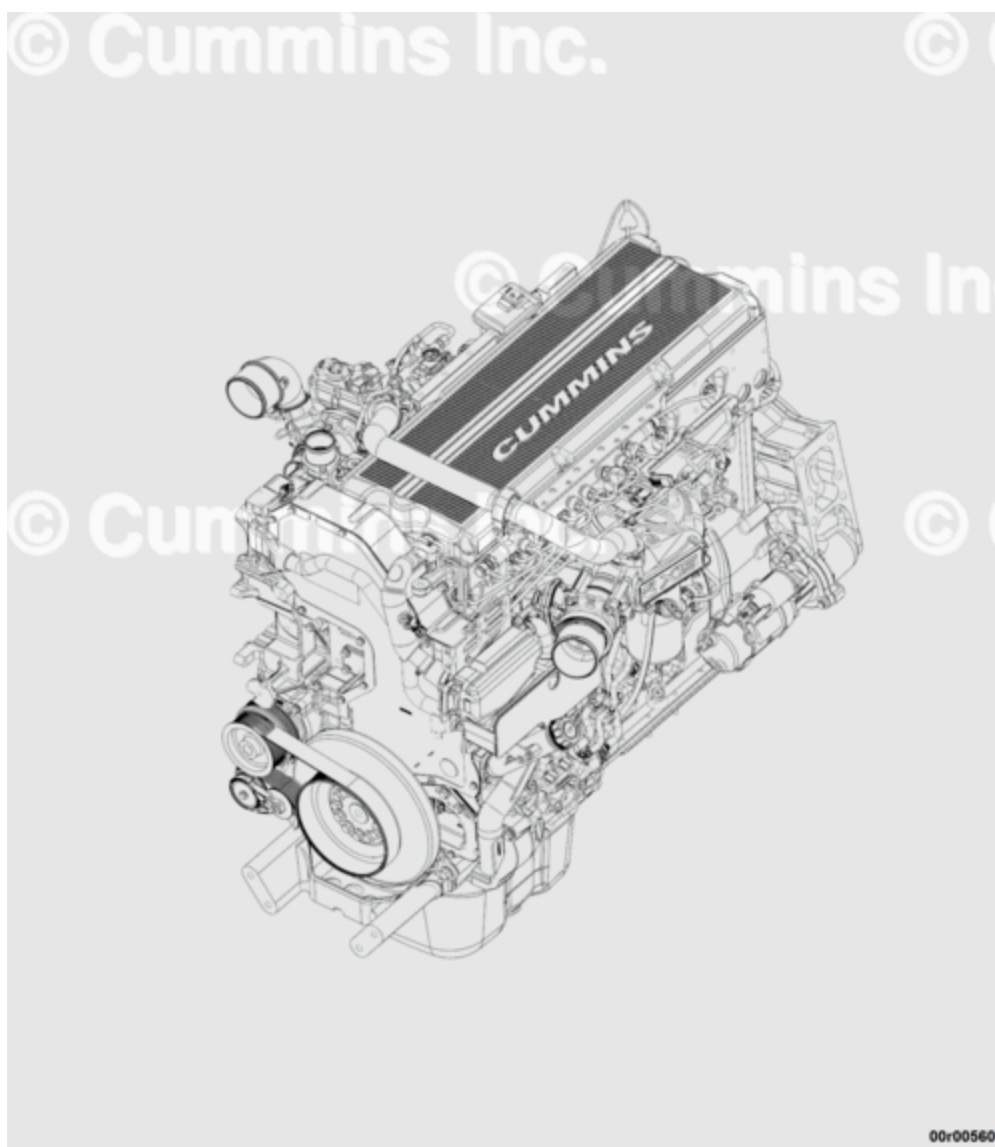


(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Owners Manual

X15 CM2450 X124B - Efficiency Series

X15 CM2450 X134B - Performance Series



Bulletin Number 5504581

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

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.

Last Modified: 19-Apr-2016

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

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)		
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)		

Description	Number	Comments/Additional Information
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		

Last Modified: 26-Apr-2016

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

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.

Last Modified: 06-Jan-2025

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

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.

Last Modified: 05-Sep-2023

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

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.

©Cummins Inc.

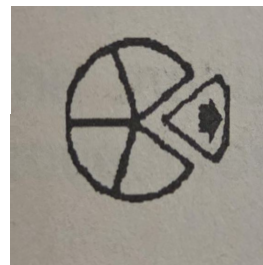
 CAUTION

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

©Cummins Inc.

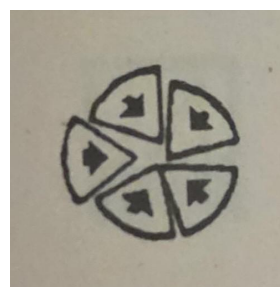
Indicates a **REMOVAL** or **Dissassembly** step.

©Cummins Inc.



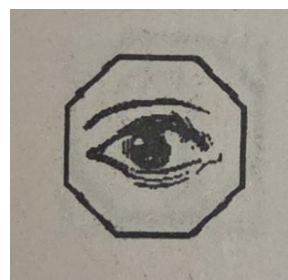
Indicates an **INSTALLATION** or **ASSEMBLY** step.

©Cummins Inc.



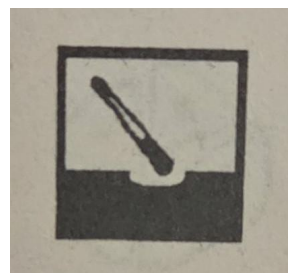
INSPECTION is required.

©Cummins Inc.



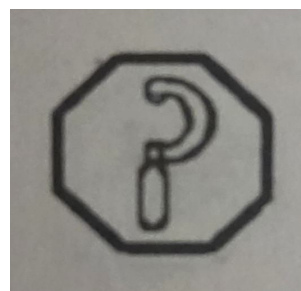
CLEAN the part or assembly.

©Cummins Inc.



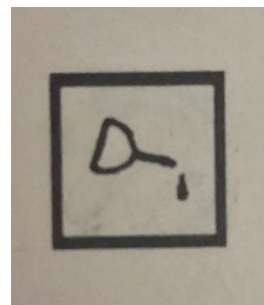
PERFORM a mechanical or time **MEASUREMENT**.

©Cummins Inc.



LUBRICATE the part or assembly.

©Cummins Inc.



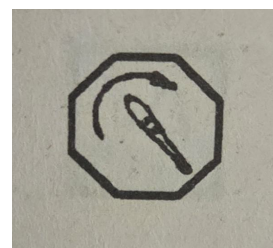
Indicates that a **WRENCH** or **TOOL SIZE** will be given.

©Cummins Inc.



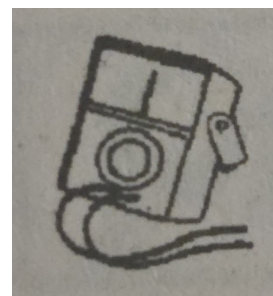
TIGHTEN to a specific torque.

©Cummins Inc.



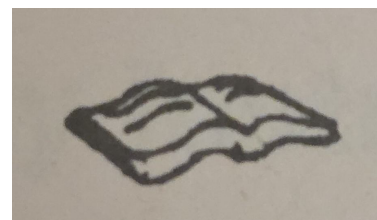
PERFORM an electrical **MEASUREMENT**.

©Cummins Inc.



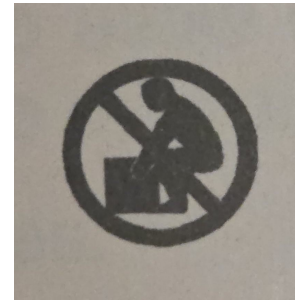
Refer to another location in this manual or another publication for additional information.

©Cummins Inc.



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.

©Cummins Inc.



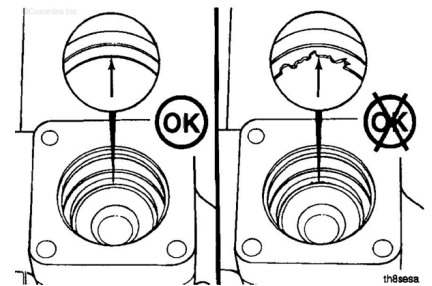
Last Modified: 05-Sep-2023

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

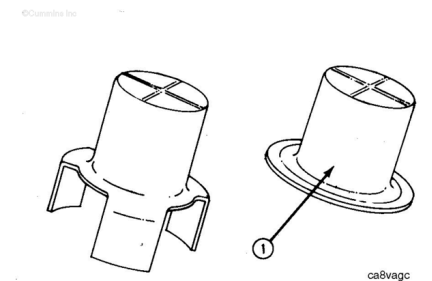
Trainings ▾

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.



Last Modified: 12-Mar-2002

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

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 determined 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.

Last Modified: 27-Nov-2024

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

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 Identifier
GVW	Gross Vehicle Weight
Hg	Mercury
hp	Horsepower
H₂O	Water
inHg	Inches of Mercury
in H₂O	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

Last Modified: 15-Apr-2020

Cummins Inc

1

2

3

MANUFACTURED BY CUMMINS INC. Assembled in the USA 3967907	Engine No.	Ref. No.	MODEL	Fuel Rate at Adv. HP	mm ³ Stroke	CPL	
	Idle Speed (rpm)	Advertised HP	at rpm	Family	FEL	EPA CARB	
	Date of Mfg:	Firing Order	Timing - T.D.C.	ELECTRONIC	Catalyst No.	ROX+HBBIC	
	Valve lash cold	int.	Exh.	C.I.D./L	/	E.C.S.	PM
	IMPORTANT ENGINE INFORMATION: This engine is exempt from the prohibitions of section 203 (a) (i) (3) & (4) of the Clean Air Act as amended. See exemption label information for exemption no. and effective date.						

4

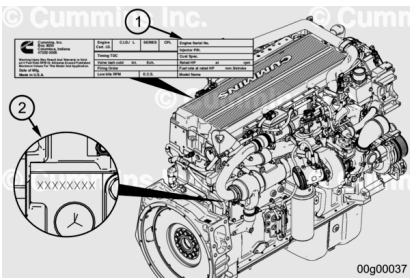
5

00d00269

- 1. ESN
- 2. Engine model information
- 3. CPL
- 4. Valve lash (overhead) setting
- 5. Horsepower and rpm rating.

Note : Depending on the manufacturing plant, calibration data can be found on the engine dataplate.

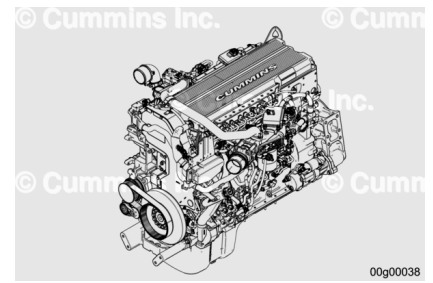
If the engine dataplate (1) is **not** legible, the ESN (2) can be found on the engine block. Additional engine information is on the engine control module dataplate.



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. ([/qs3/pubsys2/xml/en/procedures/99/99-100-008.html](https://qs3/pubsys2/xml/en/procedures/99/99-100-008.html))

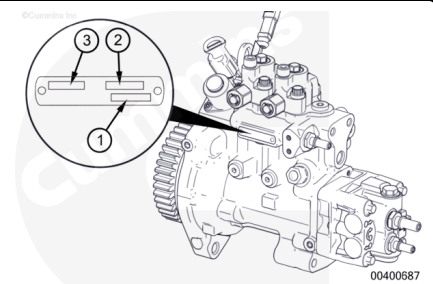
The Cummins® Product Technology procedure provides the Cummins® Service Model Name and describes the unique technology used by the engine covered by this manual. Refer to Procedure 100-006 in Section E.
(/qs3/pubsys2/xml/en/procedures/564/564-100-006.html)



Fuel Pump Dataplate

The fuel pump dataplate is located on the side of the high-pressure pump. The dataplate contains the following information:

1. Cummins® part number
2. Pump serial number
3. Factory code.



Engine Control Module Dataplate

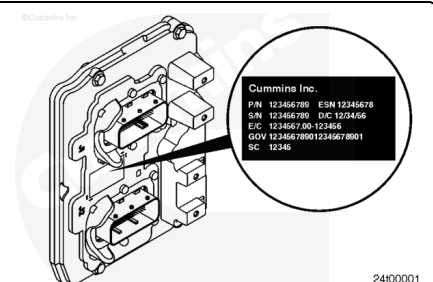
The engine control module (ECM) dataplate is located on the front of the ECM.

The following information is found on the ECM dataplate:

- Part number (PN)
- ECM serial number (SN)
- Data code (DC)
- ESN
- ECM code (identifies the software in the ECM).

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.

Note : Not all engines will have ECM dataplates.



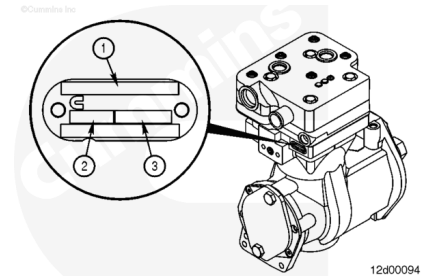
Engines covered by this manual are equipped with a CM2450 ECM. A CM2450 ECM has two 96 pin connectors.

Air Compressor

Note : Not all engine are equipped with an air compressor.

The Cummins® branded air compressor dataplate, identified by the Cummins Inc. log on the dataplate, is typically located on the rear side of the air compressor. The dataplate contains the following information that assists in service or replacement:

1. Cummins® part number
2. Data code
3. Serial number.

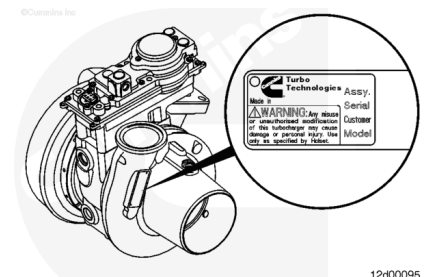


Variable Geometry Turbocharger

The variable geometry turbocharger (VGT) dataplate is located on the turbocharger inlet compressor housing. The dataplate contains the following information which will assist in service 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 assists in service or replacement.



Exhaust System

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

The aftertreatment assembly has information laser-etched into the canister. There are several important identification locations on the aftertreatment system.

1. Diesel oxidation catalyst (DOC) part identification
2. Diesel particulate filter (DPF) part identification
3. Decomposition tube part identification
4. Aftertreatment assembly part identification
5. Selective catalytic recirculation (SCR) part identification.

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



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

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

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

The decomposition tube part identification numbers are located on the side of the module. There are six 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 aftertreatment assembly serial number (#####).

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

- Cummins Emission Solutions™ part number (A###A###) (E PN)
- Cummins® part number (#####) (C PN)
- 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) (XXXXXXXXXXXXXXXXXX)
- Cummins® part number (XXXXXXX)

Last Modified: 04-May-2022

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

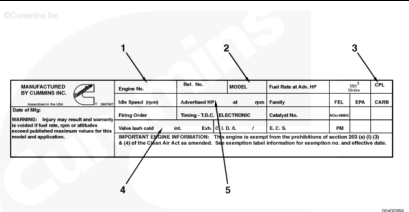
General Information

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.

B6.7 CM2350 B121B
└─ B6.7

00/00188

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.

B6.7 CM2350 B121B
└─┬─ 6.7
└─ B

00/00189

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.

B6.7N CM2350 B121B
└─ N

00/00215

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

B6.7 CM2350 B121B
CM2350 └─

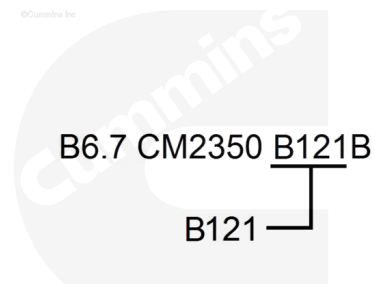
00/00190

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.

©Cummins Inc.



00/00191

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

Last Modified: 31-Mar-2023

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

General Information

This procedure covers two service model names.

- X15 CM2450 X124B – Efficiency Series
- X15 CM2450 X134B – Performance Series

There are product technology differences between these two service model names. However, the information in this manual is the same for both engines, except where specified.

X15 CM2450 X124B - Efficiency Series

The service model name for this product is **X15 CM2450 X124B**.

Additional Product Description: Efficiency Series

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

United States and Canada

- Environmental Protection Agency (EPA)
 - 2013 Emission Levels
 - 2017/2021 Greenhouse Gas Requirements
- Air Resources Board (ARB)
 - 2013 Emission Levels

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

- On-Board Diagnostics (OBD-D)

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

- 5348
- 5535
- 5779

EPA Product

This engine has the following Agency defined Emissions Control System (ECS) 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.

(/qs3/pubsys2/xml/en/procedures/564/564-100-001.html)

- 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 Head
- Camshaft Followers/Tappets
 - Roller Followers/Tappets
- Primary Gear Train Location
 - Front of the Engine
- Engine Balancer Option
 - External
- Engine Braking
 - Compression Brake Option
- Accessory Drive Option

- Crankcase Ventilation System
 - Open

Fuel System

- Diesel
- Common Rail Fuel System
 - Cummins® XPI Common Rail Fuel System
- Fuel Lift Pump
 - Electric
 - 12 VDC

Cooling System

- Cooling System Heater Option
 - 120 VAC

Air Handling

- Turbocharger (Single)
 - Variable Geometry
 - Sliding Nozzle Design
- Charge Air Cooler
- 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
- Aftertreatment Diesel Exhaust Fluid (DEF) Dosing System
 - Airless Diesel Exhaust Fluid Dosing Unit

Electrical Equipment

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

Electronic Control System

- Engine Control Module (Single)
 - Control Module: CM2450
- ECM Supply Voltage

- 12 VDC

- Engine Coolant Level Sensor
- Engine Coolant Temperature Sensor
- Engine Oil Pressure Sensor
- Engine Oil Temperature Sensor
- Crankcase Pressure Sensor
- Camshaft Position Sensor
- Crankshaft Position Sensor
- Fuel Rail Pressure Sensor
- Fuel Pump Actuator
- Water in Fuel Sensor
- EGR Differential Pressure Sensor
- Exhaust Gas Pressure Sensor
- EGR Temperature Sensor
- Intake Manifold Pressure/Temperature Sensor
- Turbocharger Speed Sensor
- Turbocharger Compressor Intake Temperature Sensor
- Ambient Air Pressure 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
- Fire Truck
- Recreational Vehicle

X15 CM2450 X134B - Performance Series

The service model name for this product is **X15 CM2450 X134B**.

Additional Product Description: Performance Series

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
- Air Resources Board (ARB)
 - 2013 Emission Levels

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

- On-Board Diagnostics (OBD-D)

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

- 5349
- 5479

EPA Product

This engine has the following Agency defined Emissions Control System (ECS) 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.

(/qs3/pubsys2/xml/en/procedures/564/564-100-001.html)

- 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 Head
- Camshaft Followers/Tappets
 - Roller Followers/Tappets
- Primary Gear Train Location
 - Front of the Engine
- Engine Balancer Option
 - External
- Engine Braking
 - Compression Brake Option
- Accessory Drive Option
- Crankcase Ventilation System
 - Open

Fuel System

- Diesel
- Common Rail Fuel System
 - Cummins® XPI Common Rail Fuel System
- Fuel Lift Pump
 - Electric
 - 12 VDC

Cooling System

- Cooling System Heater Option
 - 120 VAC

Air Handling

- Turbocharger (Single)
 - Variable Geometry
 - Sliding Nozzle Design
- Charge Air Cooler
- 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
- Aftertreatment Diesel Exhaust Fluid (DEF) Dosing System
 - Airless Diesel Exhaust Fluid Dosing Unit

Electrical Equipment

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

Electronic Control System

- Engine Control Module (Single)
 - Control Module: CM2450
- ECM Supply Voltage
 - 12 VDC
- Engine Coolant Level Sensor
- Engine Coolant Temperature Sensor
- Engine Oil Pressure Sensor
- Engine Oil Temperature Sensor
- Crankcase Pressure Sensor
- Camshaft Position Sensor
- Crankshaft Position Sensor
- Fuel Rail Pressure Sensor
- Fuel Pump Actuator
- Water in Fuel Sensor
- EGR Differential Pressure Sensor
- Exhaust Gas Pressure Sensor
- EGR Temperature Sensor
- Intake Manifold Pressure/Temperature Sensor
- Turbocharger Speed Sensor
- Turbocharger Compressor Intake Temperature Sensor
- Ambient Air Pressure 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
- Fire Truck

-
- Recreational Vehicle

Last Modified: 09-Sep-2020

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

General Information

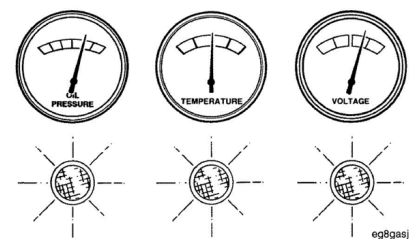
Correct care of your engine will result in longer life, better performance, and more economical operation.

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.

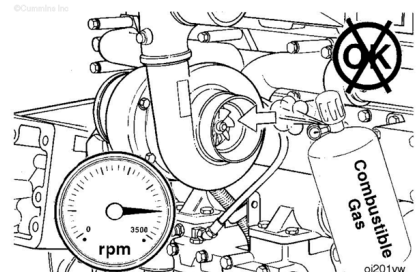
Check the oil pressure indicators, temperature indicators, warning lights, and other gauges daily to verify operation.

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 combustable 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.

Last Modified: 20-Jul-2023

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

General Information

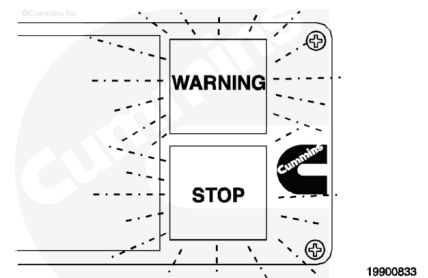
The STOP or STOP ENGINE lamp is red and indicates the need to stop the engine as soon as safely done. The engine **must** then remain shut down until repaired.

The WARNING or CHECK ENGINE lamp is yellow. When the check engine lamp illuminates, the engine is in need of repair at the first available opportunity.

The yellow lamp will flash for 30 seconds at keyswitch ON when one of the following occurs:

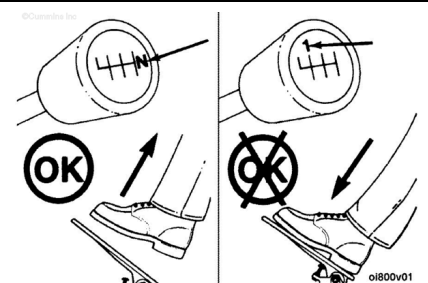
- Maintenance required (if Maintenance Monitor is enabled)
- Water-in-fuel is detected
- Low coolant level.

If the warning light flashes for 30 seconds at keyswitch ON and water is drained from the suction side water-separating fuel filter, the pressure side fuel filter **must** be replaced.



⚠ CAUTION ⚠

Do not depress the accelerator pedal or move the accelerator lever from the idle position while cranking the engine. This movement can result in engine overspeed and severe damage to the engine.



⚠ CAUTION ⚠

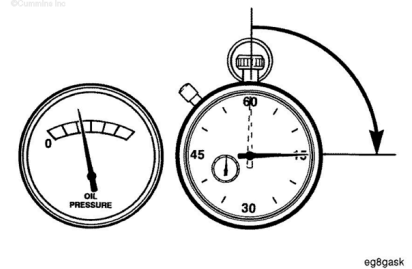
To prevent damage to the starting motor, do not engage the starting motor for more than 30 seconds. Wait 2 minutes between each attempt to start (electrical starting motors only).

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

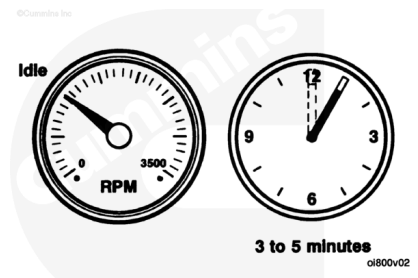
- Disengage the driven unit, or if equipped, put the transmission in neutral.
- With the accelerator pedal or lever in the idle position, turn the keyswitch to the ON position, then turn the keyswitch to the START position.
- If the engine does **not** start after three attempts, check the fuel supply system. Absence of blue or white exhaust smoke during cranking indicates no fuel is being delivered.

⚠ CAUTION ⚠

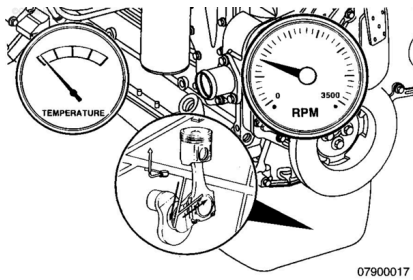
The engine must have adequate oil pressure within 15 seconds after starting. If the warning lamp indicating low oil pressure has not gone out or no oil pressure is indicated on a gauge within 15 seconds, shut OFF the engine immediately to reduce the possibility of engine damage. The low oil pressure troubleshooting procedure is located in Troubleshooting Symptoms (Section TS).



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



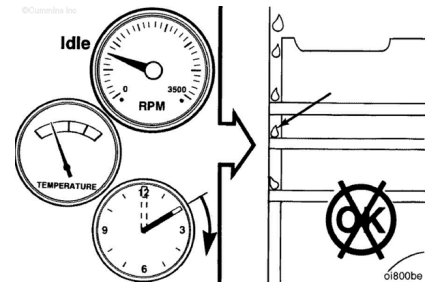
After starting a cold engine, increase the engine speed (rpm) slowly to provide adequate lubrication to the bearings and to allow the oil pressure to stabilize.



⚠ CAUTION ⚠

Do not operate engine at low idle for long periods with engine coolant temperature below the minimum specification in Coolant Recommendations and Specifications (Section V). Low coolant temperature can result in:

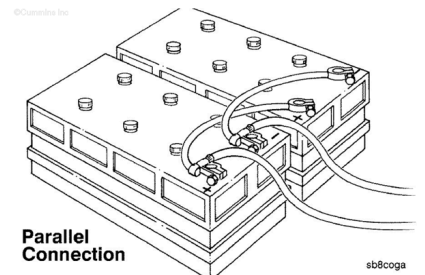
- Fuel dilution of the lubricating oil
- Carbon buildup in the cylinder
- Cylinder head valve sticking
- Reduced performance.



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 ⚠

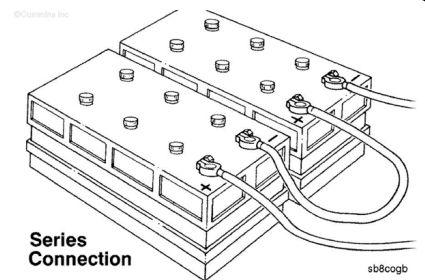
When using jumper cables to start the engine, connect the cables in parallel: Positive (+) to positive (+) and negative (-) to negative (-). When using an external electrical source to start the engine, turn the disconnect switch to the OFF position. Remove the key before attaching the jumper cables.

⚠ CAUTION ⚠

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

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

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



Last Modified: 11-Sep-2023

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

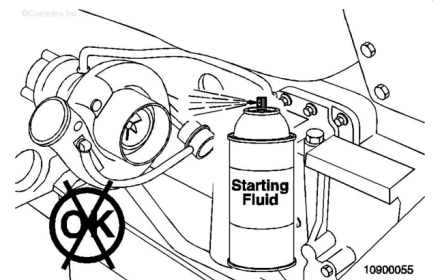
Trainings ▾

General Information

Follow the Normal Starting Procedure in this section. In cold weather, the engine can run longer at idle but **only** until the minimum specified oil pressure is detected by the engine control module (ECM).

Using Starting Aids

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



Last Modified: 14-Oct-2016

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

General Information

Follow the Normal Starting Procedure in this section. The engine will run at idle **only** until the minimum specified oil pressure is detected by the engine control module (ECM).

Last Modified: 14-Oct-2016

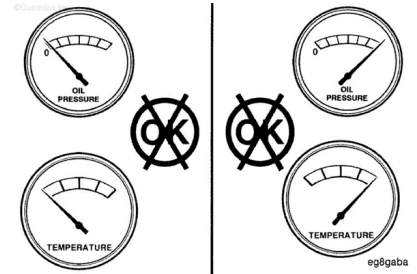
(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

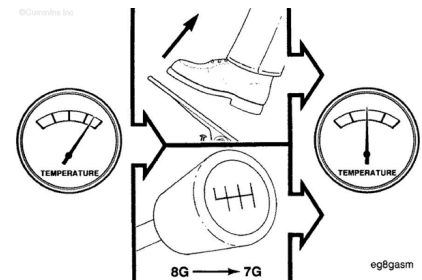
Normal

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).

Last Modified: 10-Jul-2023

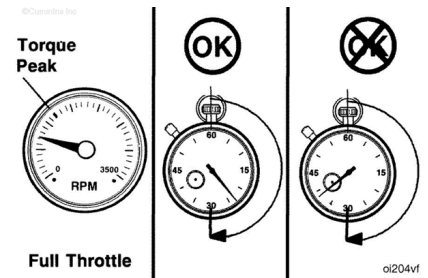
(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

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.



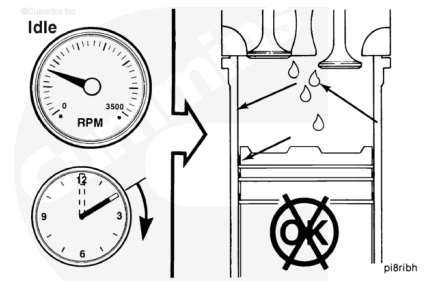
⚠ CAUTION ⚠

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.



Last Modified: 11-Feb-2025

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

General Information

⚠ CAUTION ⚠

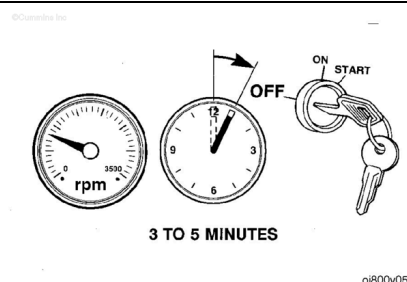
Failure to follow the correct shutdown procedure can result in damage to power cylinder components and the turbocharger, if equipped, and shorten the turbocharger life.

For engines with shielded exhaust manifold and turbochargers, allow the engine(s) to idle for 10 to 12 minutes before shutting off after full load operation.

Otherwise, allow the engine(s) to idle 3 to 5 minutes before shutting off after full load operation. This process allows the cool down of pistons, cylinders, bearings and turbocharger components.

For engines equipped with an engine control module (ECM), turn the keyswitch off for a minimum of 100 seconds before attempting to restart the engine or attempting to disconnect the continuous (unswitched) battery power supply. If 100 seconds have **not** passed, corruption to ECM information, fault codes and internal engine damage can occur.

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



Last Modified: 23-Apr-2025

(/qs3/pubsys2/xml/en/manual/5504581/5504581-titlepage.html)

Trainings ▾

General Information

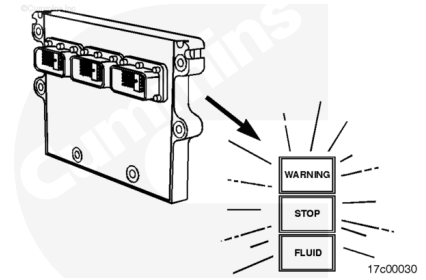
The engine control system is an electronically operated fuel control system that also provides many operator and vehicle or equipment features. The base functions of the control system include fueling and timing control, limiting the engine speed operating range between the low- and high-idle set points, 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.

⚠ 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.



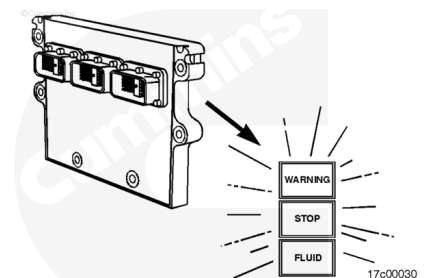
The engines are equipped with an engine protection system. The system monitors critical engine temperatures and pressures and will log diagnostic faults when an over or under normal operation condition occurs. If an out-of-range condition exists and engine derate action is to be initiated, the operator 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 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

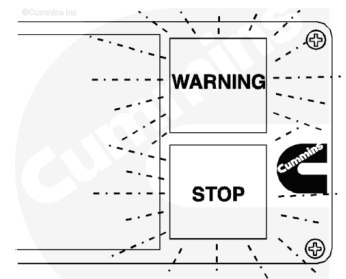
to worsen. When the red STOP lamp is illuminated, the driver **must** pull to the side of the work area, when it is safe to do so, to reduce the possibility of engine damage.

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.

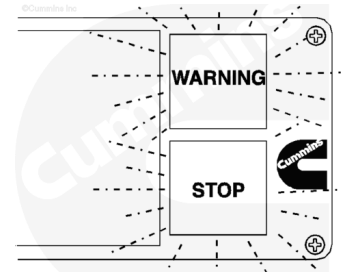
The red STOP lamp in the cab will flash for 30 seconds prior to shutdown to alert the driver.



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.

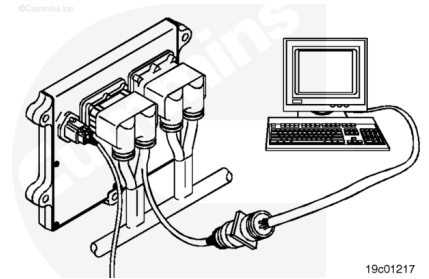
If the vehicle is **not** equipped with a clutch switch, then the OEM will provide a dash-mounted switch marked as the ENGINE PROTECTION SHUTDOWN OVERRIDE switch. When the operator triggers this switch while the red lamp is flashing, a timer within the ECM will reset and allow the engine to run for an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

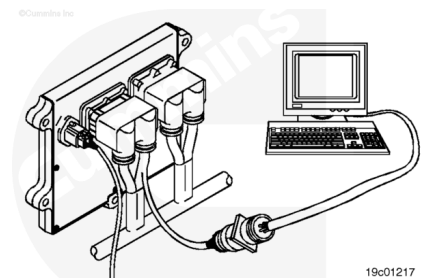
This data makes up additional fault code information that can be obtained by using an electronic service tool.

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 recreate 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.



Last Modified: 07-Aug-2020

Trainings ▾

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.

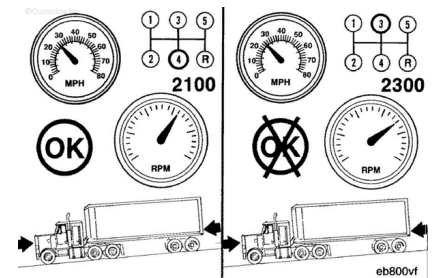
Last Modified: 13-Feb-2023

Trainings ▾

General Information

⚠ CAUTION ⚠

Do not exceed governed engine speed when operating engine brakes. Engine damage can occur. The engine brakes are designed to assist the vehicle's service brakes to slow the vehicle down. Never use only the engine brakes to stop the vehicle. If other engine brakes are used, refer to the component manufacturer's manual.

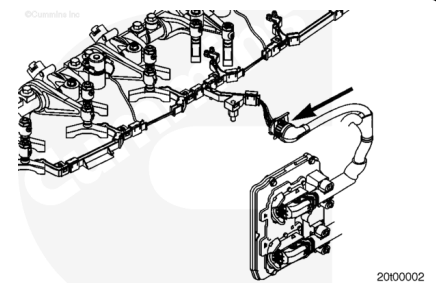


Engines in this family are equipped with engine brakes.

Engine brakes are devices that use the energy of engine compression to provide vehicle retardation. Engine brakes provide the maximum retarding power at rated speed; gear selection, therefore is important.

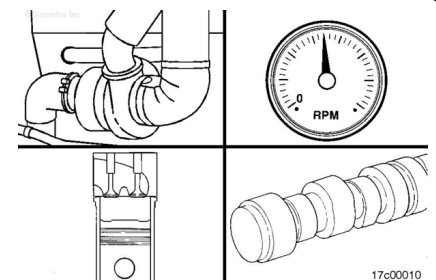
The engine brakes temporarily convert the engine to an energy-absorbing device to reduce vehicle speed. This is accomplished through the use of a hydraulic circuit that opens the exhaust valves near the end of the compression stroke.

This engine family uses the added benefit of the variable geometry turbocharger to assist in engine braking.



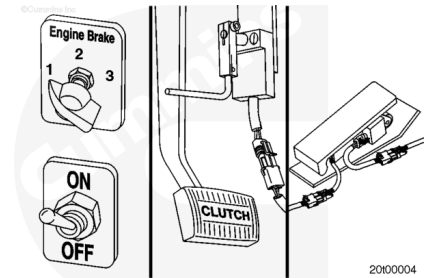
The amount of braking power available in a given engine series varies. Braking power depends on turbocharger boost pressure, engine speed, compression ratio, injector timing, and when the engine brakes open the exhaust valves.

This engine family uses the added benefit of the variable geometry turbocharger to assist in engine braking.



Engine brake controls consist of the following:

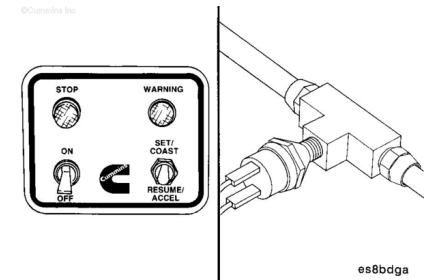
- A three-position selector switch.
- An ON/OFF switch.
- A clutch switch.
- A throttle sensor.
- A service brake pressure switch.



20100004

Other switches for cruise control that affect engine brake operations are:

- Cruise control ON/OFF and SET/RESUME switches, if the Engine Brake In Cruise Control feature is turned OFF.
- Service brake air pressure switch.



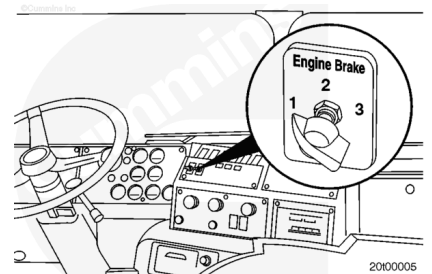
es8bdga

Engine brakes can operate while cruise control is turned on. The electronic feature, Fan Control Engine Braking, can be enabled to turn the fan on during engine braking. This increases the parasitic load on the engine during braking. Reference the Programmable Features in this section.

The selector switch is located in the cab, and allows the selection of the retarding power.

Engine Brake Level Specifications

- Position Number 1 = 33-percent engine braking power
- Position Number 2 = 67-percent engine braking power
- Position Number 3 = 100-percent engine braking power.

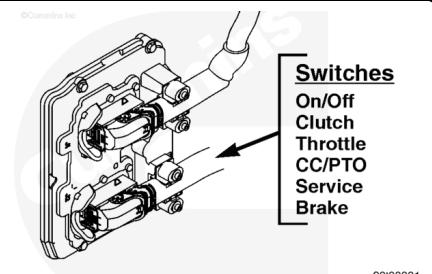


20100005

For engines in this family, the engine brake select switch does **not** always directly correlate to the number of engine brake solenoids that are activated. This is due to the added use of the variable geometry turbocharger to assist in engine braking, and the use of **only** two engine brake solenoids.

Note : Any one of these switches can deactivate the engine brakes.

Signals from the ON/OFF switch, the clutch switch, the throttle sensor, the cruise control/PTO switches, or both, are fed into the engine control module.

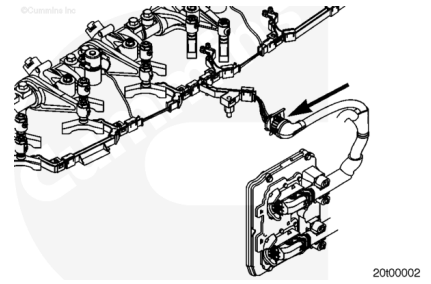


20100001

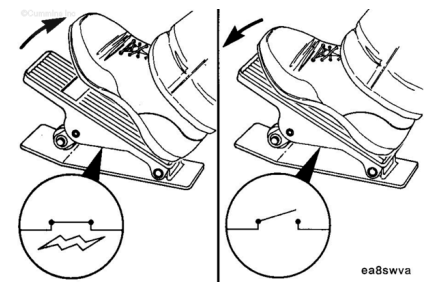
The ECM then electronically enables or disables the engine brakes.

Engine brakes can **not** be enabled:

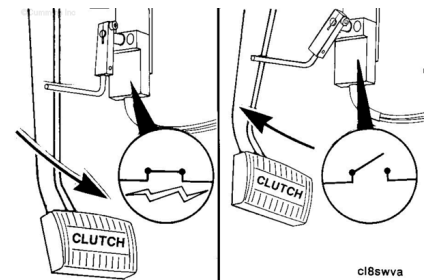
- When cruise control is active, if the Engine Brake In Cruise Control feature is turned OFF.
- When engine speed goes below 850 rpm or below the engine brake control minimum vehicle speed parameter.
- When an electronic fault code is active.



The throttle position sensor is part of the accelerator pedal assembly located in the cab and will deactivate the engine brakes when depressed.



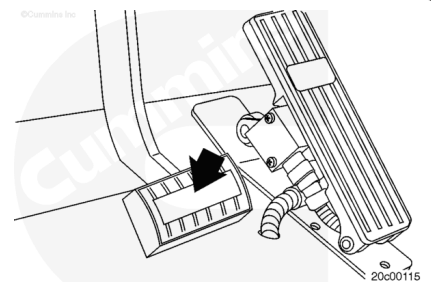
The clutch switch uses the motion of the clutch linkage to deactivate the engine brakes when the clutch pedal is depressed.



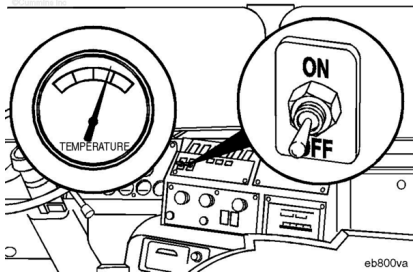
The service brake pressure switch is attached to the service brake air supply line.

Applying the service brakes while in cruise control will disengage the cruise control and enable the engine brakes.

If the Pedal-Activated Engine Brake feature is enabled, the service brake pedal **must** be tapped before the engine brakes will be activated.



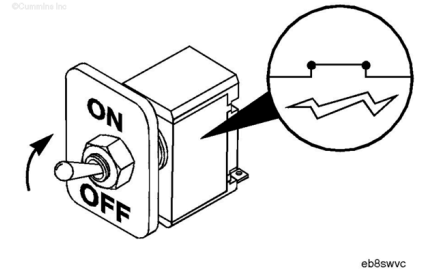
Idle the engine 3 to 5 minutes at approximately 1000 rpm to warm the engine before activating the engine brakes. Do **not** operate the engine brake until the engine oil temperature is above 30°C [86°F].



To activate the engine brakes, switch the ON/OFF switch to the ON position. Once activated, the operation of the engine brake is fully automatic.

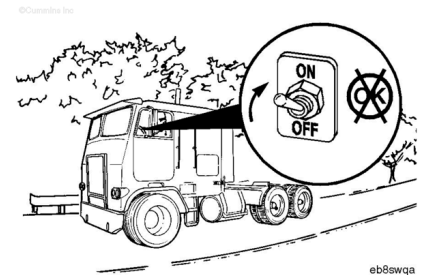
Note : See the “Tips for Operation” in this section for specific information about engine brake operation under certain road conditions.

Note : Some vehicles have an additional pedal that must be pressed for the engine brakes to activate. It is not fully automatic.



⚠ WARNING ⚠

Do not use the engine brakes while bobtailing or pulling an empty trailer. With the engine brakes in operation, wheel lockup can occur more quickly when the service brakes are applied, especially on vehicles with single-drive axles.

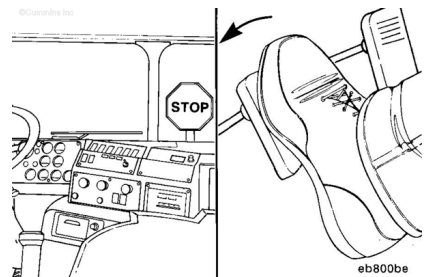


Make sure the engine brakes are switched to the OFF position when bobtailing or pulling an empty trailer.

⚠ CAUTION ⚠

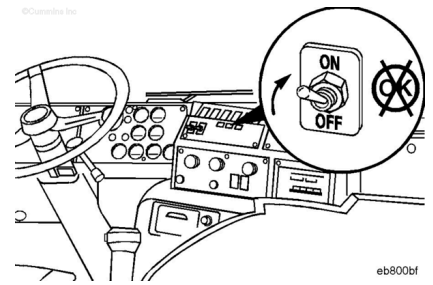
The engine brakes are designed to assist the vehicle's service brakes in slowing the vehicle to a stop.

Remember, service brakes will be required to bring the vehicle to a stop.

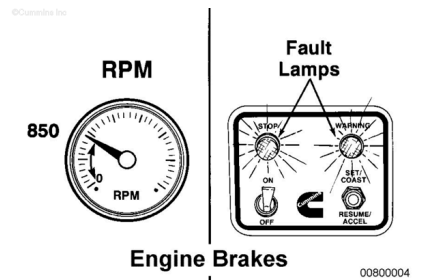


⚠ CAUTION ⚠

Do not use the engine brakes to aid clutchless gear shifting. This can cause the engine to stall or lead to engine damage.



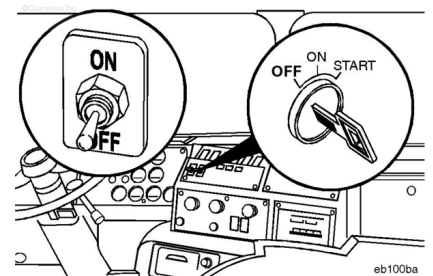
The ECM will disable the engine brakes when the engine rpm is below 850 rpm or below the Engine Brake Control Minimum Vehicle Speed parameter when an electronic fault code is active.



⚠ CAUTION ⚠

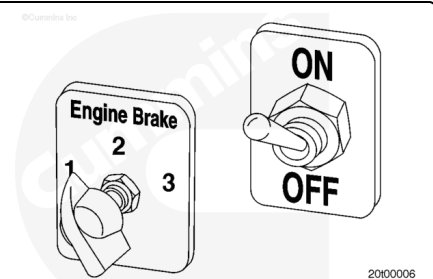
Do not operate the engine if the engine brake will not deactivate. To do so will cause severe engine damage.

If the engine brakes will **not** shut off, immediately shut off the engine and see equipment manufacturer service information.



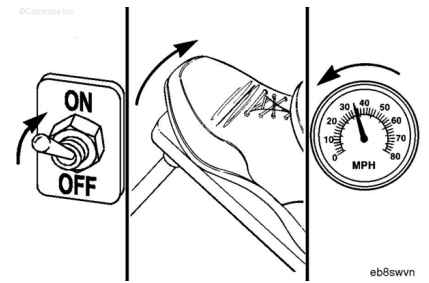
Tips for Operation on Level and Dry Pavement

For operating on dry and relatively flat surfaces when greater retarding power is **not** required, put the position selector switch in a lower position

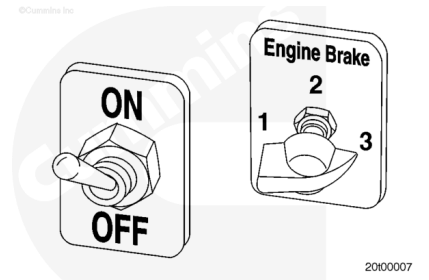


To reduce vehicle speed, put the engine brake ON/OFF switch in the ON position. Remove your foot from the accelerator pedal and clutch pedal. The engine brakes will immediately

begin to operate, slowing the vehicle.



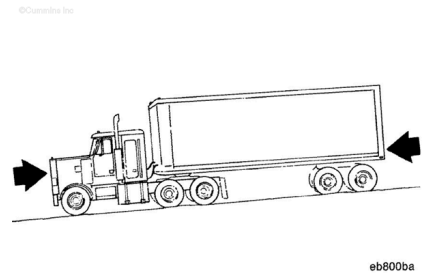
For operation on dry pavement when maximum retarding power is required, put the position selector switch in the highest position.



Tips for Operation on Grades with Dry Pavement

⚠ 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.



Note : Always be prepared to use the vehicle service brakes for emergency stopping.

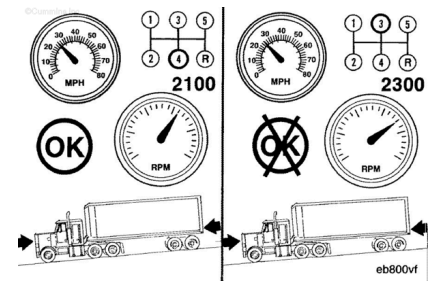
Vehicles equipped with properly operated engine brakes are capable of traveling downhill at slightly higher control speeds than vehicles **not** equipped with engine brakes.

⚠ CAUTION ⚠

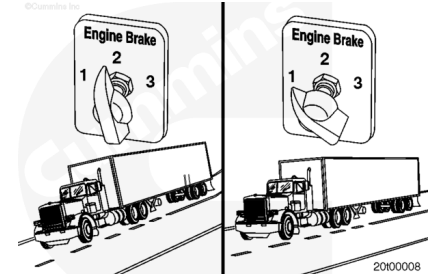
Never exceed governed engine speed as engine damage can occur.

Note : The optimum braking power of engine brakes is reached at rated engine speed. Correct gear selection, therefore, is critical.

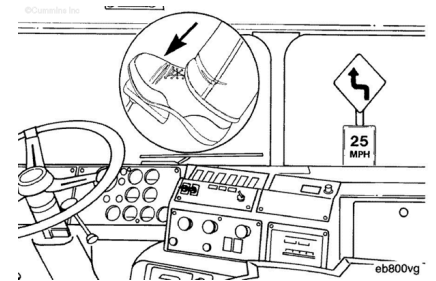
Once you have determined the safe speed for your vehicle, operate the engine brakes with the transmission in the lowest gear that will **not** cause the engine speed to exceed the rated engine speed.



The position selector switch can be used to vary braking power as road conditions change.

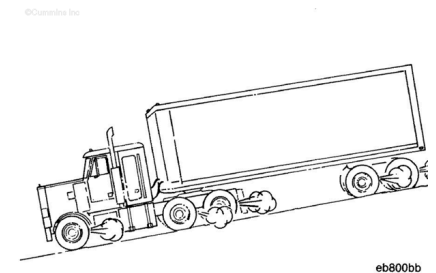


Vehicle service brakes **must** be used when additional braking power is required.



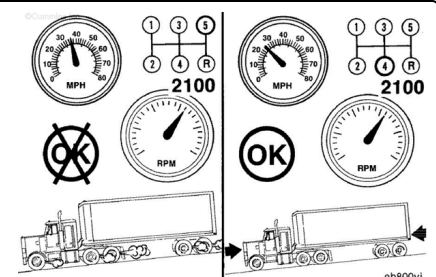
⚠ CAUTION ⚠

Frequent use of the service brakes will cause them to heat up, which reduces the ability to slow or stop the vehicle.



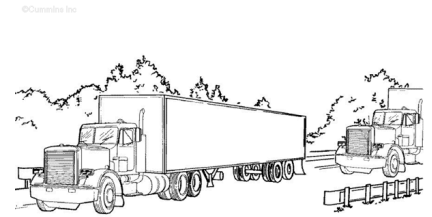
Note : The longer or steeper the hill, the more important it is to use the engine brakes. Make maximum use of the engine brakes by gearing down and letting the engine brakes do the work.

If frequent use of the vehicle service brakes is required, it is recommended that a slower control speed be used by selecting a lower transmission gear.



Tips for Operation on Slick Roads

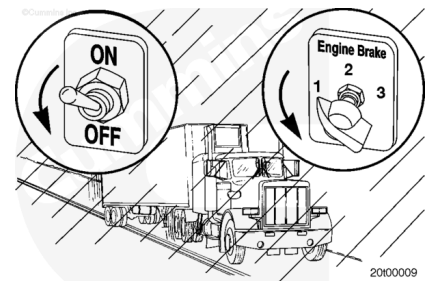
The operation of any vehicle is difficult to predict on slick roads. The first 10 to 15 minutes of rainfall are the most dangerous, as road dirt and oil mixed with rain create a very slippery surface.



eb800bc

⚠ WARNING ⚠

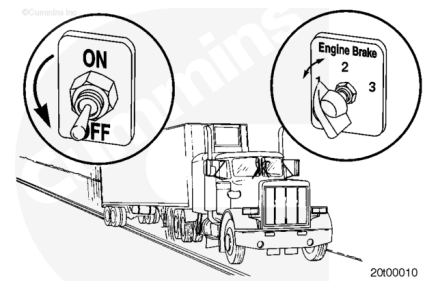
To reduce the possibility of personal injury or property damage, reduce the retarding power or turn "OFF" the engine brakes on slick roads. Using engine brakes on wet or slippery roads can cause over braking, especially on vehicles with light loads or single-drive axles. Stopping distance can actually increase, or the vehicle can skid or jackknife.



20100009

When driving on slick roads, start with the ON/OFF switch in the OFF position and the position selector switch in the LOW position.

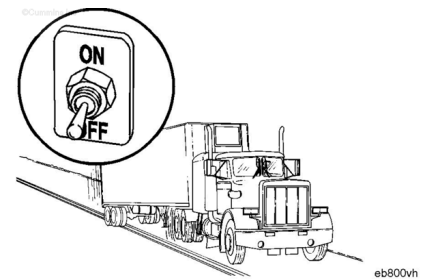
If the tractor is equipped with a twin-screw rear axle, use the power divider in the UNLOCKED position.



20100010

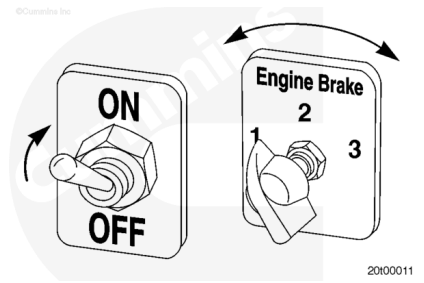
Remove your foot from the accelerator pedal to make sure that the vehicle will maintain traction with the retarding power of the engine alone.

If the vehicle drive wheels begin to skid or there is a fishtailing motion, do **not** activate the engine brakes.

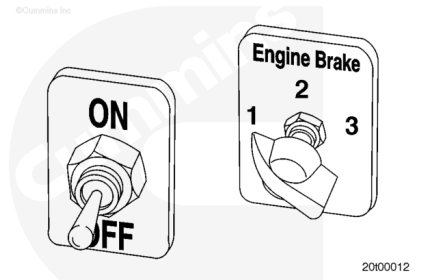


eb800vh

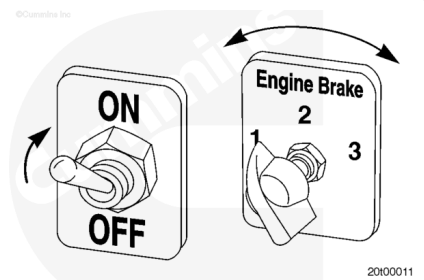
If traction is maintained using the retarding power of the engine alone, and more braking power is required, switch the position selector switch to the lowest position and activate the engine brakes by switching the on/off switch to the ON position.



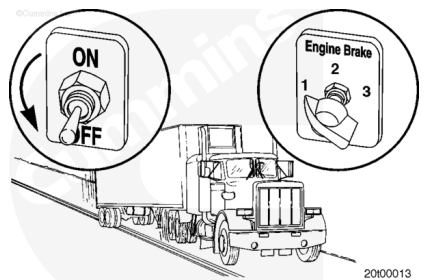
If the vehicle's drive wheels begin to skid or there is a fishtailing motion, switch the ON/OFF switch to the OFF position.



If traction is maintained when the engine brakes are activated and more braking power is required, move the two-position selector switch to the highest position.



Again, if the vehicle has lost traction or there is a fishtailing motion, switch the ON/OFF switch to the OFF position. Do **not** attempt to use the engine brakes in the higher position.



Last Modified: 18-Mar-2019

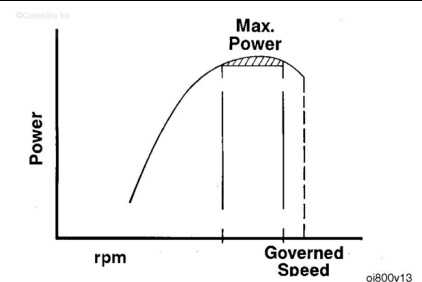
Trainings ▾

General Information

The engine produces maximum power at an rpm less than governed engine speed.

To obtain optimum engine performance on a grade, allow the engine speed to load down to near peak torque before shifting. This operation will result in an engine operating speed in the maximum power zone after the shift is completed.

Refer to the engine dataplate for peak torque rpm and governed speed rpm.



Last Modified: 10-Jul-2023

Trainings ▾

Variable Geometry Turbocharger

The variable geometry turbocharger (VGT) is used to create back pressure in the exhaust system to aid in the exhaust gas recirculation (EGR) flow. Non-EGR engines typically utilize wastegated turbochargers that minimize the amount of exhaust manifold back pressure in the exhaust manifold, but do **not** use all of the exhaust gas flowing through the turbocharger. The design of the VGT helps create the back pressure needed for EGR flow and still control boost pressure, since there is no exhaust gas being wastegated around the turbine wheel.

What to expect with variable geometry turbocharged engines:

1. Turbocharger boost can fluctuate depending on speed, load, and desired EGR flow.
 - Boost will peak briefly at a snap throttle and return to a lower boost setting at the same throttle position and engine load. The control system aids in throttle response and by design, will overshoot its boost needs rather than undershoot.
 - Boost can also increase when you let off the throttle, as the control system closes down the variable geometry in anticipation of the next on throttle event.
 - When the engine is at a constant speed and experiences no load change, boost can still fluctuate as EGR flow demand is changed by the control system.
2. Boost pressure can vary day to day.
 - Boost pressures can vary depending on power requirements, EGR flow requirements, and ambient conditions. Because the control system can closely control the turbocharger the engine **only** gets the boost pressure it needs. For example: The driver can notice boost pressures of around 172 kPa [25 psi] while pulling a hill at 72 kph [45 mph] during the summer with a certain EGR flow. However, in winter conditions the boost pressure can be 138 kPa [20 psi] as EGR demands can change and boost pressure needs **not** be as great.
3. Turbocharger may whistle loudly in certain normal engine operating conditions.
 - The turbocharger may whistle loudly periodically when the engine control module (ECM) requests more exhaust heat for aftertreatment regeneration purposes. This turbocharger whistle has been described as sounding like a boost leak. Read the following procedure for further information regarding VGT and aftertreatment system interactions. Refer to Procedure 101-047 in Section 1.
(/qs3/pubsys2/xml/en/procedures/564/564-101-047.html)

Engine Cooling

Because of changes to the cooling system as required by the addition of the EGR system, the engine cooling system characteristics will be different from that of a non-EGR engine.

1. The engine can run cooler at cold ambient air temperatures.
 - Due to more coolant flow from the water pump and more capable cooling packages provided by the OEM, there will be more coolant flow going through the engine. Due to the design changes, when operating in colder ambient temperatures, the engine coolant can average 83°C [180°F]. The engine is designed to run efficiently at lower coolant temperatures. Thermostats **must not** be replaced because the engine will **not** run constantly at 82°C [180°F]. Additional control of coolant temperatures can still be accomplished by using winter fronts, same as today's engines.
 - Engines can run hotter at hot ambient air temperatures. Due to added heat rejection from cooling the EGR valve, EGR cooler, and VGT, the engine has been designed to operate at higher coolant temperatures. It is **not** abnormal to see coolant temperatures between 82°C to 107°C [180°F to 225°F] while operating in hotter ambient temperatures. Coolant fans will engage when the coolant temperature reaches 99°C [210°F]. Engine protection for coolant temperature will begin at 107°C [225°F].
 - Thermostat opening is **not** noticeable when monitoring coolant temperatures. Due to decreasing the number of coolant thermostats from two to one on the EGR engine, it is no longer noticeable when the thermostat opens. A gradual climb in coolant temperature occurs as the thermostat opens, compared to the slight decrease and eventual stabilization of temperature seen on engines when the dual thermostats are utilized.
 - With the addition of the cooled EGR system, the under hood temperature has increased by approximately 7°C [20°F] compared to a non-EGR engine.

Performance/Driveability

With the addition of the EGR system to the engine, some of the characteristics of the engine are different from that of a non-EGR engine.

- It is normal to see boost pressure fluctuate while the engine brakes are activated. To take full advantage of the increased braking power provided by the addition of the VGT, the engine brake selector switch level chosen will **not** necessarily activate the same number of engine brakes as a non-EGR engine. The ECM controls the number of engine cylinders that are activated for braking and the VGT will be positioned to meet the desired braking horsepower.

The variable geometry turbocharger will adjust in order to meet the power requirements depending on the engine brake position switch. More braking power correlates to a more closed VGT position, more cylinders braking, or both.

Shifting Techniques

Drivers have experienced a change in shifting techniques with EGR engines. With the VGT improving boost response, the engine speed will decelerate and accelerate quicker than a non-EGR. The additional back pressure on the engine during out of gear, no throttle conditions causes the engine speed to drop quickly. The ability of the VGT to spool up quickly causes quicker engine speed acceleration during out of gear, no throttle conditions. Drivers have characterized this as a more sensitive throttle pedal, meaning small pedal movements create large engine speed changes.

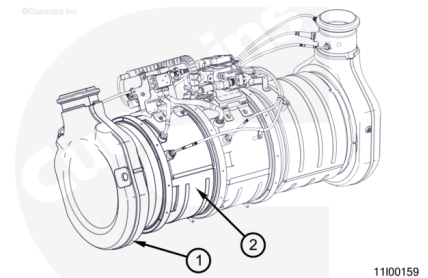
Last Modified: 18-Mar-2019

Trainings ▾

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 Specialist (CDS) <https://cleandieselspecialists.com/>
(<https://cleandieselspecialists.com/>)
 - Emission Cooling Solutions (ECS).<https://www.ecspart.com/>
(<https://www.ecspart.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.ecspart.com/>
(<https://www.ecspart.com/>)
 - Ceramex North America works primarily with dealers and fleets and can clean DPFs at its centralized location in Springfield, MO. <https://ceramexnorthamerica.com/>
(<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>
(<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 DPF. The third additional indicator lamp indicates the position of the Regeneration Permit switch.

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 : The blending of fuel with new or used engine lubricating oil or other oils is not permitted on equipment using an aftertreatment DPF.

Some engines contain an engine control module (ECM) calibration feature, Aftertreatment Warm-Up, which activates automatically during periods of extended idle to remove water and hydrocarbon accumulations from the aftertreatment system.

The Aftertreatment Warm-Up feature is different from Active or Manual (Non-Mission) Regeneration, as it operates at a lower engine speed (RPM) and does **not** require aftertreatment fuel injection, because of lower aftertreatment system temperature requirements.

The ECM will automatically increase the engine speed to 760 RPM for approximately 15 to 20 minutes, if the ECM detects all of the conditions below have been met:

- More than 4 continuous idle hours with exhaust temperature <110 °C [230 °F] or
- More than 8 continuous idle hours with exhaust temperature <250 °C [482 °F]
- The clutch pedal is released
- The brake pedal is released
- The transmission is in neutral or park
- PTO or Remote PTO is turned OFF
- The vehicle speed is 0 mph
- The accelerator pedal is released.

The Aftertreatment Warm-Up feature can **not** be disabled by activating the active regeneration permit switch, if equipped, because the feature does **not** use aftertreatment fuel injection.

Increasing the temperature of the exhaust gas that enters the aftertreatment system to above 250°C [482°F] for approximately 15 to 20 minutes allows the Aftertreatment Warm-Up feature to deactivate. This can be done by allowing the engine to operate in this condition for approximately 15 to 20 minutes, or by driving the vehicle.

Note : The engine speed will **not** be changed during power take-off (PTO) or remote PTO operation.

Note : The Aftertreatment Warm-Up feature can **not** be disabled or adjusted with the recommended Cummins® electronic service tool or equivalent.

Regeneration

Overview

Regeneration is the process of converting the soot collected in the aftertreatment DPF into carbon dioxide.

The regeneration process requires heat to occur, and can be classified into two different types: passive regeneration and active regeneration.

Passive Regeneration

Passive regeneration occurs when the exhaust temperatures are naturally high enough to oxidize the soot collected in the aftertreatment DPF faster than the soot is being collected.

Passive regeneration typically occurs when the vehicle is driven at high speeds (ie, highway speeds) and/or under heavy loads.

Active Regeneration

Active regeneration occurs when the exhaust temperatures are **not** naturally high enough to oxidize the soot collected in the aftertreatment DPF faster than it is being collected.

Active regeneration requires assistance from the engine in order to increase the exhaust temperature. This is typically accomplished by the engine injecting a small amount of diesel fuel into the exhaust stream, which is then oxidized by the aftertreatment DOC. This creates the heat needed to regenerate the aftertreatment DPF.

Active regeneration will occur more frequently in vehicles with low speed, low load, or stop-and-go duty cycles.

Active regeneration **only** occurs if the engine control module has detected that the aftertreatment DPF restriction has reached a specified limit, and may **only** occur if the vehicle is moving above a speed threshold. The engine control module will activate and de-activate active regeneration as needed.

The speed threshold for active regeneration to occur is dictated by the vehicle manufacturer, and can be set at vehicle speeds from 8 to 40 km/hr [5 to 25 mph].

Active regeneration can occur any time the vehicle speed is above the speed threshold.

Use the vehicle owner's manual for information about the speed threshold for active regeneration used for a specific vehicle.

WARNING

If the vehicle is not equipped with a High Exhaust System Temperature Lamp, follow these precautions for active regeneration whenever the vehicle is running and the vehicle slows or comes to a stop. Active regeneration can occur any time the vehicle is moving, and the exhaust temperature can remain hot after the vehicle has stopped moving. The exhaust temperature could reach 816°C [1500°F], which is hot enough to ignite or melt common materials, or to burn people.

Active regeneration is largely transparent to the vehicle operator. The vehicle operator may notice an increase in turbocharger noise during an active regeneration event, and may notice that the high exhaust temperature lamp is illuminated, if the exhaust temperature is greater than the high exhaust system temperature threshold set by the original equipment manufacturer (OEM).

During active regeneration, the exhaust temperature can be higher than when the engine is operating at full load. The exhaust temperature during a normal active regeneration event could reach 593°C [1100°F], and possibly 816°C [1500°F] under certain conditions.

Manual (Non-Mission) Regeneration

WARNING

During regeneration, exhaust gas temperature could reach 816°C [1500°F], and exhaust system surface temperature could exceed 740°C [1300°F], which is hot enough to ignite or melt common materials, and to burn people. Engine speed will increase and could possibly reach between 1000 to 1500 RPM. Follow these instructions to avoid the risk of fire, property damage, burns, or other serious personal injury.

Manual (non-mission) regeneration is a form of active regeneration that is initiated by the vehicle operator when the vehicle is **not** moving.

Manual (non-mission) regeneration requires an elevated engine speed of approximately 1000 to 1400 RPM. The length of a manual (non-mission) regeneration will vary, depending on how full the aftertreatment DPF is, but will typically take anywhere from 45 minutes to 1.5 hours to complete.

A manual (non-mission) regeneration can be initiated in one of two ways:

1. A vehicle mounted manual (non-mission) regeneration switch. Use the vehicle owners manual for the location and operation of this switch, if so equipped (this switch may also be called a "parked regeneration" switch or "start" switch). The vehicle mounted manual (non-mission) regeneration switch will only initiate a manual (non-mission) regeneration when the aftertreatment DPF lamp is illuminated.
2. The electronic service tool can initiate a manual (non-mission) regeneration by starting the "Aftertreatment Diesel Particulate Filter Regeneration Test".

To perform a manual (non-mission) regeneration, follow the steps listed:

- Select an appropriate location to park the vehicle.
 - Preferably on a surface that will **not** burn or melt under high exhaust temperatures (such as clean concrete or gravel, **not** grass or asphalt).
- Park the vehicle away from anything that can burn, melt, or explode.
 - Be sure there are no items within 61 cm [2 ft] of the exhaust outlet.
 - Items that can burn, melt, or explode **must** be kept at least 152 cm [5 ft] from the exhaust outlet (such as gasoline, paper, plastics, fabrics, compressed gas containers, or hydraulic lines).
 - Be sure that there are no gases or vapors nearby that could burn, explode, or contribute to a fire (such as LP gas, gasoline vapors, oxygen, or nitrous oxide).
- Park the vehicle securely. Place the transmission in park, if provided, otherwise in neutral. Set wheel chocks at the front and rear of at least one tire.
- Set up a safe exhaust area. If bystanders might enter the area, set up barriers to keep people at least 152 cm [5 ft] from the exhaust outlet during the manual (non-mission) regeneration.

When indoors, attach an exhaust discharge pipe rated for at least 816°C [1500°F].

- Keep a fire extinguisher nearby.
- Check the exhaust system surfaces. Confirm that nothing is on or near the exhaust system surfaces (such as tools, rags, grease, or debris).
- Verify the following conditions are met in the vehicle:
 - The clutch pedal is released.
 - The brake pedal is released.
 - The transmission is in neutral or park.
 - Power Take-Off (PTO) or Remote PTO is off.
 - The vehicle speed is 0 MPH.
 - The throttle pedal is released.
- Initiate the manual (non-mission) regeneration by toggling the vehicle mounted manual (non-mission) regeneration switch or by using the electronic service tool.
 - Once the manual (non-mission) regeneration is initiated, the engine speed will increase, and turbocharger noise will increase.
 - The High Exhaust System Temperature Lamp, if equipped, may illuminate during the manual (non-mission) regeneration as the exhaust temperatures increase.
 - When the engine control module detects that the aftertreatment DPF has been regenerated, the engine will automatically return to normal idle speed.
- Monitor the vehicle and surrounding area during the manual (non-mission) regeneration. If any unsafe condition occurs, shut off the engine immediately.

Once the manual (non-mission) regeneration is complete, exhaust gas and surface temperatures will remain elevated for 3 to 5 minutes.

Some engines contain an ECM calibration feature, Aftertreatment Idle-Up, that activates automatically and is used to control the aftertreatment system temperature. This feature will maintain an elevated low idle speed, approximately 760 rpm, when an aftertreatment regeneration, active or manual, completes or is cancelled by:

1. Depressing the accelerator, clutch, or service brake pedal
2. Activating the aftertreatment regeneration inhibit switch or
3. Activating another engine feature that may interact with the regeneration, such as remote throttle or PTO.

Note : The Aftertreatment Idle-Up feature can not be disabled or adjusted with the electronic service tool.

Aftertreatment Switches

The vehicle manufacturer may choose to equip the vehicle with up to two switches that interact with the aftertreatment system:

- A manual (non-mission) regeneration switch (can also be called a "START" switch or "PARKED REGENERATION" switch).
- An active regeneration permit switch (can also be called an "INHIBIT" switch, "DISABLE" switch, or "STOP" switch)

Both of these switches are optional. Please reference the vehicle owners manual for the location and presence of these switches.

The manual (non-mission) regeneration switch is used to initiate a manual (non-mission) regeneration. Please reference the "Stationary (Parked) Regeneration" section of this procedure for further instructions.

The active regeneration permit switch is used to disable active regeneration of the aftertreatment.

The permit switch **must only** be used for special circumstances where it is desirable to **not** allow an active regeneration event. Prolonged engine operation with this switch engaged may result in illumination of the aftertreatment diesel particulate lamp, as the aftertreatment DPF will continue to accumulate soot as the engine operates.

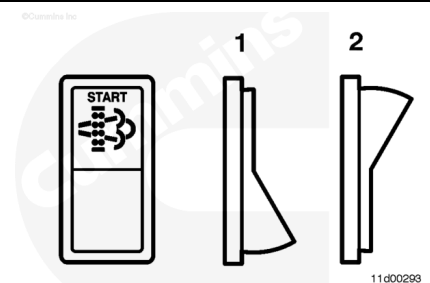
The aftertreatment switches are typically used in two configurations:

1. A two-position switch that is used to activate manual (non-mission) regeneration.
2. A three-position switch that is used to activate manual (non-mission) regeneration and also disable active regeneration.

The examples below are generic and show two typical switch configurations. Use the vehicle owner's manual for the location and presence of these switches.

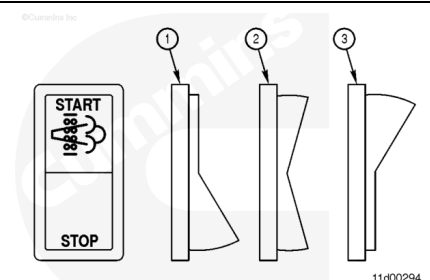
A two-position switch (ON and OFF positions) will, when in the "ON" position (1), activate a manual (non-mission) regeneration.

The switch should be left in the "OFF" position (2) when the switch is **not** being used.



A three-position switch (ON, NEUTRAL, and OFF positions) will typically have both "START" and "PERMIT" functions.

In the "ON" position (1), the "START" switch is depressed, which will activate a manual (non-mission) regeneration.



In "NEUTRAL" position (2), neither the "START" switch or "PERMIT" switch is depressed as the switch is in the NEUTRAL position. This position is recommended for normal engine operation.

In "OFF" position (3), the "PERMIT" switch is depressed. When the switch is in this position, active regeneration of the aftertreatment system will **not** be allowed.

Last Modified: 28-Apr-2025

Trainings ▾

General Information

Overview

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

- Check engine
- Aftertreatment diesel particulate filter (DPF)
- Stop engine
- Aftertreatment diesel exhaust fluid (DEF)
- Exhaust high temperature.

Engine Operation

Malfunction Indicator Lamp (MIL)

- Cummins® Environmental Protection Agency (EPA) 2017 heavy duty on-highway engines are equipped with On-Board Diagnostics (OBD). The OBD 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.



00c00178

Note : The MIL is **only** used on OBD certified products.

The 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.

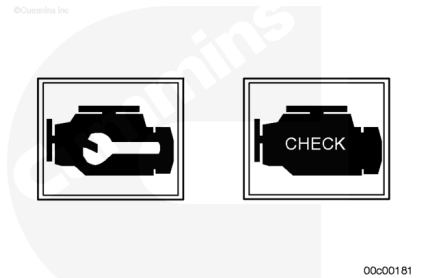
The MIL can be illuminated along with any of the engine indicator lamps. It is **not** used to indicate an engine protection or maintenance required condition.

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 shift.

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

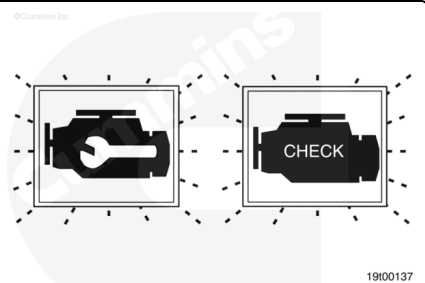
- The words WARNING or CHECK ENGINE spelled out
- A symbol of an engine, similar to the illustration.



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 could flash for the following reasons:

- Maintenance required, if the Maintenance Monitor feature is enabled
- Water in fuel detected
- Coolant level low
- DEF 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 DPF require, if enabled in calibration.

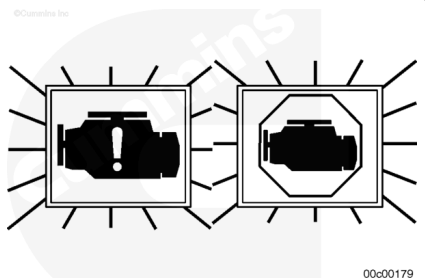


The lamp will turn off if no other condition exists.

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
- A symbol of an engine with an exclamation point in the center, similar to the illustration.
- A symbol of a stop sign with an engine outline in the center, similar to the illustration.

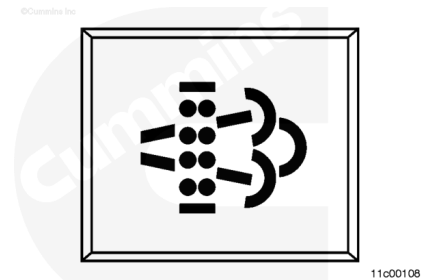
Aftertreatment Diesel Particulate Filter Lamp

The AFTERTREATMENT DIESEL PARTICULATE FILTER lamp indicates, when illuminated or flashing, that the aftertreatment DPF requires regeneration.

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

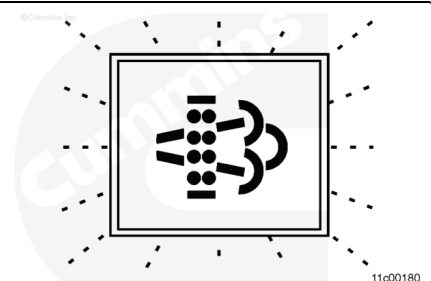
- Changing the duty cycle by increasing the engine parasitics, including activating the vehicle's driving lights and head lights, activating the engine fan, if dash switch equipped, activating the air conditioner or defroster, driving and maintaining a road speed of 50 mph or greater until the AFTERTREATMENT DIESEL PARTICULATE FILTER lamp deactivates. Continue driving for an additional 20 minutes to provide for adequate aftertreatment DPF regeneration.
- 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 diesel particulate filter needs to be regenerated at the next possible opportunity. Engine power may be reduced automatically.

When this lamp is flashing, the operator should:



- Change the duty cycle by increasing the engine parasitics, including activating the vehicle's driving and head lights, activating the engine fan, if dash switch equipped, activating the air conditioner or defroster, driving and maintaining a road speed of 50 mph or greater until the AFTERTREATMENT DIESEL PARTICULATE FILTER lamp deactivates. Continue driving for an additional 20 minutes to provide for adequate DPF regeneration.
- 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.

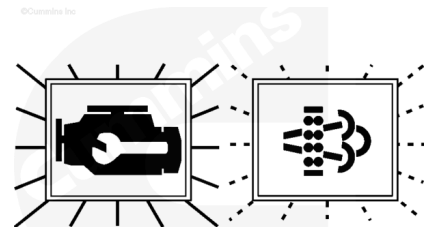
A flashing AFTERTREATMENT DIESEL PARTICULATE FILTER lamp combined with an illuminated WARNING or CHECK ENGINE lamp indicates that the aftertreatment DPF needs be regenerated immediately. Engine power will be reduced automatically.

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.

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



00c00182

High Exhaust System Temperature Lamp

⚠ WARNING ⚠

To reduce the possibility of personal injury, wear protective gloves when handling parts that have been heated.



11c00107

The HIGH EXHAUST SYSTEM TEMPERATURE lamp indicates, when illuminated, that exhaust temperatures are high due to regeneration of the aftertreatment DPF. This lamp can illuminate during normal engine operation or during stationary 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, make sure that the exhaust pipe outlet is **not** directed at any surface or material that can melt, burn, or explode.

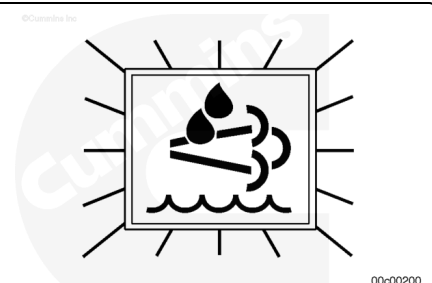
- Keep the exhaust outlet away from people and anything that can melt, burn, or explode.
- Nothing within 0.6 m [2 ft] of the exhaust outlet
- Nothing that can melt, burn, or explode within 1.5 m [5 ft], such as gasoline, wood, paper, plastics, fabric, compressed gas containers, and hydraulic lines.
- 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.

Aftertreatment Diesel Exhaust Fluid Lamp

The DIESEL EXHAUST FLUID lamp indicates, when illuminated or flashing, that the DEF level is low.

An illuminated 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.

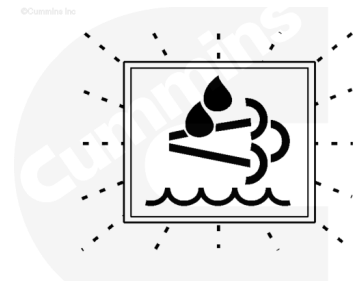


00c00200

A flashing 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.

Other events that can cause the flashing 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.

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

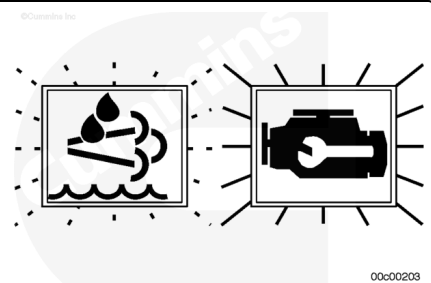


00c00185

An illuminated or flashing 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 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.

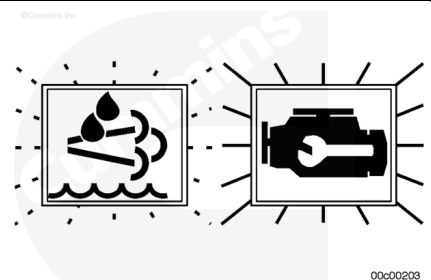


00c00203

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 on-board diagnostics (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.



00c00203

If the engine has been shut down or has idled for an extended period of time after the tank has been emptied, the STOP ENGINE lamp will also be illuminated along with the flashing DIESEL EXHAUST FLUID lamp and illuminated CHECK ENGINE

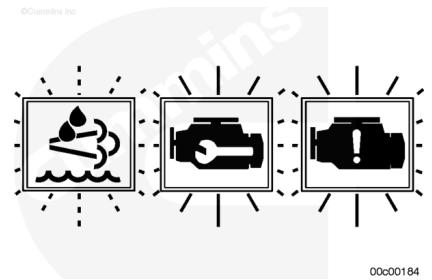
lamp. The engine power will continue to be limited automatically. The vehicle will also be limited to a 5 mph speed limit.

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

Note : In order 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 : On OBD certified products, the MIL may also be illuminated.



Battery Power Required Lamp

The ECM requires that battery power be constantly connected anytime the keyswitch is in the ON position and for some time after the keyswitch is turned to the OFF position. The ECM will turn the BATTERY POWER REQUIRED lamp on when the keyswitch is ON, and for the entire duration that the battery is required after the keyswitch is turned OFF. Reference the equipment manufacturer service information for details on lamp configuration.

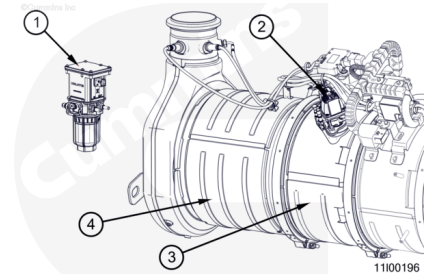
Last Modified: 18-Mar-2019

Trainings ▾

General Information

The selective catalytic reduction (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 decomposition tube.
4. Aftertreatment SCR catalyst.



⚠ CAUTION ⚠

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 an 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.

Note : Cummins Inc. supplies the aftertreatment DEF controller, aftertreatment dosing unit and aftertreatment DEF dosing valve, and the aftertreatment SCR catalyst. The vehicle manufacturer supplies the DEF tank, the DEF lines, the DEF tank temperature, the DEF 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.

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

The engine control module (ECM) controls the amount of DEF sprayed into the exhaust. It also controls the DEF tank heater and DEF line heaters.

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

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

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 will differ 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 ECM.

After turning the keyswitch OFF on a vehicle with SCR, a pumping sound may be heard from underneath 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. To avoid system damage, do **not** disconnect the vehicle batteries during this process.

Note : When the dosing valve is dosing DEF into the exhaust, there is a noticeable clicking sound. This is normal and does not indicate that the valve has malfunctioned.

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.

Trainings ▾

General Information

EPA HD OBD is Heavy Duty On-Board Diagnostics (OBD) for all US vehicles with a gross vehicle weight over 14,000 pounds. Beginning in 2013 all heavy-duty on-highway engine families are required to be equipped with OBD.

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), will illuminate to inform the driver of the malfunction, and a fault code, which will identify the likely malfunction, is stored in the engine control module (ECM).

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

Differences between an OBD system and the traditional Cummins® diagnostic system are that an OBD system will illuminate the MIL, detect deteriorated components and systems (**not** just total malfunctions), and perform multiple trip diagnostics. Multiple trip diagnostics are malfunctions that have to occur in multiple consecutive trips before the MIL will be 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 will turn on when an OBD fault code is logged, and in most cases, it takes three trips without the malfunction occurring again to clear the lamp.

Reference the On-Board Diagnostics (OBD) for EPA/ARB Certified Engines, Service Bulletin 2883408 (</qs3/pubsys2/xml/en/bulletin/2883408.html>) for additional OBD information.

Note : 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. (</qs3/pubsys2/xml/en/procedures/564/564-101-048.html>)

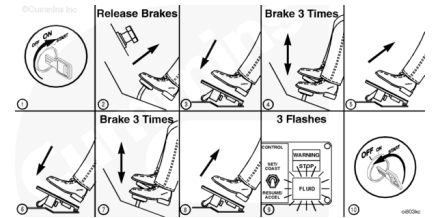
Trainings ▾

Reset

After Lubricating Oil Change

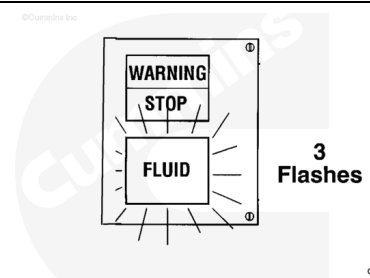
- The CHECK ENGINE lamp will appear when the lubricating oil change interval has been reached.
- Use the following steps to reset the CHECK ENGINE lamp after changing the lubricating oil.

The maintenance monitor can be reset using an electronic service tool, or by following steps one through ten, as illustrated. Steps three through eight **must** be done within 12 seconds in order 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. Make sure 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 after the throttle pedal is released on step 8 above, the reset sequence must be performed again.

Last Modified: 16-Dec-2022

Trainings ▾

General Information

Beginning in 2016, Cummins® heavy duty diesel automotive engines are compliant with the 2017 Greenhouse Gas Emissions Requirements. These regulations set engine and/or vehicle standards for the emissions of carbon dioxide (CO₂), NOx, methane (CH₄), and hydrofluorocarbons (HFCs).

Due to the above statement, Cummins® heavy duty diesel automotive engines can be used in vehicles that meet Greenhouse Gas Emissions requirements. Vehicles that are certified under the 2017 Greenhouse Gas Emissions Requirements can be identified by a sticker, typically located on the vehicle doorjamb.

Vehicles certified under the 2017 Greenhouse Gas Emissions Requirements may also feature the following:

- Aerodynamic improvements
- Low rolling resistance tires
- Vehicle weight reduction
- Vehicle speed limiters
- Idle reduction/shutdown features.

Vehicle speed limiters and idle shutdown features are controlled by the engine control module (ECM). For Greenhouse Gas certified vehicles, the ECM may have additional password protected Greenhouse Gas Vehicle Speed Limiter and Greenhouse Gas Idle Shutdown features. Passwords are original equipment manufacturer (OEM) controlled and can **not** be overridden with recalibrations, ROM-boot, or Zap-it®. Contact the OEM dealer if password removal or installation is required.

Last Modified: 18-Mar-2019

Trainings ▾

General Information

The Advanced Dynamic Efficient Powertrain Technology (ADEPT™) suite of advanced electronic features provides vehicle controls to help drivers operate vehicles in a fuel-efficient manner while maintaining the desired level of productivity and performance. The ADEPT™ features will make minor adjustments to vehicle speed, engine power and driveline conditions to take advantage of vehicle momentum and knowledge of upcoming route attributes in order to achieve a more fuel efficient vehicle operation. The ADEPT™ features can provide further improvements to fuel efficiency and performance based on knowledge of upcoming route attributes when used in conjunction with a look-ahead module such as a Connectivity Module, Cummins® Route Parameter Manager or an original equipment manufacturer (OEM) predictive cruise control system.

Features are divided into eight groups:

- Load Based Torque Control
- SmartCoast™
- Predictive Gear Shifting
- Predictive Engine Braking
- On-Ramp Boost
- Predictive Cruise Control
- Predictive Road Speed Governor
- Hill Roll Out.

Each of the individual ADEPT™ features can be disabled or adjusted to fit customer preferences using INSITE™ electronic service tool.

Feature Description

Load Based Torque Control Feature

The Load Based Torque Control Feature is designed to provide the engine torque required to maintain the vehicle operating conditions to optimize fuel economy.

There are currently four types of Load Based Torque Control:

- Base
- Dynamic Power
- SmartTorque
- SmartTorque2.

The Base type is defined by the torque rating installed. A straight torque rating allows full torque for all vehicle operating conditions. The SmartTorque rating allows full torque in **only** the top two gears. Dynamic Power allows dynamic modulation of available engine torque to improve fuel economy.

The default values provided in the calibration are recommended for the most fuel efficient operation and set at the factory. The Load Based Torque Control type parameter can be adjusted with the proper programming tools such as INSITE™ electronic service tool.

SmartTorque2

SmartTorque2 expands upon the current SmartTorque feature of limiting engine torque when operating in gears below the top two. The expanded functionality of SmartTorque2 utilizes an estimated vehicle weight and road grade to limit the available torque to what is needed to maintain the operating condition for that weight and road grade condition. This results in more efficient engine operation by limiting the use of excessive torque when it is **not** required.

Dynamic Power Feature

Dynamic Power feature improves upon the current SmartTorque2 feature by unlocking dynamic engine torque modulation in all gears rather than static limiting outside the top two. The expanded functionality of Dynamic Power utilizes similar inputs as SmartTorque2 in addition to current transmission gear and vehicle losses to modulate the available engine torque based on desired performance selection to reflect current vehicle operation and environment influence. This results in more efficient engine operation by limiting the use of excessive torque when it is **not** required in addition to increasing time spent in areas of peak engine efficiency.

Note : Connectivity Module, Cummins® Route Parameter Manager or OEM Predictive Cruise Control hardware is required for proper operation of this feature.

Note : This feature will work only on specific engine and transmission combinations. Contact a local Cummins® distributor for more details.

SmartCoast™ Feature

The SmartCoast™ feature works in conjunction with an Eaton™ automated manual transmission to disengage the driveline when the vehicle operating conditions are such that the engine provided positive torque is **not** needed to maintain the target vehicle speed. By taking advantage of vehicle momentum, SmartCoast™ operation can significantly improve vehicle fuel economy, depending on the road grades traversed.

SmartCoast™ disengages the driveline when the vehicle is on a slight downhill grade and there is no other need for the driveline to be engaged. This can occur when cruise control is active, or when cruise control is inactive and either the road speed governor is used or when the operator has released the accelerator pedal.

When the Cruise Control Operating Mode is used and the vehicle speed exceeds the cruise control set speed plus the cruise control lower droop speed, the transmission will automatically reengage the driveline to allow the engine to maintain the cruise control set speed plus the lower droop speed. The driveline will also reengage with any action that causes the deactivation of Cruise Control.

When the Accelerator Control Operating Mode is used and the vehicle has exceeded the Road Speed Governor Maximum Vehicle Speed or the Maximum Vehicle Speed Control Start Maximum Engine Braking Speed, the driveline will automatically re-engage the driveline to allow the engine to maintain vehicle speed. The driveline will also re-engage with any action to engage the engine brakes or service brakes.

While SmartCoast™ is active the engine will either operate at its programmed low idle speed or operate at the SmartCoast™ specific idle speed if that feature is enabled. The default is for the engine to run at 500 rpm during SmartCoast™. The engine speed will smoothly return to the proper operating speed as the driveline is reengaged at the appropriate transmission gear.

Note : This feature will work only on specific engine and transmission combinations. Contact a local Cummins® distributor for more details.

Predictive Gear Shifting Feature

Predictive Gear Shifting improves vehicle speed tracking performance during cruise control using knowledge of the upcoming road grade. The feature will select the optimum gear to allow the vehicle to maintain cruise control reference speed tracking on hills where the power available from the engine is limited as compared to power requirements, while minimizing fuel economy impact.

The feature is **only** available when used in conjunction with Connectivity Module, Cummins® Route Parameter Manager or an original equipment manufacturer (OEM) Predictive Cruise Control System and will utilize vehicle characteristics and road grade profile information to determine the proper transmission gear when the engine is power limited on hills.

Predictive Engine Braking Feature

Predictive Engine Braking aims to enhance the vehicle speed limiting capability of existing engine brake features based on the upcoming road grade. The features to which this predictive functionality can apply are Cruise Control and Engine Brake Interaction or Maximum Vehicle Speed Control.

Predictive Engine Braking will select the appropriate transmission gear to allow the engine brakes to generate sufficient power for the upcoming road terrain. The feature can also activate the engine brakes up to 3 mph below the speed at which engine brakes would normally activate as needed for the upcoming terrain. The feature uses both the Start Minimum Engine Braking and Start Maximum Engine Braking vehicle speed values which are configured by Cruise Control and Engine Brake Interaction or Maximum Vehicle Speed Control. If both features are being used, Predictive Engine Braking will apply to the lower of the speed values. It also requires that these features can access full braking power. If the operator is overriding either of these features with the accelerator pedal or engine brake switch, Predictive Engine Braking will **not** activate. See the details of these individual features for more information.

Note : Connectivity Module, Cummins® Route Parameter Manager or OEM Predictive Cruise Control hardware is required for proper operation of this feature.

Note : This feature will work only on specific engine and transmission combinations. Contact a local Cummins® distributor for more details.

On-ramp Boost Feature

On-ramp Boost improves vehicle acceleration on an on-ramp leading to an interstate by increasing power output of the vehicle which increases the merging speeds and assists in an easier merging maneuver. It will temporarily disable torque limiting features of the engine and provide a performance shift schedule to boost the acceleration maneuver. By doing this, it allows the vehicle to operate in a fuel-efficient mode during regular operation and allows for better performance during certain conditions like on-ramps.

Note : Connectivity Module, Cummins® Route Parameter Manager or OEM Predictive Cruise Control hardware is required for proper operation of this feature.

Note : This feature will work only on specific engine and transmission combinations. Contact a local Cummins® distributor for more details.

Predictive Cruise Control Feature

Predictive Cruise Control dynamically adjusts the vehicle speed profile while the vehicle is operating in cruise control. The vehicle speed profile is optimized for fuel economy based on the upcoming road grade.

Predictive Cruise Control uses Global Position System (GPS) signal data to determine the vehicle's position and the route being traveled. Combining the vehicle's route knowledge and a route map with road elevations allows the system to determine a more efficient speed profile to apply. For example, when the momentum of a vehicle can carry the vehicle over the hill crest with a slight speed increase the system will provide that slight increase prior to entering the hill and then allow the speed to decrease prior to cresting the hill. Adjusting the speed prior to entering the hill can be done more efficiently than waiting to provide more power while on the grade to

maintain the minimum cruise control speed. The transmission gear may also need to change to a less efficient gear when waiting until being on the grade in order to maintain minimum cruise control speed.

The rules for operating Cruise Control are the same as they have been previously and are the same regardless of OEM or Cummins® Predictive Cruise Control. Cruise Control has the same enable and abort conditions and programmable functionality as it has had in the past. Predictive Cruise Control simply provides minor adjustments to the cruise control target speed to optimize the operation of the vehicle within the defined operating range.

Cummins® engines support two forms of Predictive Cruise Control:

- OEM-provided Predictive Cruise Control systems
- Cummins® Predictive Cruise Control

Note : Connectivity Module, Cummins® Route Parameter Manager or OEM Predictive Cruise Control hardware is required for proper operation of this feature.

OEM Predictive Cruise Control

The OEM-provided Predictive Cruise Control system calculates and provides, via J1939 vehicle network to the engine control module (ECM), the speed delta between the Predictive Cruise Control desired speed and the current cruise control vehicle speed. The ECM in turn adjusts the cruise control target speed to attain that desired predictive cruise control speed. This speed adjustment **only** occurs when the engine is in cruise control mode and the predictive cruise control device has determined a more efficient speed profile for the upcoming route.

Cummins® Predictive Cruise Control

The Cummins® Predictive Cruise Control will run automatically when a Connectivity Module or Cummins® Route Parameter Manager device is installed on the vehicle. The ECM uses the information provided by the device to calculate the desired change to the cruise control target speed. This results in the same type of adjustment to the cruise control target speed as the OEM system.

Upon agreement between Cummins® and OEMs, the Cummins® ECM can recognize the OEM's Predictive Cruise Control Module as compatible for enabling Cummins® Predictive Cruise Control Algorithm. The module communicates the look-ahead route data to the ECM via the J1939 powertrain network and the engine control module calculates the change to the cruise control target speed.

Cummins® Route Parameter Manager

The Cummins® system includes a small electronic module that is installed in a protected environment. The module communicates the look-ahead route data to the ECM which calculates the necessary information to support the ADEPT™ electronic features, including Cummins®

Predictive Cruise Control. The module communication occurs automatically when the module is properly installed on the J1939 vehicle network.

Cummins® Route Parameter Manager comes with two options: First Fit installed and Aftermarket Kit. First Fit option is installed by truck OEM and available as the factory option. Aftermarket Kit options can be purchased and installed at any time at Cummins® certified service locations.

Note : For more information about this hardware and to confirm if it is installed in your vehicle, contact a local Cummins® distributor for more details.

Predictive Road Speed Governor Feature

Predictive Road Speed Governor dynamically adjusts the Road Speed Governor while the vehicle is operating in accelerator control. With constant application of the accelerator pedal, the vehicle speed profile is optimized for fuel economy based on the upcoming road grade.

Predictive Road Speed Governor uses Global Position System (GPS) signal data to determine the vehicle's position and the route being traveled. Combining the vehicle's route knowledge and a route map with road elevations allows the system to determine a more efficient speed profile to apply. For example, when the momentum of a vehicle can carry the vehicle over the hill crest with a slight speed increase the system will allow that slight increase prior to entering the hill and then reduce the speed prior to cresting the hill. Adjusting the speed prior to entering the hill can be done more efficiently than waiting to provide more power while on the grade. Additionally, the transmission gear may also need to change to a less efficient gear when waiting until being on the grade.

Note : Connectivity Module, Cummins® Route Parameter Manager or OEM Predictive Cruise Control hardware is required for proper operation of this feature.

Hill Roll Out Feature

Hill Roll Out allows early disengagement of engine brakes and a temporary vehicle speed increase based on upcoming terrain. Hill Roll Out can improve the powertrain efficiency by reducing engine braking near an end of downhill terrain and take advantage of vehicle momentum to traverse the upcoming terrain. If Smartcoast™ is enabled on a Cruise Control operation mode, Hill Roll Out can request Smartcoast™ events to increase efficiency. Refer to Smartcoast™ section for more information on Smartcoast™ operation.

The Hill Roll Out feature is configurable to be enabled or disabled and is only in operation while Cruise Control is active. Hill Roll Out may disengage engine brakes early when approaching the end of downhill terrain. When Smartcoast™ is enabled and configured to a mode that allows operation on Cruise Control, Hill Roll Out can request Smartcoast™ events to increase efficiency.

Hill Roll Out is designed to apply the Hill Roll Out Maximum Offset above the Start Maximum Engine Braking speed when Cruise Control with Engine Brakes Interaction is enabled. When Cruise Control with Engine Brakes Interaction is disabled, the Hill Roll Out Maximum Offset is applied above the Cruise Control Lower Droop.

When Hill Roll Out is in operation, the vehicle speed may enter the Hill Roll Out Maximum offset region momentarily near the end of a downhill. The Maximum Vehicle Speed Control (MVSC) feature will limit the Maximum Offset region of Hill Roll Out via the Start Maximum Engine Braking vehicle speed. Hill Roll Out will become inactive when vehicle speed is above the MVSC Start Maximum Engine Braking speed. Activation of the service brake pedal, moving the engine brake switch to a higher braking level position, cancelling Cruise Control and Adaptive Cruise Control requests will cause the feature to become inactive allowing regular vehicle operation for the rest of the downhill.

Note : Connectivity Module, Cummins® Route Parameter Manager or OEM Predictive Cruise Control hardware is required for proper operation of this feature.

Note : This feature will work only on specific engine and transmission combinations. Contact a local Cummins® distributor for more details.

Last Modified: 24-Mar-2021

Trainings ▾

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>
(<https://www.cummins.com/parts-and-service/digital-products-and-services>)

Last Modified: 26-Sep-2023

Trainings ▾

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.

Last Modified: 05-Aug-2014

Trainings ▾

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 Cleaner Restriction - Check
- Air Intake Piping - Check
- Air Tanks and Reservoirs - Drain
- Coolant Level - Check
- Charge Air Piping - Check
- Crankcase Breather Tube - Check
- Drive Belts - Check
- Fan, Cooling - Check

- Fuel-Water Separator - Drain
- Lubricating Oil Level - Check
- Aftertreatment Exhaust Piping - Check
- Diesel Exhaust Fluid (DEF) Level - Check

Last Modified: 18-Mar-2019

Trainings ▾

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] Hour or Time					
D = Maintenance Check Performed					
E = Check Performed By					
F = Comments					
A	B	C	D	E	F

Last Modified: 04-Aug-2014

Trainings ▾

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.

Last Modified: 20-Jul-2023

Trainings ▾

General Information

Most of the maintenance operations described in this manual can be performed with common hand tools (metric and US customary wrenches, sockets, and screwdrivers).

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

Tool Part Number	Description	Use or Additional Description
3500158	Coolant Filter Wrench	
3400157	Oil and Fuel Filter Wrench	
2892438	Torque wrench	
3163530	Brake Feeler Gauge - 7.00 mm [0.276 in]	

Refer to the appropriate sections for a description of the tools and how to use them.

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

Last Modified: 18-Mar-2019

Trainings ▾

Schedule

Kilometers x 1000		48	80	200	400	480	800					
Miles x 1000		30	50	125	250	300	500					
Hours		1000	1500	3000	6000	6750	10000					
Months		6										
Years			1		2		5					
Procedure	Step											
Lubricating Oil and Filters (/qs3/pubsys2/xml/en/procedures/564/564-007-002.html)	Change	See Lubricating Oil and Filter Intervals procedure. Refer to Procedure 359-009 in Section 3. (/qs3/pubsys2/xml/en/procedures/564/564-359-009.html)										
Pressure Fuel Filter (/qs3/pubsys2/xml/en/procedures/564/564-006-065-om.html)	Change	See Fuel Filter Intervals procedure. Refer to Procedure 359-008 in Section 3. (/qs3/pubsys2/xml/en/procedures/564/564-359-008.html)										
1. See equipment manufacturer service information.												
2. If equipped.												

Kilometers x 1000		48	80	200	400	480	800					
Miles x 1000		30	50	125	250	300	500					
Hours		1000	1500	3000	6000	6750	10000					
Months		6										
Years			1		2		5					
Procedure	Step											
Fuel Filter Suction (/qs3/pubsys2/xml/en/procedures/564/564-006-066-om.html)	Check	See Fuel Filter Intervals procedure. Refer to Procedure 359-008 in Section 3. (/qs3/pubsys2/xml/en/procedures/564/564-359-008.html)										
Radiator Pressure Cap (/qs3/pubsys2/xml/en/procedures/564/564-008-047.html)	Check	X										
Supplemental Coolant Additive (SCA) and Antifreeze Concentration (/qs3/pubsys2/xml/en/procedures/99/99-008-046.html)	Check	X										
1. See equipment manufacturer service information.												
2. If equipped.												

Kilometers x 1000		48	80	200	400	480	800					
Miles x 1000		30	50	125	250	300	500					
Hours		1000	1500	3000	6000	6750	10000					
Months		6										
Years			1		2		5					
Procedure	Step											
Charge Air Cooler (/qs3/pubsys2/xml/en/procedures/99/99-010-027.html)	Check	X										
Air Shutoff Valve (/qs3/pubsys2/xml/en/procedures/564/564-010-143-om.html) ²	Check	X										
Air Compressor Discharge Lines (/qs3/pubsys2/xml/en/procedures/99/99-012-015.html)	Check		X									
1. See equipment manufacturer service information.												
2. If equipped.												

Kilometers x 1000		48	80	200	400	480	800					
Miles x 1000		30	50	125	250	300	500					
Hours		1000	1500	3000	6000	6750	10000					
Months		6										
Years			1		2		5					
Procedure	Step											
Air Leaks, Air Intake and Exhaust Systems (/qs3/pubsys2/xml/en/procedures/564/564-010-024-om.html)	Check		X									
Cooling Fan Belt Tensioner (/qs3/pubsys2/xml/en/procedures/564/564-008-087.html)	Check		X									
Engine Wiring Harness (/qs3/pubsys2/xml/en/procedures/564/564-019-043-om.html)	Check		X									
1. See equipment manufacturer service information.												
2. If equipped.												

Kilometers x 1000		48	80	200	400	480	800					
Miles x 1000		30	50	125	250	300	500					
Hours		1000	1500	3000	6000	6750	10000					
Months		6										
Years			1		2		5					
Procedure	Step											
Radiator Hoses (/qs3/pubsys2/xml/en/procedures/99/99-008-045.html)	Check			X								
Cold Starting Aid (/qs3/pubsys2/xml/en/procedures/564/564-010-029.html)	Check			X								
Radiator Shutter Assembly (/qs3/pubsys2/xml/en/procedures/564/564-008-049.html)	Check			X								
1. See equipment manufacturer service information.												
2. If equipped.												

Kilometers x 1000		48	80	200	400	480	800					
Miles x 1000		30	50	125	250	300	500					
Hours		1000	1500	3000	6000	6750	10000					
Months		6										
Years			1		2		5					
Procedure	Step											
Vibration Damper, Viscous (/qs3/pubsys2/xml/en/procedures/99/99-001-052.html)	Check			X								
Engine Mounting Bolts (/qs3/pubsys2/xml/en/procedures/564/564-000-008.html)	Check			X								
Engine Cleaning (/qs3/pubsys2/xml/en/procedures/99/99-000-009.html)	Clean			X								
1. See equipment manufacturer service information.												
2. If equipped.												

Kilometers x 1000		48	80	200	400	480	800					
Miles x 1000		30	50	125	250	300	500					
Hours		1000	1500	3000	6000	6750	10000					
Months		6										
Years			1		2		5					
Procedure	Step											
Aftertreatment Diesel Particulate Filter (/qs3/pubsys2/xml/en/procedures/564/564-011-041-om.html)	Check	See Aftertreatment Diesel Particulate Filter Intervals procedure. Refer to Procedure 359-006 in Section 3. (/qs3/pubsys2/xml/en/procedures/564/564-359-006.html)										
Coolant Filter (/qs3/pubsys2/xml/en/procedures/564/564-008-006-om.html)	Change	See Coolant Filter Intervals procedure. Refer to Procedure 359-014 Section 3. (/qs3/pubsys2/xml/en/procedures/564/564-359-014.html)										
Cooling System (/qs3/pubsys2/xml/en/procedures/564/564-008-018-om.html) ¹	Flush	See equipment manufacturer service information										
1. See equipment manufacturer service information.												
2. If equipped.												

Kilometers x 1000		48	80	200	400	480	800					
Miles x 1000		30	50	125	250	300	500					
Hours		1000	1500	3000	6000	6750	10000					
Months		6										
Years			1		2		5					
Procedure	Step											
Aftertreatment Diesel Exhaust Fluid Dosing Unit Filter (/qs3/pubsys2/xml/en/procedures/564/564-011-060.html)	Change					X						
Engine Brake Assembly (/qs3/pubsys2/xml/en/procedures/564/564-020-004-om.html)	Adjust						X					
Fan Hub, Belt Driven (/qs3/pubsys2/xml/en/procedures/564/564-008-036-om.html)	Check						X					
1. See equipment manufacturer service information.												
2. If equipped.												

Kilometers x 1000		48	80	200	400	480	800					
Miles x 1000		30	50	125	250	300	500					
Hours		1000	1500	3000	6000	6750	10000					
Months		6										
Years			1		2		5					
Procedure	Step											
Overhead Set (/qs3/pubsys2/xml/en/procedures/564/564-003-004-om.html)	Adjust						X					
Air Shutoff Valve (/qs3/pubsys2/xml/en/procedures/564/564-010-143-om.html) ²	Change						X					
1. See equipment manufacturer service information.												
2. If equipped.												

Last Modified: 28-Aug-2019

Trainings ▾

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

Last Modified: 04-Aug-2014

Trainings ▾

General Information

Table 1: Diesel Particulate Filter (DPF) Cleaning Intervals

Fuel Consumption		
Severe 2.3 km/liter [5.5 mpg]	Normal 2.3 to 2.7 km/liter [5.5 to 6.5 mpg]	Light 2.7 to 3.2 km/liter [6.5 to 7.5 mpg]
400,000 to 640,000 km [250,000 to 400,000 miles]	640,000 to 965,000 km [400,000 to 600,000 miles]	965,000 to 1,300,000 km [600,000 to 800,000 miles]

Options for DPF maintenance intervals:

- Extended maintenance interval - The maintenance lamp and DPF maintenance fault code will indicate the DPF is ash loaded. The DPF maintenance fault code is described in Table 2. Use the following procedure for maintenance lamp behavior descriptions. Refer to Procedure 101-048 in Section 1. (</qs3/pubsys2/xml/en/procedures/564/564-101-048.html>)

Ash accumulation is variable based on many duty cycle factors. To optimize maintenance cost, it is recommended to use the maintenance lamp as an indicator for DPF maintenance. When using the maintenance lamp, it is normal for the maintenance intervals to exceed the intervals specified in Table 1.

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. (</qs3/pubsys2/xml/en/procedures/564/564-101-047.html>)

Note : The maintenance lamp for aftertreatment DPF is not a user selectable feature or parameter in INSITE™ electronic service tool.

The following conditions require more frequent DPF maintenance than listed in Table 2:

- Use of engine lubricating oil that does **not** meet API CJ-4. Refer to Procedure 018-003 in Section V. (</qs3/pubsys2/xml/en/procedures/564/564-018-003.html>)
- Frequent or extended use of engine brakes.
- Extended idle.

Table 2: 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.

Last Modified: 10-Mar-2022

Trainings ▾

General Information

Fuel filter change intervals are based on the following:

- Fuel consumption.

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

Suction-Side Fuel Filter Check Interval

Check the suction-side fuel filter during oil drain maintenance intervals. See Lubricating Oil and Filter Intervals procedure. Refer to Procedure 359-009 in Section 3 (</qs3/pubsys2/xml/en/procedures/564/564-359-009.html>).

To check the suction-side fuel filter, see equipment manufacture service information.

Note: Suction-side fuel filters are OEM installed and can vary based on OEM hardware selection and fuel quality.

Pressure-Side Fuel Filter Change Interval by Fuel Consumption - FF5825NN

Extreme Severe < 1.27 km/liter [3 mpg]	Severe 1.27 to 2.1 km/liter [3 to 4.9 mpg]	Short Haul 2.1 to 2.5 km/liter [5 to 5.9 mpg]	Normal 2.5 to 3 km/liter [6 to 6.9 mpg]	Light > 3 km/liter [7 mpg]
7,000 km [4,500 mi]	40,000 km [25,000 mi]	81,000 km ⁽¹⁾⁽²⁾ [50,000 mi]	97,000 km ⁽¹⁾⁽²⁾ [60,000 mi]	121,000 km ⁽¹⁾⁽²⁾ [75,000 mi]

- An Extended Life FF5971NN pressure-side fuel filter is recommended to achieve this interval and align with the oil drain interval.
- A Davco 400 series, or equivalent, capacity suction-side filter is recommended to align the suction-side filter change interval with the oil drain interval.

Last Modified: 02-Jun-2020

Trainings ▾

General Information

Lubricating oil and filter change intervals are based on the following:

- Application
- Fuel consumption.

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

The use of Centinel™ or any type of oil blending is prohibited. The use of a high quality filter is mandatory.

See the following bulletin for information regarding engine oil analysis:

- Fluids for Cummins® Products Service Manual, Bulletin 5411406.

See Table 1 for oil drain maintenance intervals for the following vehicle applications:

- Recreational
- Refuse
- Mixer
- Dump
- Delivery
- Logging
- Fire Truck
- Crane.

Oil drain maintenance intervals for all other applications are based on fuel consumption. See Table 2.

Table 1: Oil Drain Interval for Select Applications				
Oil Classification	Kilometers	Miles	Hours	Months
Cummins® Engineering Standard (CES) 20086, CK-4	32,000	20,000	500	12
CES 20087, FA-4	32,000	20,000	500	12

Table 2: Oil Drain Intervals for All Other Applications⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾**Fuel Consumption**

Oil Classification	Extreme Severe < 1.27 km/liter [3 mpg]	Severe 1.27 to 2.1 km/liter [3 to 4.9 mpg]	Short Haul 2.1 to 2.5 km/liter [5 to 5.9 mpg]	Normal 2.5 to 3 km/liter [6 to 6.9 mpg]	Light > 3 km/liter [7 mpg]
CES 20086, CK-4	7,000 km [4,500 mi]	40,000 km [25,000 mi]	81,000 km [50,000 mi]	97,000 km [60,000 mi]	121,000 km ⁽⁵⁾ [75,000 mi]
CES 20087, FA-4 ⁽⁴⁾	7,000 km [4,500 mi]	40,000 km [25,000 mi]	81,000 km [50,000 mi]	97,000 km [60,000 mi]	121,000 km ⁽⁵⁾ [75,000 mi]
Valvoline™ Premium Blue™ One Solution™ Gen2	7,000 km [4,500 mi]	48,000 km [30,000 mi]	89,000 km [55,000 mi]	105,000 km ⁽⁵⁾ [65,000 mi]	129,000 km ⁽⁵⁾ [80,000 mi]

1. Use distance value found in Table 2 or 12 months, whichever comes first.
2. Drain intervals can be extended with participation in the Cummins® OilGuard™ oil analysis program.
3. If combined percent idle time plus power takeoff (PTO) time is greater than 40 percent for Short Haul, Normal, or Light intervals, use the next lower drain interval. For Extreme Severe and Severe intervals, use the published drain interval regardless of the combined idle plus PTO time.
4. Refer to Procedure 018-003 in Section V (/qs3/pubsys2/xml/en/procedures/564/564-018-003.html) on oil type and grade.
5. An Extended Life LF14001NN oil filter is recommended to achieve intervals beyond 97,000 km [60,000 mi].

Last Modified: 02-Jun-2020

Trainings ▾

General Information

Coolant filter change intervals are based on the filter used. See Coolant Recommendations and Specifications procedure for additional coolant requirements. Refer to Procedure 018-004 in Section V. (</qs3/pubsys2/xml/en/procedures/564/564-018-004.html>)

Note : Filters must meet Cummins SAM 10769. Fleetguard® filters meet SAM 10769. Standard filter is Fleetguard® WF2126. For systems larger than 100 gallons, use 1 quart per 15 gallons. Consult vehicle manufacturer for total cooling system capacity.

WF2126

- This filter is designed for service intervals up to 80,467 km [50,000 miles] and is used for cooling systems up to 20 gallons. This filter contains 8 units of DCA4 Plus.

WF2127

- This filter has been designed for extended service intervals of 80,467 km [50,000] to 241,402 km [150,000 miles]. It has no chemical additives and can be used in the following systems.
 - Cooling systems above 20 gallons in capacity.
 - See maintenance chart below.

When using WF2127 filter, following volumes of treatment listed in table **must** be added at designated mileages.

Cooling System Capacity	80,467 km [50,000 miles] - Standard service interval with fully formulated standard service coolant. Use standard SCA such as Fleetguard® DCA2 or DCA4.	241,402 km [150,000 miles] - Extended service interval with fully formulated extended service coolant. Use extender SCA such as Fleetguard® ES extender liquid. DCA4 can also be used.
0 to 76 liters [0 to 20 gallons]	0.98 liters [1 qt]	0.95 liters [1 qt]
	10 units	15 units
76 to 152 liters [20 to 40 gallons]	1.89 liters [2 qt]	1.89 liters [2 qt]
	20 units	30 units

Cooling System Capacity	80,467 km [50,000 miles] - Standard service interval with fully formulated standard service coolant. Use standard SCA such as Fleetguard® DCA2 or DCA4.	241,402 km [150,000 miles] - Extended service interval with fully formulated extended service coolant. Use extender SCA such as Fleetguard® ES extender liquid. DCA4 can also be used.
152 to 227 liters [40 to 60 gallons]	2.84 liters [3 qt]	2.84 liters [3 qt]
	30 units	45 units
227 to 303 liters [60 to 80 gallons]	3.79 liters [4 qt]	3.79 liters [4 qt]
	40 units	60 units
303 to 379 liters [80 to 100 gallons]	4.74 liters [5 qt]	4.74 liters [5 qt]
	50 units	75 units

Last Modified: 29-Aug-2019

Trainings ▾

General Information

The following publications can be purchased:

Bulletin Number	Title of Publication
5504581	X15 CM2450 X124B – Efficiency Series and X15 CM2450 X134B – Performance Series Owners Manual
5504582	X15 CM2450 X124B – Efficiency Series Operation and Maintenance Manual
5504583	X15 CM2450 X124B – Efficiency Series Service Manual
5504584	X15 CM2450 X124B Fault Code Troubleshooting Manual
5504585	X15 CM2450 X124B Wiring Diagram
5613372	X15 CM2450 X134B - Performance Series Operation and Maintenance Manual
5613373	X15 CM2450 X134B - Performance Series Service Manual
5613374	X15 CM2450 X134B Wiring Diagram
5613375	X15 CM2450 X134B Fault Code Troubleshooting Manual
3379009	Operation of Diesel Engines in Cold Climates
5411406	Fluids for Cummins® Products Service Manual
5467581	Aftertreatment Selective Catalytic Reduction (SCR) Reuse Guidelines

Trainings ▾

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> (<https://store.cummins.com>)

Last Modified: 11-Feb-2020

Trainings ▾

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.

Last Modified: 10-Jul-2023

Trainings ▾

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

Last Modified: 13-Dec-2016

Trainings ▾

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.

Last Modified: 04-Jun-2012

Trainings ▾

Specifications

General Engine Specifications

Horsepower	Refer to the engine dataplate
Displacement	15 liters [912 C.I.D.]
Bore and Stroke	137 mm [5.40 in] x 169 mm [6.65 in]
Firing Order	1-5-3-6-2-4
Crankshaft Rotation (viewed from front of engine)	Clockwise

Engine Speed

400 to 500 hp	Refer to the engine dataplate
500 to 600 hp	Refer to the engine dataplate

Engine Weight

Dry Engine	1343 kg [2961 lb]
Wet Engine	1425 kg [3142 lb]

Overhead Adjustment

Intake Valve	0.36 mm [0.014 in]
Exhaust Valve	0.69 mm [0.027 in]
Engine Brake	7.00 mm [0.276 in]

Trainings ▾

Specifications

Maximum Fuel Drain Line Pressure

High Idle	102 mm-Hg [4 in-Hg]
Loaded Condition	203 mm-Hg [8 in-Hg]

Maximum Fuel Inlet Restriction

At Gear Pump Inlet (Dirty Filter, Loaded Condition)	254 mm-Hg [10 in-Hg]
At original equipment manufacturer (OEM) Connection (Dirty Filter, Loaded Condition)	203 mm-Hg [8 in-Hg]

Minimum Gear Pump Pressure

During Cranking Condition	193 kPa [28 psi]
During Rated Condition	1000 kPa [145 psi]

Filter Pressure Drop

Maximum	600 kPa [87 psi]
---------	------------------

Minimum Lift Pump Pressure

At Gear Pump Inlet (During Cranking)	69 kPa [10 psi]
--------------------------------------	-----------------

Engine Cranking Speed

Minimum	150 rpm
---------	---------

Last Modified: 21-Mar-2019

Trainings ▾

Specifications

Oil Pressure

At Idle (minimum allowable at 93°C [200°F] oil temperature)	68 kPa [10 psi]
---	-------------------

At No-Load Governed Speed

Oil Pressure	241 to 324 kPa [35 to 47 psi]
--------------	---------------------------------

Oil Temperature	93°C [200°F]
-----------------	----------------

Pressure Drop Across Oil Filter

Maximum Allowable	172 kPa [25 psi]
-------------------	--------------------

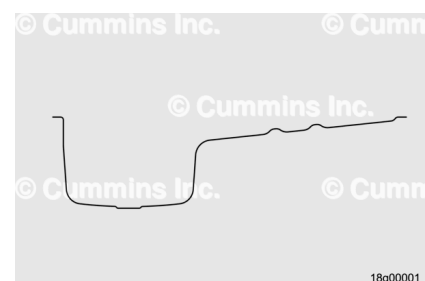
Oil Pan Drain

Fitting Size	M27x2 STOR
--------------	------------

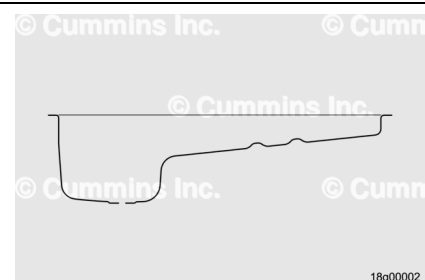
The lubricating oil change fill volume is the amount of oil added if the lubricating oil pan has been fully drained for a service event then refilled for operation. Lubricating oil fill volumes are unique to the installed dipstick of the engine being serviced.

If the lubricating oil change fill volume is **not** known:

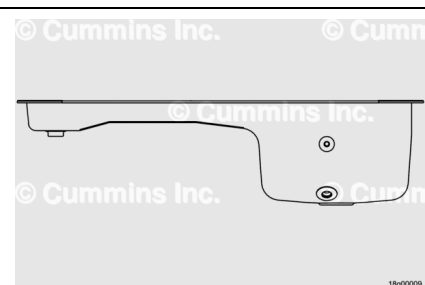
- Contact a Cummins® Distributor/Dealer
- Determine the capacity of the lubricating oil pan option for the engine being serviced by using QuickServe™ Online (QSOL) and the engine serial number.
- Fill the lubricating oil pan to the smallest lubricating oil pan capacity listed for the engine being serviced. Then add 0.95 liters [1 U.S. qt] of lubricating oil at a time until the lubricating oil reaches the high mark on the lubricating oil dipstick. Record the number of liters/quarts or lubricating oil added, so the lubricating oil capacity is known the next time the lubricating oil is drained.



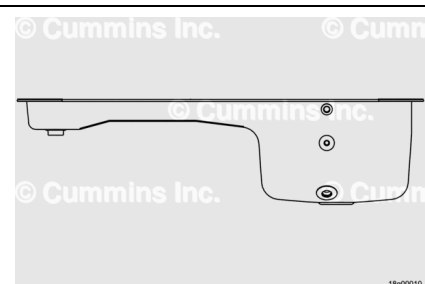
Steel and Front Sump Style			
Lubricating Oil Pan Capacity		Lubricating Oil Filter Capacity	Total Lubricating Oil Capacity
Low	Maximum		
34.1 liters [9.0 U.S. gal]	41.6 liters [11.0 U.S. gal]	2.2 liters [0.6 U.S. gal]	46.8 liters [12.4 U.S. gal]



Steel and Front Sump Style			
Lubricating Oil Pan Capacity		Lubricating Oil Filter Capacity	Total Lubricating Oil Capacity
Low	Maximum		
34.1 liters [9.0 U.S. gal]	41.6 liters [11.0 U.S. gal]	2.2 liters [0.6 U.S. gal]	46.8 liters [12.4 U.S. gal]

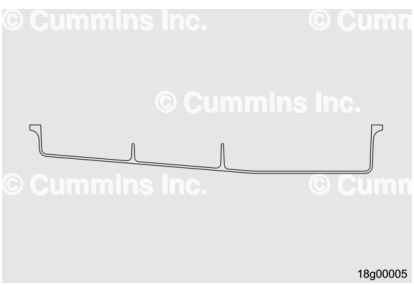


Steel and Rear Sump Style			
Lubricating Oil Pan Capacity		Lubricating Oil Filter Capacity	Total Lubricating Oil Capacity
Low	Maximum		
34.1 liters [9.0 U.S. gal]	41.6 liters [11.0 U.S. gal]	2.2 liters [0.6 U.S. gal]	46.8 liters [12.4 U.S. gal]

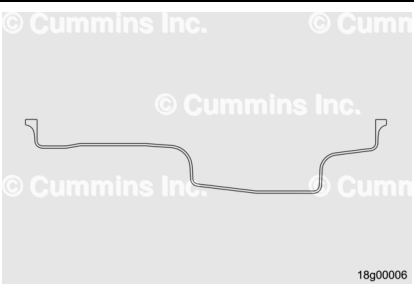


Steel and Rear Sump Style			
Lubricating Oil Pan Capacity		Lubricating Oil Filter Capacity	Total Lubricating Oil Capacity
Low	Maximum		
34.1 liters [9.0 U.S. gal]	41.6 liters [11.0 U.S. gal]	2.2 liters [0.6 U.S. gal]	46.8 liter [12.4 U.S. gal]

Aluminum and Rear Sump Style			
Lubricating Oil Pan Capacity		Lubricating Oil Filter Capacity	Total Lubricating Oil Capacity
Low	Maximum		
43.5 liters [11.5 U.S. gal]	47.3 liters [12.5 U.S. gal]	2.2 liters [0.6 U.S. gal]	48.1 liters [12.7 U.S. gal]



Aluminum and Rear Sump Style			
Lubricating Oil Pan Capacity		Lubricating Oil Filter Capacity	Total Lubricating Oil Capacity
Low	Maximum		
36.0 liters [9.5 U.S. gal]	43.5 liters [11.5 U.S. gal]	2.2 liters [0.6 U.S. gal]	48.7 liters [12.9 U.S. gal]



Last Modified: 16-Apr-2024

Trainings ▾

General Information

Cummins Inc. recommends the use of fully-formulated antifreeze or coolant containing a precharge of supplemental coolant additive (SCA) for the X15 CM2450 X124B engine. The antifreeze or coolant **must** meet the specifications outlined in the Technology and Maintenance Council (TMC) Recommended Practice (RP) 329 (ethylene glycol) or Recommended Practice (RP) 330 (propylene glycol). The use of fully-formulated antifreeze or coolant significantly simplifies cooling system maintenance.

Copies of Technology and Maintenance Council (TMC) specifications can be obtained through Cummins Inc., or by contacting:

Technology and Maintenance Council
American Trucking Association
2200 Mill Road
Alexandria, VA 33314-5388
Phone: (703) 838-1763
Fax (703) 836-6070

Fully-formulated antifreeze contains balanced amounts of antifreeze, SCA, and buffering compounds, but does **not** contain 50 percent water. Fully-formulated coolant contains balanced amounts of antifreeze, SCA, and buffering compounds already premixed 50/50 with deionized water.

Alternative maintenance practices for cooling systems can be found in Cummins® Coolant Requirements and Maintenance, Bulletin 3666132 (</qs3/pubsys2/xml/en/bulletin/3666132.html>).

Specifications

Coolant Capacity

Engine Only	26.5 liters [28 qt]
-------------	---------------------

Standard Modulating Thermostat

Temperature Range	82 to 93°C [180 to 200°F]
-------------------	---------------------------

Maximum Coolant Pressure

Exclusive of Pressure Cap, Closed Thermostat @ Maximum No-load Governed Speed	434 kPa [63psi]
--	-----------------

Coolant Alarm Activation Temperature

Ratings Below 565 Horsepower	107°C [225°F]
------------------------------	---------------

Ratings of 565/600 Horsepower	110°C [230°F]
-------------------------------	---------------

Maximum Allowable Top Tank Temperature

Ratings Below 565 Horsepower	107°C [225°F]
------------------------------	---------------

Ratings of 565/600 Horsepower	110°C [230°F]
-------------------------------	---------------

Minimum Recommended Top Tank Temperature

Temperature	70°C [160°F]
-------------	--------------

Draw Down

Minimum Allowable	11 Percent
-------------------	------------

Pressure Cap

Minimum Recommended	103 kPa [15 psi]
---------------------	------------------

Fill Rate

Minimum Without Low-Level Alarm	19 liters/min [5 gpm]
---------------------------------	-----------------------

Deaeration Time

Maximum Time	25 minutes
--------------	------------

Fan-ON

Coolant Temperature	99°C [210°F]
---------------------	--------------

Intake Air Temperature	93°C [200°F]
------------------------	--------------

Shutter Opening Temperature

Coolant	96°C [205°F]
---------	--------------

Intake Air	104°C [220°F]
------------	---------------

Winterfronts

Air Passage Area	774 cm ² [120 in ²]
------------------	--

Last Modified: 18-Mar-2019

Trainings ▾

Specifications

Fleetguard® filters are manufactured by Cummins Filtration Inc., which is a subsidiary of Cummins Inc. Fleetguard® filters are developed through joint testing at Cummins Inc. and at Cummins Filtration Inc. Fleetguard® filters are standard on new Cummins® engines. Cummins Inc. recommends their use.

Fleetguard® products meet all Cummins Inc. 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 Type	
Lubricating Oil Filter	
Cummins® Part Number	4367100
Fleetguard® Part Number	LF14000NN
Lubricating Oil Filter - Extended Life	
Cummins® Part Number	5575298
Fleetguard® Part Number	LF14001NN
Spin-On Suction Fuel Filter	
Cummins® Part Number	3685711
Fleetguard® Part Number	FS19764
Spin-On Pressure Fuel Filter	
Cummins® Part Number	5599456
Fleetguard® Part Number	FF5825NN
Spin-On Pressure Fuel Filter - Extended Life	
Cummins® Part Number	5575143
Fleetguard® Part Number	FF5971NN
Coolant Filter	

Filter Type	
Fleetguard® Part Number	WF2126 ¹
	WF2127 ²
Diesel Exhaust Fluid Filter	
Cummins® Part Number	4388378

1. This filter is designed for extended service intervals up to 80,467 km [50,000 mi] when using TMC RP329/RP330 or American Society for Testing and Materials (ASTM) D6210 coolants that meet Cummins® Engineering Standard (CES) 14603. The filter is designed for cooling systems up to 49 liters [13 gal]. Refer to Cummins® Coolant Requirements and Maintenance, Bulletin 3666132 (/qs3/pubsys2/xml/en/bulletin/3666132.html).
2. This filter has been designed for extended service intervals of 80,467 to 241,402 km [50,000 to 150,000 mi]. It has no chemical additives, as it contains zero units of DCA4 and can be used in the following systems:
 - Cooling systems of any capacity
 - See maintenance chart below.

When using WF2127 filter, the following volumes of liquid treatment **must** be added at the designated distances/intervals.

Cooling System Capacity	80,467 km [50,000 mi] Service Interval with RP329/330 Coolant or Treated Water (DCA2 or DCA4)	241,402 km [150,000 mi] Service Interval with ES Compleat™ Coolant (ES Extender Liquid)
0 to 57 liters [0 to 15 gal]	0.95 liters [1 qt]	0.95 liters [1 qt]
	10 units	15 units
58 to 114 liters [16 to 30 gal]	1.89 liters [2 qt]	1.89 liters [2 qt]
	20 units	30 units
115 to 170 liters [31 to 45 gal]	2.84 liters [3 qt]	2.84 liters [3 qt]
	30 units	45 units
171 to 227 liters [46 to 60 gal]	3.79 liters [4 qt]	3.79 liters [4 qt]
	40 units	60 units
228 to 284 liters [61 to 75 gal]	4.74 liters [5 qt]	4.74 liters [5 qt]
	50 units	75 units
285 to 341 liters [76 to 90 gal]	5.69 liters [6 qt]	5.69 liters [6 qt]
	60 units	90 units
342 to 397 liters [91 to 105 gal]	6.63 liters [7 qt]	6.63 liters [7 qt]
	70 units	105 units

Note : Filters must meet Cummins Inc. SAM 10,769. Fleetguard® filters meet Cummins Inc. SAM 10,769. The standard filter is Fleetguard® WF2126. For systems larger than 379 liters [100 gal], use 0.94 liters [1 qt] per 57 liters [15 gal]. Consult the vehicle manufacturer for total cooling system capacity information.

Last Modified: 30-Jan-2023

Trainings ▾

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. (/qs3/pubsys2/xml/en/bulletin/4021566.html)

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.

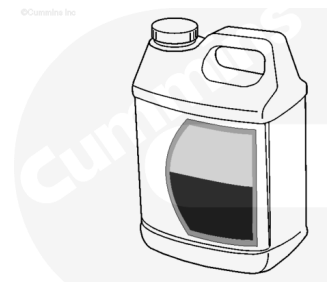


11900149

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).



11800284

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.

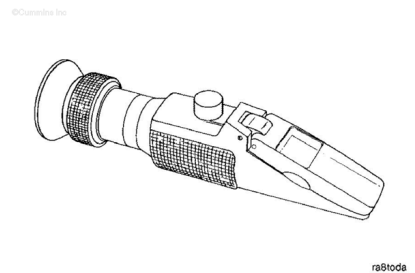
Percent Urea Concentration: 32.5 +/- 0.7%

The specification listed above takes into consideration the refractometer tool tolerances, variability, 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.

Last Modified: 24-Feb-2023

Trainings ▾

Fuel Recommendations

⚠ WARNING ⚠

Do not bleed the fuel system of a hot engine; this can result in fuel spilling onto a hot exhaust manifold, which can cause a fire.

⚠ 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 ⚠

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

Fuel Recommended Properties

Cummins Inc. recommends the use of fuels that meet the following specifications:

Property	Recommended Specifications
Viscosity (ASTM D445)	1.3 to 4.1 centistokes [1.3 to 4.1 mm per second] at 40°C [104°F].
Cetane Number (ASTM D613)	40 minimum above 0°C [32°F]. 45 minimum below 0°C [32°F].
Sulfur Content (ASTM D129 or D1552)	Not to exceed 0.05 mass percent for engines without aftertreatment devices. For engines with aftertreatment devices, sulfur content can not exceed 0.0015 (15 ppm) mass percent.
Active Sulfur (ASTM D130)	Copper strip corrosion not to exceed number 3 rating after three hours at 50°C [122°F].
Water and Sediment (ASTM D1796)	Not to exceed 0.05 volume percent.

Fuel Recommended Properties

Carbon Residue (Rams bottom, ASTM D524 or Conradson, ASTM D189)	Not to exceed 0.35 mass percent on 10 volume percent residuum.
Density (ASTM D287)	42 to 30° API gravity at 0.816 to 0.876 g/cc at 15°C [60°F].
Cloud Point (ASTM D97)	6°C [10°F] below lowest ambient temperature at which the fuel is expected to operate.
Ash (ASTM D482)	Not to exceed 0.02 mass percent (0.05 mass percent with lubricating oil blending). Oil blending is prohibited on engines with aftertreatment devices.
Distillation (ASTM D86)	The distillation curve must be smooth and continuous.
Acid Number (ASTM D664)	Not to exceed 0.1 mg KOA per 100 ml.

1. In addition to the requirements in the Fuel Recommended Properties table, Cummins Inc. strongly recommends the use of fuel with particle counts less than the ISO 4406 code of 18/16/13. Refer to the "Fuel Cleanliness" section of the Fuels For Cummins® Engines, Bulletin 3379001, (/qs3/pubsys2/xml/en/bulletin/3379001.html) for more details.
2. For additional information on fuel recommendations and specifications, refer to Fuels for Cummins® Engines, Bulletin 3379001 (/qs3/pubsys2/xml/en/bulletin/3379001.html). See ordering information in the back of this manual.

Fuel Cleanliness

This section explains the importance of fuel cleanliness to the successful operation of Cummins® Engines.

Modern fuel systems have been developed to improve combustion performance and fuel consumption, and improve engine performance. These high-pressure fuel systems operate at pressures approaching 2600 bar [37,700 psi], and with component match clearances typically from 2- to 5-microns for injectors. At these pressures, very small, hard particles are potential sources of a fuel system malfunction.

Excessive contamination of diesel fuel can cause premature clogging of diesel fuel filters and/or premature wear of critical fuel injection system parts. Depending on the size and nature of the particles, this can lead to:

- Reduced component life
- Component malfunction
- Fuel system and/or engine malfunction.

Determining fuel cleanliness requires measuring both the size and number of particles per size class in the fuel, i.e. the particle size distribution. The International Standards Organization (ISO) has developed a protocol for expressing the level of contamination by coding the size distribution called ISO 4406. ISO 4406 cleanliness codes are expressed as a series of three numbers (x/x/x), which correspond respectively to the number of particles greater than 4-, 6-, and 14-microns. For example, the numbers in the ISO 4406 rating of 18/16/13 translate to:

- 18 - Up to 2500 particles larger than 4µm (per mL of fuel)
- 16 - Up to 640 particles larger than 6µm (per mL of fuel)
- 13 - Up to 80 particles larger than 14µm (per mL of fuel).

ISO 4406		
ISO Code	Number of Particles per mL	
	More Than	Up to and Including
24	80,000	160,000
23	40,000	80,000
22	20,000	40,000
21	10,000	20,000
20	5000	10,000
19	2500	5000
18	1300	2500
17	640	1300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.3	2.5
7	0.64	1.3
6	0.32	0.64
5	0.16	0.32
4	0.08	0.16
3	0.04	0.08
2	0.02	0.04
1	0.01	0.02

ISO 4406		
ISO Code	Number of Particles per mL	
	More Than	Up to and Including
0	0.005	0.01
00	0.0025	0.005

Engine builders and fuel injection equipment manufacturers have found that the particles greater than 4-microns and greater than 6-microns are particularly critical to the durability of the fuel injection system. They also recognize that the fuel systems **must** tolerate hard particles smaller than 4-microns that are difficult to filter out, even with the finest filtration. To maximize the efficiency and effectiveness of filtration, Cummins Inc. has adopted the recommendation of the World Wide Fuel Charter that fuel supplied to engines⁽¹⁾ meet the ISO 4406 code of 18/16/13 maximum for respectively 4-, 6-, and 14-micron particle sizes.

Cummins Inc. recommends that if the fuel does **not** meet the ISO cleanliness code of 18/16/13 when supplied to the engine⁽¹⁾, additional filtration be applied before the fuel is delivered to the equipment's fuel tank. A Cummins® Distributor or Cummins Filtration™ representative can supply hardware and additional filtration guidance and can recommend countermeasures such as improved fuel quality from the fuel supplier, and/or better fuel handling, storage, dispensing, and fuel tank cleaning techniques.

1. Fuel quality **must** be assessed at the inlet to the suction side fuel filter.

Requirements for Using Biodiesel Fuel in Cummins® Engines

Refer to Fuels for Cummins® Engines, Bulletin 3379001

(/qs3/pubsys2/xml/en/bulletin/3379001.html), for details on acceptable biodiesel blends.

Last Modified: 21-Mar-2019

Trainings ▾

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.

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 359-009 in Section 3.

(/qs3/pubsys2/xml/en/procedures/564/564-359-009.html)

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 Standard (CES) 20086 (such as Valvoline™ Premium Blue™ One Solution™ Gen2). Refer to Procedure 359-001 in Section 3. (/qs3/pubsys2/xml/en/procedures/564/564-359-001.html)

Fuel Economy

- For fuel economy sensitive applications, Cummins Inc. recommends the use of a high quality 10W-30 viscosity heavy duty engine lubricating oil that meets the requirements of CES 20087 (such as Valvoline™ Premium Blue™ 8700 FE).

Severe Engine Operation

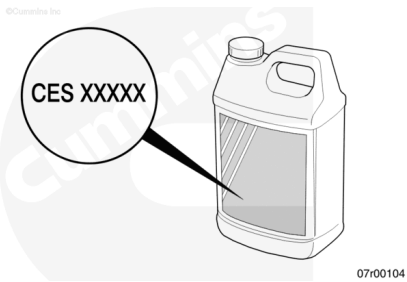
- For severe applications, the engine is compatible with 15W-40 viscosity heavy duty engine lubricating oil that meets the requirements of CES 20086 (such as Valvoline™ Premium Blue™ One Solution™ Gen2).

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, refer to the latest revision of Cummins® Engine Oil and Oil Analysis Recommendations, Bulletin 3810340 (/qs3/pubsys2/xml/en/bulletin/3810340.html).

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

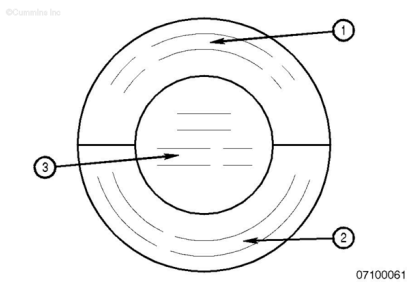


1. Reference the label on the backside of the lubricating oil container.
2. Contact the lubricating oil manufacturer.
3. Reference the list of registered lubricating oils for each CES. Visit QuickServe® Online (quickserve.cummins.com).

Use the following internet link:

https://quickserve.cummins.com/qs3/qsol/service/serviceproducts/oil_registration.html
(https://quickserve.cummins.com/qs3/qsol/service/serviceproducts/oil_registration.html)

The American Petroleum Institute (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 Society of Automotive Engineers (SAE) oil viscosity grade.

American Petroleum Institute (API) Classification ¹	Cummins® Engineering Standard (CES)
CJ-4	CES 20081
CK-4	CES 20086
FA-4	CES 20087

¹ Cummins Inc. recommends engine lubricating oils that are registered to the applicable 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

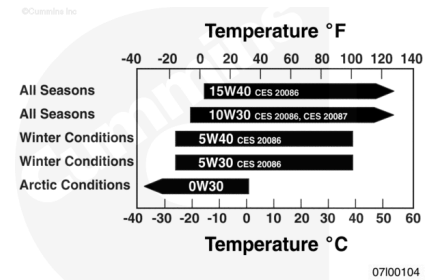
- 15W-40 is compatible for improved engine durability at extremely high ambient temperatures.

5W-40

- 5W-40 is compatible for the improved flow in cold ambient conditions.

0W-40, 0W-30

- 0W-30 synthetic oils that meet API Group III and Group IV basestocks can be used in operations where the ambient temperature never exceeds 0°C [32°F]. 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-30 oils in high-load situations.



AfterMarket Oil Additive Usage

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

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 lubricating oil that will be used during normal operation.

Last Modified: 02-Jun-2020

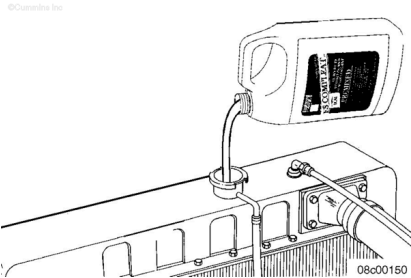
Trainings ▾

Fully Formulated Coolant/Antifreeze

Note : Low-silicate antifreeze meeting America Society of Testing and Materials (ASTM) D4985 is inadequate for extended service intervals of 50,000 to 150,000 miles.

Cummins Inc. recommends using either a 50/50 mixture of good-quality water and fully formulated antifreeze, or fully formulated coolant when filling cooling system. Fully formulated antifreeze or coolant **must** meet Cummins Engineering Standard (CES)14603 specifications.

Refer to Service Bulletin, Cummins® Coolant Requirements and Maintenance, Bulletin 3666132 (/qs3/pubsys2/xml/en/bulletin/3666132.html), for more engine coolant specifications.



Good-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 Quality	
Calcium Magnesium (Hardness)	Maximum 170 ppm as (CaCO ₃ + MgCO ₃)
Chloride	Maximum 40 ppm as (Cl)
Sulfate	Maximum 100 ppm as (SO ₄)

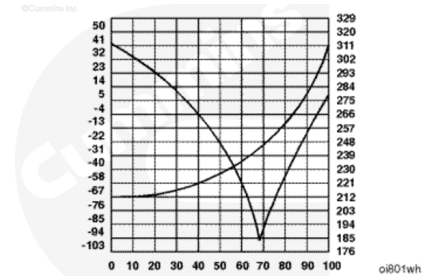
Cummins Inc. recommends the use of Fleetguard® Compleat ES™. It is fully formulated and meets or exceeds following standards:

- CES14603
- ASTM D6210
- TMC RP329

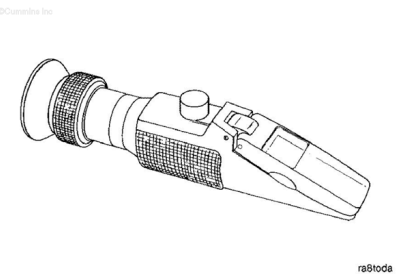


- TMC RP330.

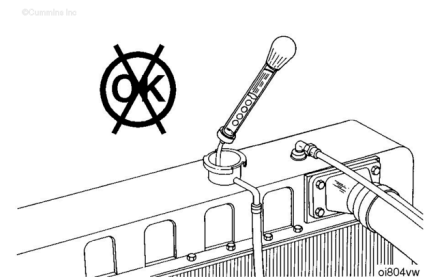
Fully formulated antifreeze **must** be mixed with good quality water at a 50/50 ratio (40 percent to 60 percent working range). A 50/50 mixture of antifreeze and water gives a -36°C [-33°F] freezing point and a 110°C [230°F] boiling point, which is adequate for locations in North America. Actual lowest freezing point of ethylene glycol antifreeze occurs at 68 percent. Using higher concentrations of antifreeze will raise freezing point of solution and increase the possibility of a silica gel problem.



A refractometer **must** be used to measure freezing point of coolant accurately.



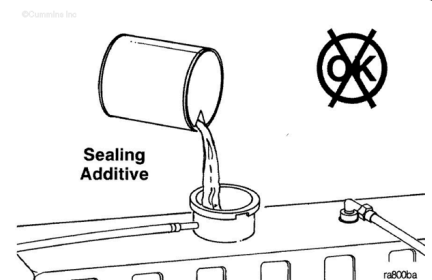
Do **not** use a floating ball hydrometer. Use of a floating ball hydrometer can give an incorrect reading.



Cooling System Sealing Additives

Do **not** use sealing additives in cooling systems. Use of sealing additives can:

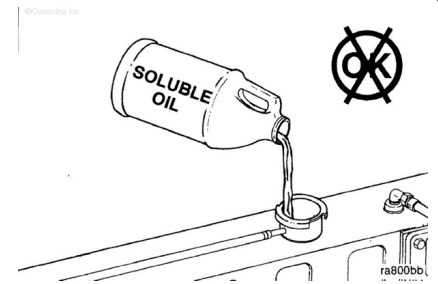
- Buildup in coolant low-flow areas
- Clog coolant filters
- Plug radiators and oil coolers.



Cooling System Soluble Oils

Do **not** use soluble oils in cooling system. Use of soluble oils can:

- Allow cylinder liner pitting.
- Corrode brass, aluminum, and copper.
- Damage heat transfer surfaces.
- Damage seals and hoses.

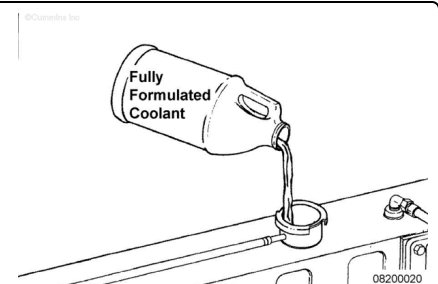


Supplemental Coolant Additive (SCA)

⚠ CAUTION ⚠

These engines use aluminum parts that are in contact with the coolant. Improper coolant, coolant filter selection, and maintenance will likely result in corrosion of any of these parts. Insufficient concentration of the coolant additives will result in liner pitting and engine failure.

Fully formulated products contain SCAs and are required to protect cooling system from scale and fouling, solder corrosion, and general corrosion. Coolant filter is required to protect cooling system from abrasive materials, debris, and precipitated coolant additives.



Fleetguard® DCA4 Service Filters and Liquid Precharge

Note : Filters must meet Cummins SAM 10769. Fleetguard® filters meet SAM 10769. Standard filter is Fleetguard® WF2126. For systems larger than 100 gallons, use 1 quart per 15 gallons. Consult vehicle manufacturer for total cooling system capacity.

WF2126 - This filter is designed for service intervals up to 80,467 km [50,000 miles] and is used for cooling systems up to 20 gallons. This filter contains 8 units of DCA4 Plus.

WF2127 - This filter has been designed for extended service intervals of 80,467 km [50,000] to 241,402 km [150,000 miles]. It has no chemical additives and can be used in the following systems:

- Cooling systems above 20 gallons in capacity
- See maintenance chart below.

When using WF2127 filter, following volumes of treatment listed in table **must** be added at designated mileages.

Cooling System Capacity	80,467 km [50,000 miles] - Standard service interval with fully formulated standard service coolant. Use standard SCA such as Fleetguard® DCA2 or DCA4.	241,402 km [150,000 miles] - Extended service interval with fully formulated extended service coolant. Use extender SCA such as Fleetguard® ES extender liquid. DCA4 can also be used.
0 to 76 liters [0 to 20 gallons]	0.98 liters [1 qt]	0.95 liters [1 qt]
	10 units	15 units
76 to 152 liters [20 to 40 gallons]	1.89 liters [2 qt]	1.89 liters [2 qt]
	20 units	30 units
152 to 227 liters [40 to 60 gallons]	2.84 liters [3 qt]	2.84 liters [3 qt]
	30 units	45 units
227 to 303 liters [60 to 80 gallons]	3.79 liters [4 qt]	3.79 liters [4 qt]
	40 units	60 units
303 to 379 liters [80 to 100 gallons]	4.74 liters [5 qt]	4.74 liters [5 qt]
	50 units	75 units

Testing SCA Concentration Level CC-2602 Test Kit

Carefully follow instructions to test coolant. Take appropriate action recommended by kit.

- Coolant sample to be tested **must** be between 10°C [50°F] and 54°C [130°F]. If sample is too cold or too hot, results will be incorrect.
- To get best color match results, compare test strip pads to color chart in daylight or under cool white fluorescent lighting. If unsure about a specific color match when a test does fall

between two colors on color chart, choose lower numbered (or lettered) block. It is safer to underestimate results than to overestimate.

- Test strips do have a limited shelf life and are sensitive to humidity and extreme heat. Proper handling and storage is necessary to protect life of strips.
- Keep cap tightly sealed on test strip bottle **except** when removing a strip. Store away from direct sunlight and in an area where temperature will generally stay below 32°C [90°F].
- Do **not** use test strips after expiration date stamped on bottle.
- Discard kit if top pads on unused strips have turned light brown.
- Use one strip at a time and take care **not** to touch any pads on strip. Doing so will contaminate pads and skew test results.
- If strip container is left uncapped for 24 hours, moisture in air will render strips useless, even though no discoloration will be evident.
- **Only** use color chart supplied with kit.
- Following correct test times is very important. Use a clock or stopwatch.
- Do **not** utilize test kit to maintain minimum SCA concentration levels (i.e., 1.5 units).
- When performing service that requires draining the cooling system, take special precautions to collect coolant in a clean non-galvanized container, seal to prevent contamination, and save for reuse.

Probablizer:

- 3318169S Plug - Installs on engine for easy coolant sampling
- 3318168S Cap - Use with Monitor C bottle to sample coolant
- CC2700 Monitor C™ - Use lab analysis of coolant samples for more detailed analysis.

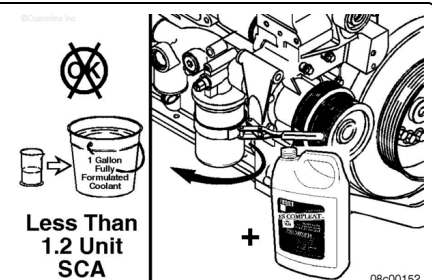
CC2602 Coolant Test Kit

- Works with any SCA formulation. Call 1-800-22FILTER (800-223-4583) if this test kit and color chart does **not** show number of units of SCA per gallon of coolant.)

Test Intervals

⚠ 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.



Testing is recommended if operator is **not** sure of cooling system condition due to leaks, uncontrolled topping off of system, or major coolant loss.

If SCA concentration is below 1.2 units per gallon, replace filter and precharge with liquid.

Check SCA concentration level at least every 6 months, and anytime coolant condition is unknown or corrosion is apparent within cooling system.

Use Fleetguard® Coolant Test Kit, CC2602, to check concentration level. Instructions are included with test kit.

Call following numbers to get answers to any questions about cooling system maintenance:

Cummins Inc.	Fleetguard
1-800-CUMMINS or visit www.cummins.com/custom er-assistance	1-800-22FILTER
1-800-286-6567	1-800-223-4583

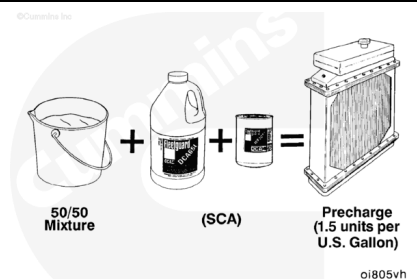
Coolant Replacement Requirements

⚠ WARNING ⚠

Some state and federal agencies have determined that used engine oil can be carcinogenic and cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil. If not reused, dispose of in accordance with local environmental regulations.

⚠ WARNING ⚠

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



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

Drain and flush cooling system after 6000 hours or 3 years of service. However, if Fleetguard®'s ES coolant and ES filters are used, check chloride, sulfate, and pH levels according to Service Bulletin, Coolant Requirements and Maintenance, Bulletin 3666132 (</qs3/pubsys2/xml/en/bulletin/3666132.html>), to determine whether coolant **must** be replaced. Refill with either new fully formulated coolant or ES coolant.

Last Modified: 21-Mar-2019

Bulletin Number: 3381437	Released Date: 11/23
ISX11.9, ISX12, X12, ISX12 G, ISX12N, ISX15, X15 and X15N Series Engines For EPA 2010 And Newer United States And Canada Automotive	

ISX11.9, ISX12, X12, ISX12 G, ISX12N, ISX15, X15 and X15N Series Engines For EPA 2010 And Newer United States And Canada Automotive

Coverage

Products Warranted

This Warranty applies to EPA 2010 and newer ISX11.9, ISX12, X12, ISX12 G, ISX12N, ISX15, X15 and X15N Series Engines sold by Cummins Inc. and delivered to the first user on or after October 1, 2009, that are used in automotive on-highway applications in the United States* and Canada, except for Engines used in bus and coach, recreational vehicle and fire apparatus/crash truck applications, for which different Warranty Coverage is provided.

Base Engine Warranty

The Base Engine Warranty covers any failures of the Engine which result, under normal use and service, from defects in Cummins material or factory workmanship (Warrantable Failure). This Coverage begins with the sale of the Engine by Cummins and ends two years or 250,000 miles (402,336 kilometers) or 6,250 hours of operation, 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, diesel exhaust fluid, filter elements, belts, hoses and other maintenance items that are not reusable due to a 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 Operations and Maintenance Manual. Owner is also responsible for providing proof that all recommended maintenance has been performed. Before the expiration of this Coverage, 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 period, 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, diesel exhaust fluid, filter elements and other maintenance items provided during Warrantable 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, "downtime" expenses, cargo damage, fines, all applicable taxes, all business costs and other losses resulting from a Warrantable Failure.

Limitations

Diesel 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

For Cummins Natural Gas engines, fuel must meet Cummins Natural Gas fuel specification (see also Cummins Fuel Bulletin #3379001). 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. Failures resulting in excessive oil consumption are not covered beyond the Base Engine Warranty. 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 or province to province.

Emission Warranty

Products Warranted

This Emission Warranty applies to EPA 2010 and newer ISX11.9, ISX12, X12, ISX12 G, ISX12N, ISX15, X15 and X15N Series 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, 2009.

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 Cummins 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), or 3,000 hours 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

Diesel 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

For Cummins Natural Gas engines, fuel must meet Cummins Natural Gas fuel specification (see also Cummins Fuel Bulletin #3379001). Failures, except those resulting from a defect 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 or fuel, or by water, diesel exhaust fluid, 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.

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

Last Modified: 16-Nov-2023

Bulletin Number: 3381161	Released Date: 8/23
Worldwide Fire Apparatus/Crash Trucks	

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.

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. 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
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.

Last Modified: 24-Aug-2023

Bulletin Number: 3381340	Released Date: 8/23
All Electronic Diesel Engines United States And Canada Recreational Vehicle	

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.

Last Modified: 24-Aug-2023

California Emission Control System Warranty

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.

Last Modified: 02-Nov-2023

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)	Engine Oil Temperature Sensor
DEF Dosing Valve	Compressor Air System
Diesel Oxidation Catalyst	Component
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
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

California CARB Diesel	
Air Handling	On Board Diagnostic (OBD) Malfunction Indicator Lamp (MIL)
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
Barometric Air Pressure Sensor	Fuel Pump
Throttle Actuator/Valve	Injector
Turbocharger Assembly	
Turbocharger Compressor Intake	
Turbocharger Speed Sensor	

Last Modified: 22-May-2018

California Emission Control System Warranty

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.

Last Modified: 17-May-2018

Manual Change History (5504581) X15 CM2450 X124B - Efficiency Series and X15 CM2450 X134B - Performance Series Owners Manual

Date	17-Jul-2019
Section	Back
Procedure Number	5504581-history (/qs3/pubsys2/xml/en/manual/5504581/5504581-history.html)
Procedure Title	Manual Change History
Update Reason	New manual for X15 CM2450 X124B released for use.

Date	27-Jan-2020
Section	Section 3 - Routine Maintenance
Procedure Number	564-359-008 (/qs3/pubsys2/xml/en/procedures/564/564-359-008.html)
Procedure Title	Fuel Filter Intervals
Update Reason	Corrected list item one to note that an Extended Life FF5971NN pressure-side fuel filter is recommended instead of it being required to be equipped in order to achieve the interval.

Date	02-Jun-2020
Section	Section 3 - Routine Maintenance
Procedure Number	564-359-008 (/qs3/pubsys2/xml/en/procedures/564/564-359-008.html)
Procedure Title	Fuel Filter Intervals
Update Reason	Revised short haul and normal interval specifications to correct amount.

Date	02-Jun-2020
Section	Section 3 - Routine Maintenance
Procedure Number	564-359-009 (/qs3/pubsys2/xml/en/procedures/564/564-359-009.html)
Procedure Title	Lubricating Oil and Filter Intervals
Update Reason	In Table 2, revised short haul and normal interval specifications to correct amount.
Date	02-Jun-2020
Section	Section V - Maintenance Specifications
Procedure Number	564-018-003 (/qs3/pubsys2/xml/en/procedures/564/564-018-003.html)
Procedure Title	Lubricating Oil Recommendations and Specifications
Update Reason	Made minor corrections to procedure.
Date	27-Aug-2020
Section	Section E - Engine and System Identification
Procedure Number	564-100-006 (/qs3/pubsys2/xml/en/procedures/564/564-100-006.html)
Procedure Title	Cummins® Product Technology
Update Reason	Added X15 CM2450 X134B - Performance Series information.

Date	24-Mar-2021
Section	Section 1 - Operating Instructions
Procedure Number	564-101-132 (/qs3/pubsys2/xml/en/procedures/564/564-101-132.html)
Procedure Title	Unique Operating Characteristics of an Engine with Advanced Dynamic Efficient Powertrain Technology (ADEPT™ Electronic Features)
Update Reason	Made changes in Predictive Engine Braking, On-Ramp Boost and Predictive Cruise Control Sections. Added a step to Dynamic Power configuration to help with performance issues in the field. Added content for new feature release: Hill Roll Out. Added content for Connectivity module.
Date	10-Mar-2022
Section	Section 3 - Routine Maintenance
Procedure Number	564-359-006 (/qs3/pubsys2/xml/en/procedures/564/564-359-006.html)
Procedure Title	Aftertreatment Diesel Particulate Filter Intervals
Update Reason	Corrected wording in Table 1. Added note that 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.
Date	04-May-2022
Section	Section E - Engine and System Identification
Procedure Number	564-100-001 (/qs3/pubsys2/xml/en/procedures/564/564-100-001.html)
Procedure Title	Engine Identification
Update Reason	Added note that the connectivity module has identification information located on the top. Added corresponding graphic depicting this.

Date	30-Jan-2023
Section	Section V - Maintenance Specifications
Procedure Number	564-018-024 (/qs3/pubsys2/xml/en/procedures/564/564-018-024.html)
Procedure Title	Filter Specifications
Update Reason	Updated pressure side fuel filter part number.
Date	26-Sep-2023
Section	Section 1 - Operating Instructions
Procedure Number	564-101-139 (/qs3/pubsys2/xml/en/procedures/564/564-101-139.html)
Procedure Title	Unique Operating Characteristics of an Engine with a Connectivity Module
Update Reason	Removed unnecessary information from procedure, corrected General Information section.
Date	28-Apr-2025
Section	Section 1 - Operating Instructions
Procedure Number	564-101-047 (/qs3/pubsys2/xml/en/procedures/564/564-101-047.html)
Procedure Title	Unique Operating Characteristics of an Engine with Aftertreatment Diesel Particulate Filter
Update Reason	Fixed broken link in procedure.

Last Modified: 09-May-2025

Cummins Inc.

Box 3005

Columbus, Indiana, U.S.A. 47202

Registered Office

Cummins Ltd.

49 - 51 Gresham Road,

Staines,

Middlesex TW18 2BD,

England

Registration 573951 England

Copyright © 2019

Cummins Inc.

Bulletin 5504581