

system within a short period of time. This damage could cause the Engine to become inoperable and failures attributable to the use of incorrect fuels will be denied Warranty Coverage. Fuel specifications also need to comply with local fuel regulations (EN590 for Europe and ASTM D975 for North America) for Warranty eligibility.

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:	
EPA 2007/2010/2013/2017/2021/ 2024	max. 15 parts per million
EPA Tier 4 Interim / Final / Stage V in North America	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
EU Stage IV 2011	max. 15 parts per million
EU Stage V	max. 10 parts per million
Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine.

Any unauthorized modifications to the aftertreatment system could negatively effect emissions certification and void the Warranty.

Cummins is also not responsible for failures caused by incorrect oil, fuel or diesel exhaust fluid or by water, dirt or other contaminants in the fuel, oil or diesel exhaust fluid.

Excessive oil consumption for B Series Engines is covered for the duration of the Coverage or 100,000 miles (160,935 kilometers) or 7,000 hours from the date of delivery of the Engine to the first user, whichever of the three occurs first. Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failures of belts and hoses supplied by Cummins are covered for the first year from the date of delivery of the Engine to the first user.

Parts used to repair a Warrantable Failure may be new Cummins parts, Cummins approved rebuilt parts or repaired parts. Cummins is not responsible for failures resulting from the use of parts not approved by Cummins.

A new Cummins or Cummins approved rebuilt part used to repair a Warrantable Failure assumes the identity of the part it replaced and is entitled to the remaining Coverage hereunder.

Cummins Inc. reserves the right to interrogate Electronic Control Module (ECM) data for purposes of failure analysis.

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

THESE WARRANTIES AND THE EMISSION WARRANTY SET FORTH HEREINAFTER ARE THE SOLE WARRANTIES MADE BY CUMMINS IN REGARD TO THESE ENGINES. CUMMINS MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state or country to country.

Emission Warranty

Products Warranted

This Emission Warranty applies to new diesel, LPG, compressed or liquid natural gas fueled Engines marketed by Cummins that are used in the United States* or Canada in vehicles designed for transporting persons or property on a street or highway. This Warranty applies to Engines delivered to the first user on or after January 1, 1999.

Coverage

Cummins warrants to the first user and each subsequent purchaser that the Engine is designed, built and equipped so as to conform at the time of sale by Cummins with all U.S. federal emission regulations applicable at the time of manufacture and that it is free from defects in material or factory workmanship which would cause it not to meet these regulations within the longer of the following periods: (A) Five years or 100,000 miles (160,935 kilometers) of operation, whichever occurs first, as measured from the date of delivery of the Engine to the first user, or (B) The Base Engine Warranty.

If the vehicle in which the Engine is installed is registered in the state of California, a separate California Emission Warranty also applies.

Limitations

Engines with an emissions certification listed below must be operated using only diesel fuel having no more than the corresponding maximum sulfur content. Failure to use the specified fuel as listed in the Cummins Fuel Bulletin #3379001 Table 1 (Cummins Inc. Required Diesel Fuel Specifications) can damage the Engine and aftertreatment system within a short period of time. This damage could cause the Engine to become inoperable and failures attributable to the use of incorrect fuels will be denied Warranty Coverage. Fuel specifications also need to comply with local fuel regulations (EN590 for Europe and ASTM D975 for North America) for Warranty eligibility.

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:	
EPA 2007/2010/2013/2017/2021/2024	max. 15 parts per million
EPA Tier 4 Interim / Final / Stage V in North America	max. 15 parts per million

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:	
EU Stage IIIB 2011	max. 15 parts per million
EU Stage IV 2011	max. 15 parts per million
EU Stage V	max. 10 parts per million
Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

Failures, other than those resulting from defects in material or factory workmanship, are not covered by this Warranty.

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine.

Any unauthorized modifications to the aftertreatment system could negatively effect emissions certification and void the Warranty.

Cummins is also not responsible for failures caused by incorrect oil, fuel or diesel exhaust fluid or by water, dirt or other contaminants in the fuel, oil or diesel exhaust fluid.

Cummins is not responsible for non-Engine repairs, "downtime" expenses, cargo damage, fines, all applicable taxes, all business costs and other losses resulting from a Warrantable Failure.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

* United States includes American Samoa, the Commonwealth of Northern Mariana Islands, Guam, Puerto Rico and the U.S. Virgin Islands.

All Engines United States And Canada School Bus Coverage

Products Warranted

This Warranty applies to new diesel, LPG, compressed or liquid natural gas fueled Engines sold by Cummins Inc. or Cummins Westport and delivered to the first user on or after September 15, 1996, that are used in school bus* applications in the United States** or Canada.

Base Engine Warranty

The Base Engine Warranty covers any failures of the Engine which result, under normal use and service, from a defect in material or factory workmanship (Warrantable Failure). This Coverage begins with the sale of the Engine by Cummins and continues for five years or 100,000 miles (160,934 kilometers), whichever occurs first, from the date of delivery of the Engine to the first user.

Engine aftertreatment components included in the Cummins Critical Parts List (CPL) and marked with a Cummins part number are covered under Base Engine Warranty.

Extended Major Components Warranty

The Extended Major Components Warranty applies to all except ISV, ISB6.7 G, B and ISB Series Engines and covers Warrantable Failures of the Engine cylinder block, camshaft, crankshaft and connecting rods (Covered Parts).

Bushing and bearing failures are not covered.

This Coverage begins with the expiration of the Base Engine Warranty and ends three years or 300,000 miles (482,804 kilometers), whichever occurs first, from the date of delivery of the Engine to the first user.

Emission Warranty

Additional Coverage is outlined under the Emission Warranty.

THESE WARRANTIES ARE MADE TO ALL OWNERS IN THE CHAIN OF DISTRIBUTION AND COVERAGE CONTINUES TO ALL SUBSEQUENT OWNERS UNTIL THE END OF THE PERIODS OF COVERAGE.

Cummins Responsibilities

During The Base Engine Warranty

Cummins will pay for all parts and labor needed to repair the damage to the Engine resulting from a Warrantable Failure.

Cummins will pay for the lubricating oil, antifreeze, filter elements, belts, hoses and other maintenance items that are not reusable due to the Warrantable Failure.

Cummins will pay for reasonable labor costs for Engine removal and reinstallation when necessary to repair a Warrantable Failure.

Cummins will pay reasonable costs for towing a vehicle disabled by a Warrantable Failure to the nearest authorized repair location when necessary to make the repair for the first 2 years from the date of delivery of the Engine to the first user. In lieu of towing expenses, Cummins will pay reasonable costs for mechanics to travel to and from the location of the vehicle, including meals, mileage and lodging, when the repair is performed at the site of the failure.

During The Extended Major Components Warranty

Cummins will pay for the repair or, at its option, replacement of the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered Part.

Owner Responsibilities

During The Base Engine Warranty

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items provided during Warranty repairs unless such items are not reusable due to the Warrantable Failure.

During The Extended Major Components Warranty

Owner is responsible for the cost of all labor needed to repair the Engine, including the labor to remove and reinstall the Engine. When Cummins elects to repair a part instead of replacing it, Owner is not responsible for the labor needed to repair the part.

Owner is responsible for the cost of all parts required for the repair except for the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered Part.

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items replaced during the repair.

During The Base Engine And Extended Major Components Warranties
Owner is responsible for the operation and maintenance of the Engine as specified in the applicable Cummins Operation and Maintenance Manual. Owner is also responsible for providing proof that all recommended maintenance has been performed.

Before the expiration of the applicable Warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility. Except for Engines disabled by a Warrantable Failure during the first two years from the date of delivery of the Engine to the first user, Owner must also deliver the Engine to the repair facility.

Service locations are listed on the Cummins Worldwide Service Locator at cummins.com.

Owner is responsible for communication expenses, meals, lodging and similar costs incurred as a result of a Warrantable Failure.

Owner is responsible for non-Engine repairs and for "downtime" expenses, passenger delays, fines, all applicable taxes, all business costs and other losses resulting from a Warrantable Failure.

Limitations

Engines with an emissions certification listed below must be operated using only diesel fuel having no more than the corresponding maximum sulfur content. Failure to use the specified fuel as listed in the Cummins Fuel Bulletin #3379001 Table 1 (Cummins Inc. Required Diesel Fuel Specifications) can damage the Engine and aftertreatment system within a short period of time. This damage could cause the Engine to become inoperable and failures attributable to the use of incorrect fuels will be denied Warranty Coverage. Fuel specifications also need to comply with local fuel regulations (EN590 for Europe and ASTM D975 for North America) for Warranty eligibility.

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:	
EPA 2007/2010/2013/2017/2021/ 2024	max. 15 parts per million
EPA Tier 4 Interim / Final / Stage V in North America	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
EU Stage IV 2011	max. 15 parts per million
EU Stage V	max. 10 parts per million
Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine.

Any unauthorized modifications to the aftertreatment system could negatively affect emissions certification and void the Warranty.

Cummins is also not responsible for failures caused by incorrect oil, fuel or diesel exhaust fluid or by water, dirt or other contaminants in the fuel, oil or diesel exhaust fluid.

Alternators and starters are covered for the first two years from the date of delivery of the Engine to the first user, or the expiration of the Base Engine Warranty, whichever occurs first.

Excessive oil consumption for ISV and B Series Engines is covered for the duration of the Coverage. Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failures of belts and hoses supplied by Cummins are not covered beyond the first year from the date of delivery of the Engine to the first user or the expiration of the applicable Base Engine Warranty, whichever occurs first.

Parts used to repair a Warrantable Failure may be new Cummins parts, Cummins approved rebuilt parts or repaired parts. Cummins is not responsible for failures resulting from the use of parts not approved by Cummins.

A new Cummins or Cummins approved rebuilt part used to repair a Warrantable Failure assumes the identity of the part it replaced and is entitled to the remaining Coverage hereunder.

Cummins, Inc. reserves the right to interrogate Electronic Control Module (ECM) data for purposes of failure analysis.

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

THESE WARRANTIES AND THE EMISSION WARRANTY SET FORTH HEREINAFTER ARE THE SOLE WARRANTIES MADE BY CUMMINS IN REGARD TO THESE ENGINES. CUMMINS MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Emission Warranty

Products Warranted

This Emission Warranty applies to new Engines marketed by Cummins that are used in the United States** or Canada in vehicles designed for transporting persons or property on a street or highway. This Warranty applies to Engines delivered to the ultimate purchaser on or after January 1, 1996.

Coverage

Cummins warrants to the ultimate purchaser and each subsequent purchaser that the Engine is designed, built and equipped so as to conform at the time of sale by Cummins with all U.S. federal emission regulations applicable at the time of manufacture and that it is free from defects in material or factory workmanship which would cause it not to meet these regulations within the longer of the following periods: (A) Five years or 100,000 miles (160,934 kilometers) of operation, whichever occurs first, as measured from the date of delivery of the Engine to the ultimate purchaser, or (B) The Base Engine Warranty.

If the vehicle in which the Engine is installed is registered in the state of California, a separate California Emission Warranty also applies.

Limitations

Engines with an emissions certification listed below must be operated using only diesel fuel having no more than the corresponding maximum sulfur content. Failure to use the specified fuel as listed in the Cummins Fuel Bulletin #3379001 Table 1 (Cummins Inc. Required Diesel Fuel Specifications) can damage the engine and aftertreatment system within a short period of time. This damage could cause the engine to become inoperable and failures attributable to the use of incorrect fuels will be denied Warranty Coverage. Fuel specifications also need to comply with local fuel regulations (EN590 for Europe and ASTM D975 for North America) for Warranty eligibility.

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:	
EPA 2007/2010/2013/2017/2021/ 2024	max. 15 parts per million
EPA Tier 4 Interim / Final / Stage V in North America	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
EU Stage IV 2011	max. 15 parts per million
EU Stage V	max. 10 parts per million

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:

Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

Failures, other than those resulting from defects in material or factory workmanship, are not covered by this Warranty.

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine.

Any unauthorized modifications to the aftertreatment system could negatively affect emissions certification and void the Warranty.

Cummins is also not responsible for failures caused by incorrect oil, fuel or diesel exhaust fluid or by water, dirt or other contaminants in the fuel, oil or diesel exhaust fluid.

Cummins is not responsible for non-Engine repairs, "downtime" expenses, cargo damage, fines, all applicable taxes, all business costs or other losses resulting from a Warrantable Failure.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

* A vehicle used to transport students to and from school. Vehicle must be painted yellow, should have warning lights and the words 'SCHOOL BUS' written on the front and rear roof caps. The requirements pertaining to paint color, warning lights and 'SCHOOL BUS' inscription would not apply if the vehicle is exclusively used to transport students for school related activities and it is owned by a school district.

** United States includes American Samoa, the Commonwealth of Northern Mariana Islands, Guam, Puerto Rico and the U.S. Virgin Islands.

All Electronic Diesel Engines United States And Canada Recreational Vehicle Coverage

Products Warranted

This Warranty applies to new electronic diesel Engines sold by Cummins Inc., hereafter "Cummins", and delivered to the first user on or after August 1, 2005, that are used in recreational vehicle* applications in the United States** or Canada.

Base Engine Warranty

The Base Engine Warranty covers any failures of the Engine which result, under normal use and service, from a defect in material or factory workmanship (Warrantable Failure). This Coverage begins with the sale of the Engine by Cummins and ends five years or 100,000 miles (160,934 kilometers), whichever occurs first, after the date of delivery of the Engine to the first user.

Engine aftertreatment components included in the Cummins Critical Parts List (CPL) and marked with a Cummins part number are covered under Base Engine Warranty.

Coverage for the ISB AD Engine begins with the sale of the Engine by Cummins and ends three years or 75,000 miles (120,700 kilometers), whichever occurs first, after the date of delivery of the Engine to the first user.

Emission Warranty

Additional Coverage is outlined in the Emission Warranty section.

These Warranties are made to all Owners in the chain of distribution and Coverage continues to all subsequent Owners until the end of the periods of Coverage.

Cummins Responsibilities

During The Base Engine Warranty

Cummins will pay for all parts and labor needed to repair the damage to the Engine resulting from a Warrantable Failure.

Cummins will pay for the lubricating oil, antifreeze, filter elements, belts, hoses and other maintenance items that are not reusable due to the Warrantable Failure.

Cummins will pay for reasonable labor costs for Engine removal and reinstallation when necessary to repair a Warrantable Failure.

Cummins will pay reasonable costs for towing a vehicle disabled by a Warrantable Failure to the nearest authorized repair location when necessary to make the repair for the first year from the date of delivery of the Engine to the first user. In lieu of towing expenses, Cummins will pay reasonable costs for mechanics to travel to and from the location of the vehicle, including meals, mileage and lodging, when the repair is performed at the site of the failure.

Owner Responsibilities

During The Base Engine Warranty

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items provided during Warranty repairs unless such items are not reusable due to the Warrantable Failure.

Owner is responsible for the operation and maintenance of the Engine as specified in the applicable Cummins Operation and Maintenance Manual. Owner is also responsible for providing proof that all recommended maintenance has been performed.

Before the expiration of the applicable Warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility. Except for Engines disabled by a Warrantable Failure during the first year after the date of delivery of the Engine to the first user, Owner must also deliver the Engine to the repair facility.

Service locations are listed on the Cummins Worldwide Service Locator at cummins.com.

Owner is responsible for communication expenses, meals, lodging and similar costs incurred as a result of a Warrantable Failure.

Owner is responsible for non-Engine repairs and for "downtime" expenses, fines, all applicable taxes, all business costs and other losses resulting from a Warrantable Failure.

Limitations

Engines with an emissions certification listed below must be operated using only diesel fuel having no more than the corresponding maximum sulfur content. Failure to use the specified fuel as listed in the Cummins Fuel Bulletin #3379001 Table 1 (Cummins Inc. Required Diesel Fuel Specifications) can damage the Engine and aftertreatment system within a short period of time. This damage could cause the Engine to become inoperable and failures attributable to the use of incorrect fuels will be denied Warranty Coverage. Fuel specifications also need to comply with local fuel regulations (EN590 for Europe and ASTM D975 for North America) for Warranty eligibility.

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:	
EPA 2007/2010/2013/2017/2021/ 2024	max. 15 parts per million
EPA Tier 4 Interim / Final / Stage V in North America	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
EU Stage IV 2011	max. 15 parts per million
EU Stage V	max. 10 parts per million
Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine.

Any unauthorized modifications to the aftertreatment system could negatively affect emissions certification and void the Warranty.

Cummins is also not responsible for failures caused by incorrect oil, fuel or diesel exhaust fluid or by water, dirt or other contaminants in the fuel, oil or diesel exhaust fluid.

Alternators and starters are covered for the first two years from the date of delivery of the Engine to the first user, or the expiration of the Base Engine Warranty, whichever occurs first.

Excessive oil consumption for ISV and B Series Engines is covered for the duration of the Coverage or 100,000 miles (160,934 kilometers) or 7,000 hours after the date of delivery of the Engine to the first user, whichever of the three occurs first. Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failures of belts and hoses supplied by Cummins are not covered after the first twelve months after the date of delivery of the Engine to the first user or the expiration of the applicable Base Engine Warranty, whichever occurs first.

Parts used to repair a Warrantable Failure may be new Cummins parts, Cummins approved rebuilt parts or repaired parts. Cummins is not responsible for failures resulting from the use of parts not approved by Cummins.

A new Cummins or Cummins approved rebuilt part used to repair a Warrantable Failure assumes the identity of the part it replaced and is entitled to the remaining Coverage hereunder.

Cummins Inc. reserves the right to interrogate Electronic Control Module (ECM) data for purposes of failure analysis.

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

THESE WARRANTIES AND THE EMISSION WARRANTY SET FORTH HEREINAFTER ARE THE SOLE WARRANTIES MADE BY CUMMINS IN REGARD TO THESE ENGINES. CUMMINS MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Emission Warranty

Products Warranted

This Emission Warranty applies to new Engines marketed by Cummins that are used in the United States** or Canada in vehicles designed for transporting persons or property on a street or highway. This Warranty applies to Engines delivered to the first user on or after January 1, 1998.

Coverage

Cummins warrants to the first user and each subsequent purchaser that the Engine is designed, built and equipped so as to conform at the time of sale by Cummins with all U.S. federal emission regulations applicable at the time of manufacture and that it is free from defects in material or factory workmanship which would cause it not to meet these regulations within the longer of the following periods: (A) Five years or 100,000 miles (160,934 kilometers) of operation, whichever occurs first, as measured from the date of delivery of the Engine to the first user, or (B) The Base Engine Warranty.

If the vehicle in which the Engine is installed is registered in the state of California, a separate California Emission Warranty also applies.

Limitations

Engines with an emissions certification listed below must be operated using only diesel fuel having no more than the corresponding maximum sulfur content. Failure to use the specified fuel as listed in the Cummins Fuel Bulletin #3379001 Table 1 (Cummins Inc. Required Diesel Fuel Specifications) can damage the Engine and aftertreatment system within a short period of time. This damage could cause the Engine to become inoperable and failures attributable to the use of incorrect fuels will be denied Warranty Coverage. Fuel specifications also need to comply with local fuel regulations (EN590 for Europe and ASTM D975 for North America) for Warranty eligibility.

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:

EPA 2007/2010/2013/2017/2021/ 2024	max. 15 parts per million
EPA Tier 4 Interim / Final / Stage V in North America	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
EU Stage IV 2011	max. 15 parts per million
EU Stage V	max. 10 parts per million
Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

Failures, other than those resulting from defects in material or factory workmanship, are not covered by this Warranty.

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine.

Any unauthorized modifications to the aftertreatment system could negatively affect emissions certification and void the Warranty.

Cummins is also not responsible for failures caused by incorrect oil, fuel or diesel exhaust fluid or by water, dirt or other contaminants in the fuel, oil or diesel exhaust fluid.

Cummins is not responsible for non-Engine repairs, "downtime" expenses, cargo damage, fines, all applicable taxes, all business costs or other losses resulting from a Warrantable Failure.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

* A 'recreational vehicle' for this Warranty is defined as a Motorhome which is a vehicular unit built on a self-propelled motor vehicle chassis, primarily designed or altered to provide temporary living quarters for recreational, travel or camping use. The living unit has been entirely constructed on a bare, specially-designed motor vehicle chassis.

** United States includes American Samoa, the Commonwealth of Northern Mariana Islands, Guam, Puerto Rico and the U.S. Virgin Islands.

California Emission Control System Warranty
Your Warranty Rights and Obligations

The California Air Resources Board and Cummins Inc. are pleased to explain the emission control system warranty on your 2023 through 2024 model year heavy-duty diesel engine. In California, new motor vehicle engines must be designed, built and equipped to meet the State's stringent anti-smog standards. Cummins Inc. must warrant the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

Your emission control system may include parts such as the fuel injection system and engine electronic control module. Also included may be hoses, connectors and other emission-related assemblies.

Where a warrantable condition exists, Cummins Inc. will repair your engine at no cost to you including diagnosis, parts and labor.

Manufacturer's Warranty Coverage

Please refer to the table below for manufacturer’s warranty coverage. This warranty coverage is provided for whichever first occurs from the date of delivery of the engine to the first user.

Application	Warranty Coverage
B6.7 Hybrid & All Natural Gas Engines (e.g., B6.7N, L9N, ISX12N)	5 years / 100,000 miles (160,935 km)/3,000 hours
Medium Duty (e.g., B6.7, L9)	5 years/150,000 miles (241,402 km)
Heavy Duty (e.g., X15, X12, L9 Urban Bus)	5 years / 350,000 miles (563,271 km)

Owner's Warranty Responsibilities

As the engine owner, you are responsible for the performance of the required maintenance listed in your Cummins® Owners and/or Operation and Maintenance Manual. Cummins Inc. recommends that you retain all receipts covering

maintenance on your engine, but Cummins Inc. cannot deny warranty solely for the lack of receipts or for your failure to substantiate the performance of all scheduled maintenance.

You are responsible for presenting your engine to a Cummins® dealer as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

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

If you have any questions regarding your warranty rights and responsibilities, you should contact Cummins® Customer Relation Department at 1-800-CUMMINS or the California Air Resources Board at 9528 Telstar Avenue, El Monte, CA 91731.

A warranted part which is scheduled for replacement as required maintenance is warranted up to the first schedule replacement point.

Prior to the expiration of the applicable warranty, Owner must give notice of any warranted emission control failure to a Cummins® distributor, authorized dealer or other repair location approved by Cummins Inc. and deliver the engine to such facility for repair. Repair locations are listed in Cummins® United States and Canada Service Directory.

Owner is responsible for incidental costs such as: communication expenses, meals, lodging incurred by Owner or employees of Owner as a result of a Warrantable Condition.

Owner is responsible for "downtime" expenses, cargo damage, fines, all applicable taxes, all business costs, and other losses resulting from a Warrantable Condition.

California Emission Control System Warranty

Coverage

This list of emission control parts may be covered by the emission control system warranty under certain failure modes:

NOTE: Where applicable with covered components, associated plumbing, mounting hardware, gaskets and o-rings are covered.

California CARB Diesel	
Aftertreatment System	**Base Engine System**
Component	**Component**
Aftertreatment Electroconnections	Clean Idle Sticker
Aftertreatment Inlet and Outlet Modules	Coolant Temperature Sensor
Aftertreatment Temperature Interface Module	Crankcase Breather
Aftertreatment Temperature Sensors	Engine Speed, Position Sensor, Cam Position
Decomposition Tube	Exhaust Valve
DEF Dosing Unit (Pump)	
DEF Dosing Valve	
Diesel Oxidation Catalyst	
Diesel Particulate Filter (except for ash maintenance)	
Diesel Particulate Filter Differential Pressure Sensor	**EGR System**
Aftertreatment Particulate Sensor	**Component**
NOx Sensors	EGR Cooler
SCR Catalyst	EGR Differential Pressure Sensor

California CARB Diesel	
DEF Quality Sensor	EGR Mixer/Venturi
DEF Tank Heater Coolant Control Valve	EGR Temperature Sensor
DEF Line Heater Control Relay	EGR Valve
DEF Temperature Sensors	
DEF Tank/Lines Heating Elements of Heat	
Exchanger and pipe	**Electronic Control System**
DEF Tank and Lines	**Component**
DEF Level Sensor	Engine Control Module
Exhaust Gas Piping from Turbocharger out to the Last Aftertreatment Device	Wiring Harness Circuits Connected at Both Ends to Emissions Warrantable Components
	Diesel Exhaust Fluid (DEF) Lamp
Air Handling	On Board Diagnostic (OBD) Malfunction
Component	OBD Connector
Ambient Air Temperature Sensor	Engine Wiring Harness
Exhaust Gas Pressure Sensor	Aftertreatment Wiring Harness
Exhaust Manifold	**Fuel System**
Charge Air Cooler and Associated Plumbing	**Component**
Intake Manifold	Fuel Pump Actuator
Intake Manifold Temperature/Pressure	Fuel Lines
Turbocharger Actuator	Fuel Pressure Sensor

California CARB Diesel	
Turbocharger Assembly	Fuel Pump
Turbocharger Compressor Intake Pressure/ Temperature Sensor	Injector
Turbocharger Speed Sensor	

California Emission Control System Warranty

Replacement Parts

Cummins Inc. recommends that any service parts used for maintenance, repair or replacement of emission control systems be new, genuine Cummins® or Cummins® approved rebuilt parts and assemblies, and that the engine be serviced by a Cummins® distributor, authorized dealer or the repair location approved by Cummins Inc.. The owner may elect to have maintenance, replacement or repair of the emission control parts performed by a facility other than a Cummins® distributor, an authorized dealer or a repair location approved by Cummins Inc., and may elect to use parts other than new genuine Cummins® or Cummins® approved rebuilt parts and assemblies for such maintenance, replacement or repair; however, the cost of such service or parts and subsequent failures resulting from such service or parts will not be covered under this emission control system warranty, except for Emergency Repairs as described below.

Cummins Responsibilities

The warranty coverage begins when the engine is delivered to the ultimate purchaser.

Repairs and service will be performed by any Cummins® distributor, authorized dealer or other repair locations approved by Cummins Inc. using new, genuine Cummins® or Cummins® approved rebuilt parts and assemblies. Cummins Inc. will repair any of the emission control parts found by Cummins Inc. to be defective without charge for parts or labor (including diagnosis which results in determination that there has been a failure of a warranted emission control part).

Emergency Repairs

In the case of an emergency where a Cummins® distributor, authorized dealer, or other repair location approved by Cummins Inc. is not available, repairs may be performed by any available repair location or by any individual using any replacement parts. A part not being available within 30 days or a repair not being complete within 30 days constitutes an emergency. Cummins Inc. will reimburse the Owner for expenses (including diagnosis), not to exceed the manufacturer's suggested retail price for all warranted parts replaced and labor charges based on the manufacturer's recommended time allowance for the warranty repair and the geographically appropriate hourly labor

rate. Replaced parts and paid invoices must be presented at a Cummins® authorized repair facility as a condition of reimbursement for emergency repairs not performed by a Cummins® distributor, authorized dealer, or other repair location approved by Cummins Inc..

Warranty Limitations

Cummins Inc. is not responsible for failures or damage resulting from what Cummins Inc. determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of cooling, lubricating or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications to the engine. Cummins Inc. is also not responsible for failures caused by incorrect oil, fuel, or coolant or by water, dirt or other contaminants in the fuel or oil or contaminants in the coolant.

Cummins Inc. is not responsible for failures resulting from improper repair or the use of parts which are not genuine Cummins® or Cummins® approved parts.

Cummins Inc. is not responsible for the material and labor costs of emission control parts and assemblies replaced during Scheduled Maintenance of the engine as specified in Cummins® Owners and/or Operation and Maintenance Manuals.

THIS WARRANTY, TOGETHER WITH THE EXPRESS COMMERCIAL WARRANTIES ARE THE SOLE WARRANTIES MADE BY CUMMINS INC.. THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

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