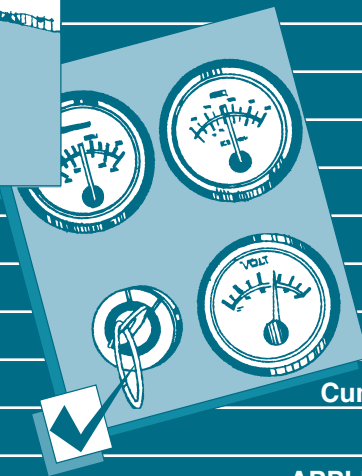
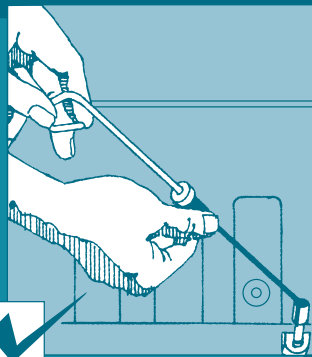
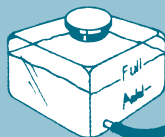




Owners Manual ISL9 CM2350 L101



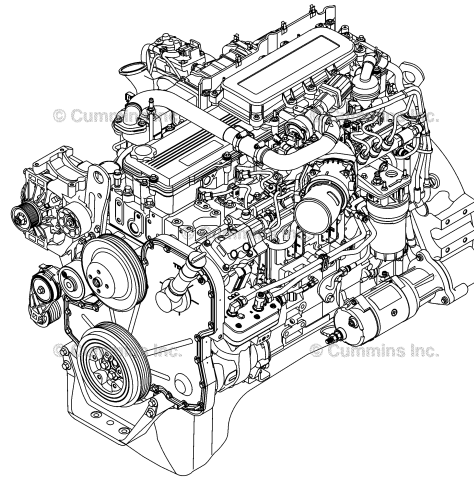
Cummins Customer Assistance Center

1-800-DIESELS™ (1-800-343-7357)

APPLICABLE ONLY IN U.S.A. AND CANADA



Owners Manual ISL9 CM2350 L101



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Foreword

This manual contains information for the correct operation and maintenance of your Cummins® Product.

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

Keep this manual with the equipment. If the equipment is traded or sold, give the manual to the new owner.

The information, specifications, and recommended maintenance guidelines in this manual are based on information in effect at the time of printing. Cummins Inc. reserves the right to make changes at any time without obligation. If you find differences between your product and the information in this manual, contact your local Cummins Authorized Repair Location or call 1-800-DIESELS (1-800-343-7357) toll free in the U.S. and Canada.

The latest technology and the highest quality components were used to produce this product. When replacement parts are needed, we recommend using only genuine Cummins® or ReCon® exchange parts.

NOTE: Warranty information is located in Section W. Make sure you are familiar with the warranty or warranties applicable to your product.

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Important Reference Numbers

Fill in the part name and number in the blank spaces provided below. This will give you a reference whenever service or maintenance is required.

Name	Number	Number
Engine Model		
Engine Serial Number (ESN)		
Control Parts List (CPL)		
Fuel Pump Part Number		
Electronic Control Module (ECM)		
Electronic Control Module Serial Numbers (ECM)		
Filter Part Numbers:		
• Air Cleaner Element		
• Lubricating Oil		
• Fuel		
• Fuel-Water Separator		
• Coolant		
• Crankcase Ventilation		
• Cummins Particulate Filter		
Governor Control Module (GCM) (if applicable)		
Belt Part Numbers:		

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•		
•		
•		
Clutch or Marine Gear (if applicable):		
• Model		
• Serial Number		
• Part Number		
• Oil Type		
• Sea Water Pump		
- Model		
- Part Number		

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Section i - Introduction

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Symbols

General Information

The symbols have been used in this manual to help communicate the intent of the instructions. When one of the symbols appears, it conveys the meaning defined below.

NOTE: It is possible to have four symbols for each text and graphic combination.



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

△CAUTION△

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



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

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



INSPECTION is required.





CLEAN the part or assembly.



PERFORM a mechanical or time **MEASUREMENT**.

LUBRICATE the part or assembly.



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





TIGHTEN to a specific torque.



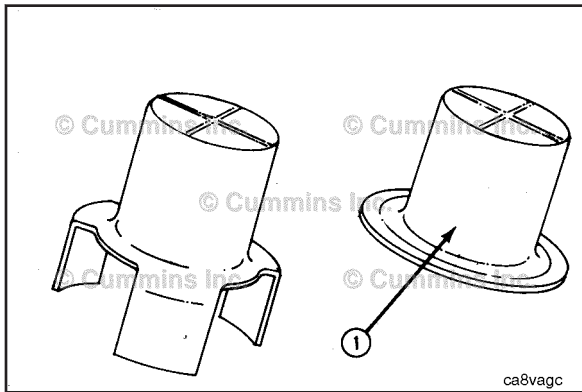
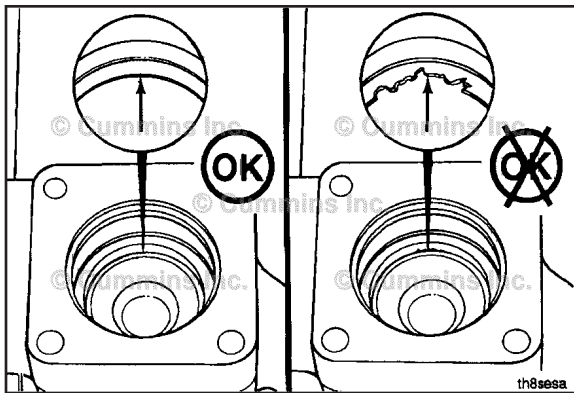
PERFORM an electrical **MEASUREMENT**.

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



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





Illustrations

General Information

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

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

General Safety Instructions

Important Safety Notice



Improper practices, carelessness, or ignoring the warnings can cause burns, cuts, mutilation, asphyxiation or other personal injury or death.

Read and understand all of the safety precautions and warnings before performing any repair. This list contains the general safety precautions that **must** be followed to provide personal safety. Special safety precautions are included in the procedures when they apply.

- Work in an area surrounding the product that is dry, well lit, ventilated, free from clutter, loose tools, parts, ignition sources and hazardous substances. Be aware of hazardous conditions that can exist.
- **Always** wear protective glasses and protective shoes when working.
- Rotating parts can cause cuts, mutilation or strangulation.
- Do **not** wear loose-fitting or torn clothing. Remove all jewelry when working.
- Disconnect the battery (negative [-] cable first) and discharge any capacitors before beginning any repair work. Disconnect the air starting motor if equipped to prevent accidental engine starting. Put a "Do **Not** Operate" tag in the operator's compartment or on the controls.
- Use **ONLY** the proper engine barring techniques for manually rotating the engine. Do **not** attempt to rotate the crankshaft by pulling or prying on the fan. This practice can cause serious personal injury, property damage, or damage to the fan blade(s) causing premature fan failure.
- If an engine has been operating and the coolant is hot, allow the engine to cool before slowly loosening the filler cap to relieve the pressure from the cooling system.

- **Always** use blocks or proper stands to support the product before performing any service work. Do **not** work on anything that is supported **ONLY** by lifting jacks or a hoist.
- Relieve all pressure in the air, oil, fuel, and cooling systems before any lines, fittings, or related items are removed or disconnected. Be alert for possible pressure when disconnecting any device from a system that utilizes pressure. Do **not** check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.
- To reduce the possibility of suffocation and frostbite, wear protective clothing and **ONLY** disconnect liquid refrigerant (Freon) lines in a well ventilated area. To protect the environment, liquid refrigerant systems **must** be properly emptied and filled using equipment that prevents the release of refrigerant gas (fluorocarbons) into the atmosphere. Federal law requires capturing and recycling refrigerant.
- To reduce the possibility of personal injury, use a hoist or get assistance when lifting components that weigh 23 kg [50 lb] or more. Make sure all lifting devices such as chains, hooks, or slings are in good condition and are of the correct capacity. Make sure hooks are positioned correctly. **Always** use a spreader bar when necessary. The lifting hooks **must not** be side-loaded.
- Corrosion inhibitor, a component of SCA and lubricating oil, contains alkali. Do **not** get the substance in eyes. Avoid prolonged or repeated contact with skin. Do **not** swallow internally. In case of contact, immediately wash skin with soap and water. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. IMMEDIATELY CALL A PHYSICIAN. KEEP OUT OF REACH OF CHILDREN.
- Naptha and Methyl Ethyl Ketone (MEK) are flammable materials and **must** be used with caution. Follow the manufacturer's instructions to provide complete safety when using these materials. KEEP OUT OF REACH OF CHILDREN.
- To reduce the possibility of burns, be alert for hot parts on products that have just been turned off, exhaust gas flow, and hot fluids in lines, tubes, and compartments.
- **Always** use tools that are in good condition. Make sure you understand how to use the tools before performing any service work. Use **ONLY** genuine Cummins® or Cummins ReCon® replacement parts.

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- **Always** use the same fastener part number (or equivalent) when replacing fasteners. Do **not** use a fastener of lesser quality if replacements are necessary.
- When necessary, the removal and replacement of any guards covering rotating components, drives, and/or belts should only be carried out by a trained technician. Before removing any guards the engine **must** be turned off and any starting mechanisms **must** be isolated. All fasteners **must** be replaced on re-fitting the guards.
- Do **not** perform any repair when fatigued or after consuming alcohol or drugs that can impair your functioning.
- Some state and federal agencies in the United States of America have determined that used engine oil can be carcinogenic and can cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil.
- Do **not** connect the jumper starting or battery charging cables to any ignition or governor control wiring. This can cause electrical damage to the ignition or governor.
- **Always** torque fasteners and fuel connections to the required specifications. Overtightening or undertightening can allow leakage. This is critical to the natural gas and liquefied petroleum gas fuel and air systems.
- **Always** test for fuel leaks as instructed, as odorant can fade.
- Close the manual fuel valves prior to performing maintenance and repairs, and when storing the vehicle inside.
- Coolant is toxic. If **not** reused, dispose of in accordance with local environmental regulations.
- The catalyst reagent contains urea. Do **not** get the substance in your eyes. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. Avoid prolonged contact with skin. In case of contact, immediately wash skin with soap and water. Do **not** swallow internally. In the event the catalyst reagent is ingested, contact a physician immediately.
- The catalyst substrate contains Vanadium Pentoxide. Vanadium Pentoxide has been determined by the State of California to cause cancer. Always wear protective gloves and eye protection when handling the catalyst assembly. Do not get the catalyst material in your eyes. In Case of contact, immediately flood eyes with large amounts of

water for a minimum of 15 minutes. Avoid prolonged contact with skin. In case of contact, immediately wash skin with soap and water.

- The Catalyst substrate contains Vanadium Pentoxide. Vanadium Pentoxide has been determined by the State of California to cause cancer. In the event the catalyst is being replaced, dispose of in accordance with local regulations.
- California Proposition 65 Warning - Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Acronyms and Abbreviations

General Information

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

ANSI	American National Standards Institute
API	American Petroleum Institute
ASTM	American Society of Testing and Materials
ATDC	After Top Dead Center
BTU	British Thermal Unit
BTDC	Before Top Dead Center
°C	Celsius
CAN	Controller Area Network
CO	Carbon Monoxide
CCA	Cold Cranking Amperes
CARB	California Air Resources Board
C.I.B.	Customer Interface Box
C.I.D.	Cubic Inch Displacement
CNG	Compressed Natural Gas
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
°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
km/l	Kilometers per Liter
kPa	Kilopascal
LNG	Liquid Natural Gas
LPG	Liquified Petroleum Gas

LTA	Low Temperature Aftercooling
MCRS	Modular Common Rail System
MIL	Malfunction Indicator Lamp
MPa	Megapascal
mph	Miles Per Hour
mpq	Miles Per Quart
N•m	Newton-meter
NOx	Mono-Nitrogen Oxides
NG	Natural Gas
O2	Oxygen
OBD	On-Board Diagnostics
OEM	Original Equipment Manufacturer
OSHA	Occupational Safety and Health Administration
PID	Parameter Identification Descriptions
ppm	Parts Per Million
psi	Pounds Per Square Inch
PTO	Power Takeoff
REPTO	Rear Power Take Off
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
VDC	Volts of Direct Current
VGT	Variable Geometry Turbocharger
VS	Variable Speed
VSS	Vehicle Speed Sensor

Section E - Engine and System Identification


Section Contents

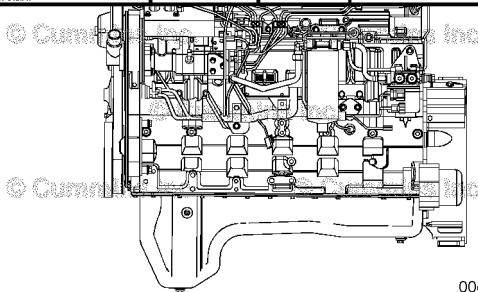
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Engine Identification

Engine Dataplate


 Cummins, Inc. Box 3005 Columbus, Indiana 47203-3005 Warning Injury May Result And Warranty Is Void if Fuel Rate RPM Or Altitude Exceed Published Maximum Values For This Model And Application Date of Mfg. Made in U.S.A.	Engine Cert. I.D.	CJ/D/ L	SERIES	CPL	Engine Serial No.
	Timing TDC				Injector P/N.
	Valve lash/cld int. Exh.				Cust Spec.
	Firing Order				Rated HP at rpm
	Low idle RPM				Fuel rate at rated HP mm 3/stroke
	E.C.S.				Model Name
	© Cummins Inc.				



00d00001

The engine dataplate provides important information about the engine. The engine serial number (ESN) and control part list (CPL) provide information for service and for ordering parts. The engine dataplate **must not** be changed unless approved by Cummins Inc.

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

<p>MANUFACTURED BY CUMMINS INC.</p>  <p>Assembled in the USA © 3967607</p> <p>Date of Mfg:</p> <p>WARNING: Injury may result and warranty is voided if fuel rate, rpm or altitudes exceed published maximum values for this model and application.</p>	<p>1</p> <p>Engine No.</p>	<p>Ref. No.</p>	<p>2</p> <p>MODEL</p>	<p>Fuel Rate at Adv. HP</p>	<p>Mm^3 Stroke</p>	<p>3</p> <p>CPL</p>	
	<p>Idle Speed (rpm)</p>	<p>Advertised HP</p>	<p>at</p>	<p>rpm</p>	<p>Family</p>	<p>FEL</p>	<p>EPA</p>
	<p>Firing Order</p>	<p>Timing - T.D.C.</p>	<p>ELECTRONIC</p>	<p>Catalyst No.</p>	<p>NOx+NMHC</p>		
	<p>Valve lash cold</p>	<p>int.</p>	<p>Exh.</p>	<p>C I. D. /L /</p>	<p>E. C. S.</p>	<p>PM</p>	
	<p>IMPORTANT ENGINE INFORMATION: This engine is exempt from the prohibitions of section 203 (a) (1) (3) & (4) of the Clean Air Act as amended. See exemption label information for exemption no. and effective date.</p>						
	<p>4</p>		<p>5</p>				

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


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ISL9 CM2350 L101
Section E - Engine and System Identification

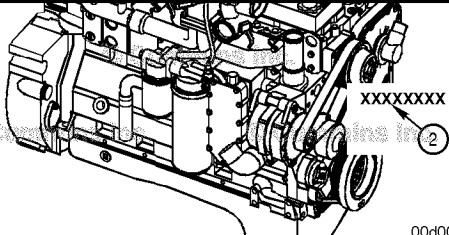
- 4 Valve lash (overhead) setting
- 5 Horsepower and rpm rating.

NOTE: Depending on the manufacturing plant, calibration data may also be found on the engine dataplate.

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

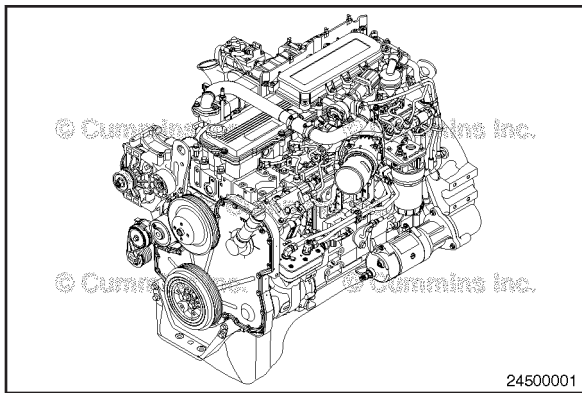
 Cummins, Inc. Box 3005 Columbus, Indiana 47202-3005	Engine Cert. I.D.	C.I.D./ L	SERIES	CPL	Engine Serial No.	
	Timing TDC					
	Valve lash cold	Int.	Exh.	Rated HP	at	rpm
	Piping Order			Rated HP	at	rpm
Low idle RPM		E.C.S.		Model Name		

Warning: Injury May Result And Warranty is Void
if Fuel Rate Exceeds Published
Maximum Values For This Model And Application.
Date of Mfg:
Made in U.S.A.



XXXXXXXX

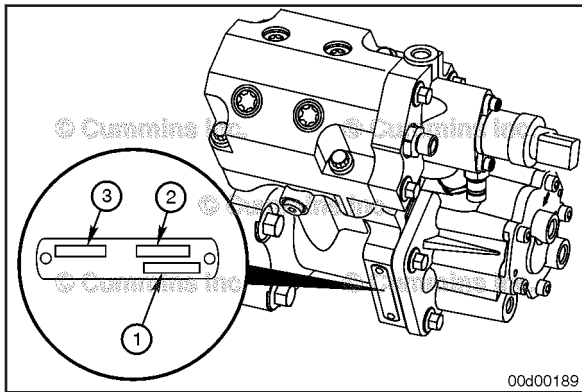
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Cummins® Engine Nomenclature

The Cummins® Service Engine Model Identification procedure describes how to use the Cummins® Service Model Name to identify an engine. Refer to Procedure 100-005 in Section E.

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



Fuel 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.

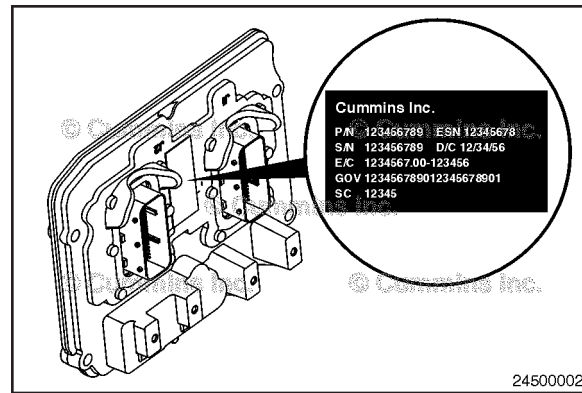
The following information is found on the engine control module dataplate:

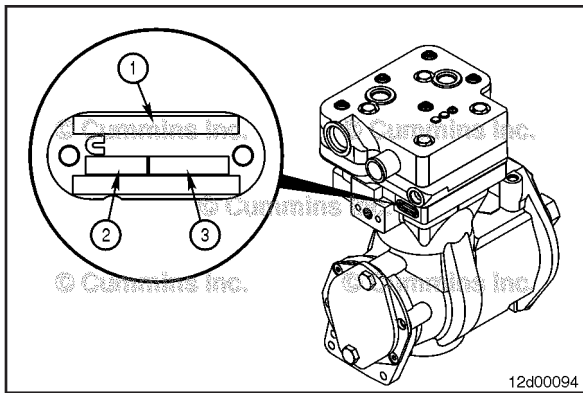
- ECM part number (PN)
- ECM serial number (SN)
- ECM date code (DC)
- Engine serial number (ESN)
- ECM Code: identifies the software in the ECM).

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 CM2350 ECM. A CM2350 engine control module has two 96-pin connectors.





Air Compressor

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

The Cummins® branded air compressor dataplate, identified by the Cummins Inc. logo 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.

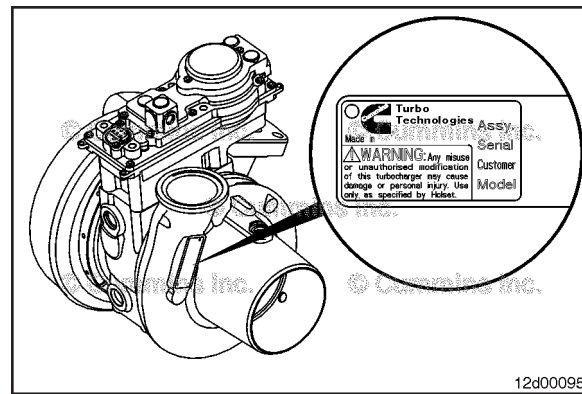
- 1 Cummins® part number
- 2 Date code
- 3 Serial number.

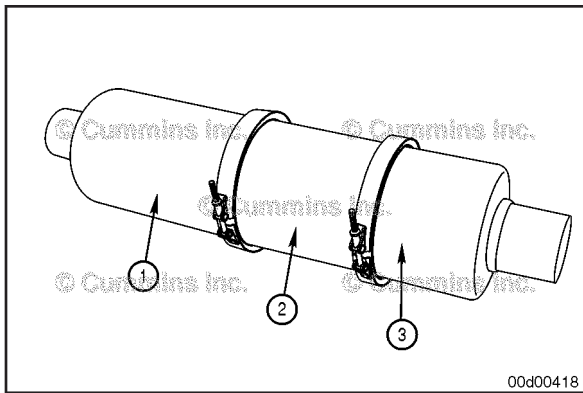
Variable Geometry Turbocharger

The variable geometry turbocharger 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 variable geometry turbocharger is a serviceable component and has a separate dataplate that assists in service or replacement.





Exhaust System

The diesel particulate aftertreatment assembly has important information for service and replacement stamped into the canister.

There are three important stamping locations on the aftertreatment assembly:

- 1 Aftertreatment diesel oxidation inlet/catalyst part number and serial number, located on the inlet/catalyst section
- 2 Aftertreatment diesel particulate filter part number and serial number, located on the filter section.
- 3 Aftertreatment assembly outlet section part number, located on the outlet of the aftertreatment system.

A typical aftertreatment information stamping can provide the following:

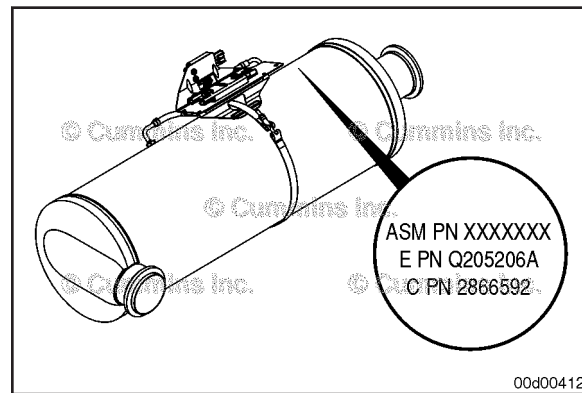
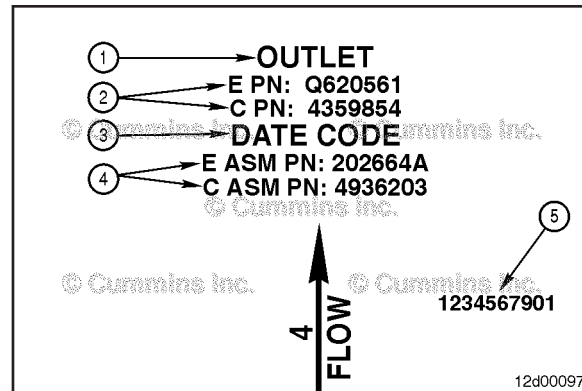
- 1 Section name
- 2 Part number
- 3 Date code
- 4 Assembly number (**only** located on the outlet section)
- 5 Serial number.

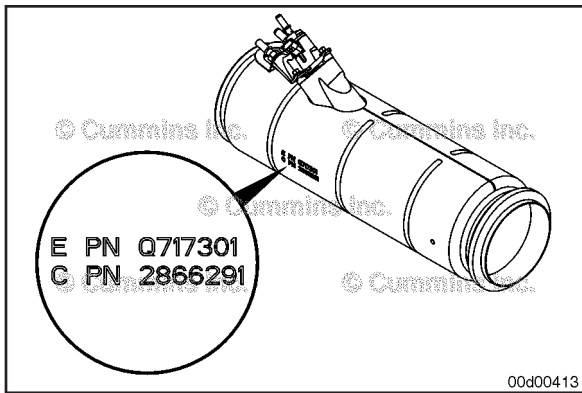
NOTE: Some aftertreatment components could possibly **only** have the Cummins Emission Solutions™ part number for cross referencing and part number identification. Reference to QuickServe® Online.

The aftertreatment selective catalytic reduction catalyst identification is located on the side of the part and contains the following information to assist in service or replacement:

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

NOTE: Some aftertreatment components could possibly **only** have the Cummins Emission Solutions™ part number for cross referencing and part number identification. Reference to QuickServe® Online.





The aftertreatment decomposition tube identification is located on the side of the part and contains the following information to assist in service or replacement:

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

NOTE: Some aftertreatment components may **only** have the Cummins Emission Solutions™ part number for cross referencing and part number identification. Reference to QuickServe® Online.

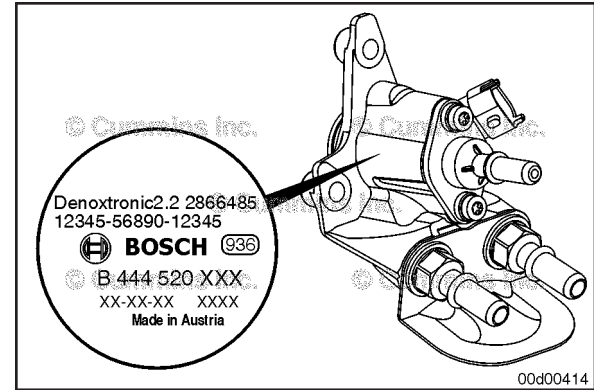
The aftertreatment diesel exhaust fluid dosing valve identification is located on the side of the valve and contains the following information to assist in service or replacement:

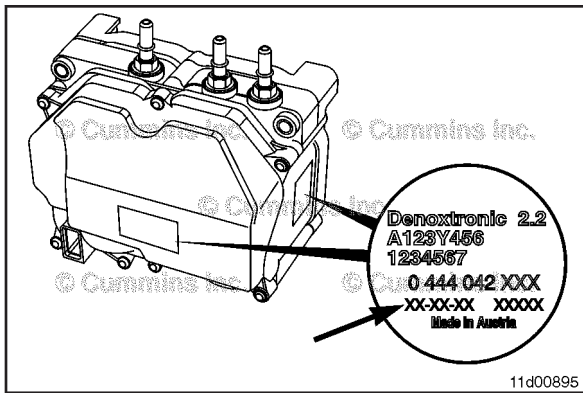
- Cummins® part number
- Cummins Emission Solutions™ part number
- Bosch™ part number
- Bosch™ production data (date code and serial number).

Example:

- 2866485 is the Cummins® part number
- 12345-67890-12345 is the Cummins Emission Solutions™ part number
- B 444 606 XXX is the Bosch™ part number
- XX-XX-XX is the date code
- XXXX is the serial number.

NOTE: Some aftertreatment components may **only** have the Cummins Emission Solutions™ part number for cross referencing and part number identification. Reference to QuickServe® Online.





The aftertreatment diesel exhaust fluid dosing unit identification is located on the side of the part and contains the following information to assist in servicing or replacement:

- Cummins Emission Solutions™ part number
- Cummins® part number
- Bosch™ part number
- Bosch™ production data (date code and serial number).

Example:

- A123Y456 is the Cummins Emission Solutions™ part number
- 1234567 is the Cummins® part number
- 0 444 042 XXX is the Bosch™ part number
- XX-XX-XX is the date code
- XXXXX is the serial number.

NOTE: Some aftertreatment components may **only** have the Cummins Emission Solutions™ part number for cross referencing and part number identification. Reference to QuickServe® Online.

Cummins® Service Engine Model Identification

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.

This includes 2013 and later products.



The form is a detailed identification sheet for Cummins engines. It includes a header with the Cummins logo and 'MANUFACTURED BY CUMMINS INC.' with a date stamp. The main body is a grid of fields for technical specifications. Callouts 1 through 5 point to specific areas: 1 points to the top left header area, 2 points to the 'MODEL' field, 3 points to the 'CPL' field, 4 points to the 'Date of Mfg.' field, and 5 points to the 'Valve lash code' field.

MANUFACTURED BY CUMMINS INC. [Date Stamp]	Engine No.	Ref. No.	MODEL	Fuel Rate at Adv. RPM	Inch ³ Only	CPL	
Idle Speed (rpm)	Advertised HP	of	rpm	Family	FEL	EPA	CARB
Date of Mfg.	Firing Order	Timing D.D.G.	ELECTRONIC	Catalyst No.	HO-HEHC		
Valve lash code	Int.	Ext.	C, I, D, L, /	E, C, S.	PM		

IMPORTANT ENGINE INFORMATION: This engine is exempt from the prohibitions of section 203 (a) (1) (3) & (4) of the Clean Air Act as amended. See exemption label information for exemption no. and effective date.

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
ISX15	ISX15 CM2350 X101

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

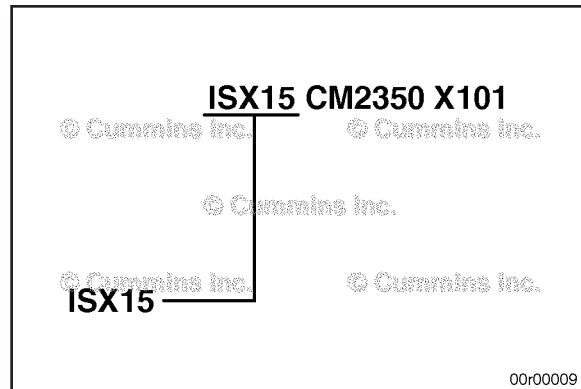
Examples of Cummins® service information and products that use service model names:

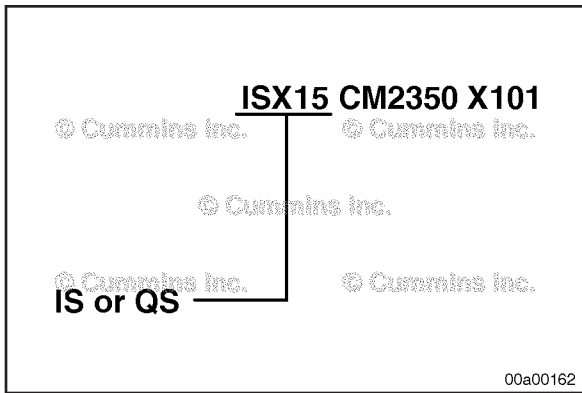
- QuickServe™ Online
- INSITE™ electronic service tool
- Owner's Manual
- Operation and Maintenance Manual
- Master Repair Manual
- Service Manual
- Wiring Diagram
- Fault Code Troubleshooting Manual
- Standard Repair Times
- Technical Service Bulletins
- Service Bulletins

ISL9 CM2350 L101
Section E - Engine and System Identification

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

NOTE: For engines released specifically for the European market, marketing model names may include an “e” between the engine platform designation and the engine liter displacement. Service model names will not display this “e”.





Typically, the first two letters of the marketing model name contain an “IS” or “QS” if the engine is an electronic engine.

“IS” prefix designates an On-Highway automotive engine.

“QS” prefix designates an Off-Highway industrial engine.

NOTE: Not all electronic engines use the “IS” or “QS” prefix. To verify if the engine is an electronic engine, check to see if an electronic control system is listed in the service model name. The control system that is identified as part of the service model name is referenced later in this procedure.

Non-electronic engines do not have an “IS” or “QS” prefix and do not have an electronic control system listed in the service model name.

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

X Series engine

15 Liters in Displacement

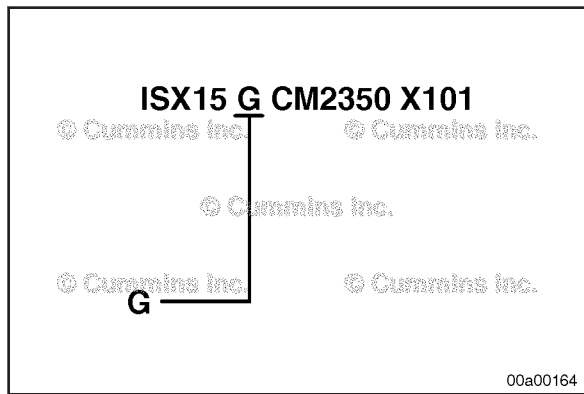
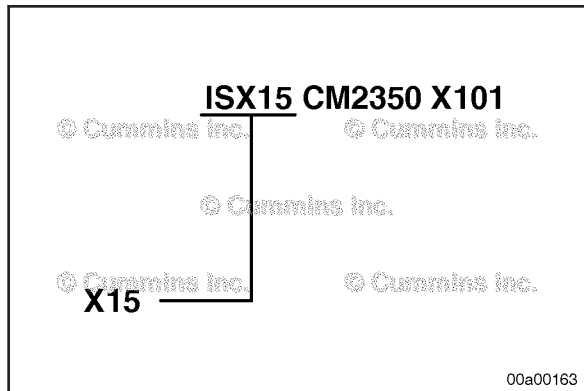
NOTE: Some legacy engines will use the cubic inch rather than liter for engine displacement.

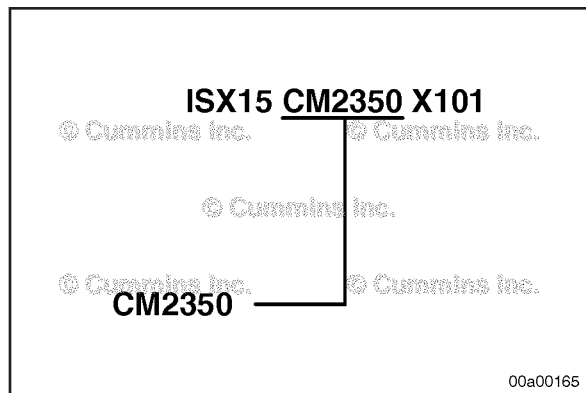
If a “G” indicator is located after the liter displacement, the engine is fueled by natural gas.

NOTE: Not all engines fueled by natural gas will have a “G” located after the displacement.

If a “M” is located after the liter displacement, the engine is in a marine application.

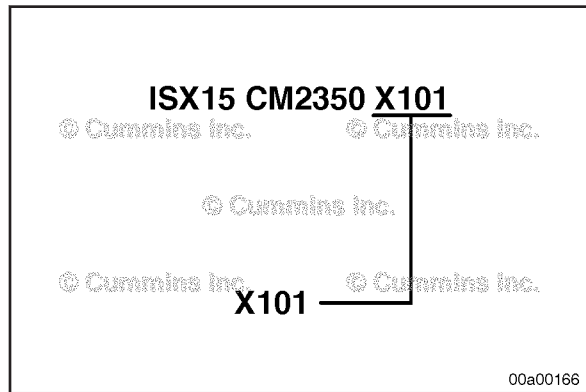
NOTE: Not all engines used in a marine application will have “M” located after the displacement.





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

NOTE: Use of a parenthesis () indicates that either engine control module (ECM) has been used on the product. Use of a slash "/" indicates that the product has multiple ECMs.



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 platform/series are released. The first number is 101.

Cummins® Product Technology

General Information

The service model name for this product is **ISL9 CM2350 L101**.

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

United States and Canada

- Environmental Protection Agency (EPA) 2013
- EPA 2014 Greenhouse Gas.

EPA Product

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

- Charge-Air Cooler.
- Direct Diesel Injection.
- Engine Control Module (ECM).
- Exhaust Gas Recirculation (EGR).
- Oxidation Catalyst.
- Periodic Trap Oxidizer.
- Selective Catalytic Reduction (SCR) - Urea.

- Turbocharger.

This engine uses the following product technology:

Engine

- Number of Cylinders - 6.
- Engine Configuration - Inline.
- Cylinder Block Material - Cast Iron.
- Cylinder Head Material - Cast Iron.
- Camshaft Location - Cylinder Block.
- Engine Brake Option.
- Variable Geometry Turbocharger (VGT) Brake Option.
- REPTO Option.

Electronic Control System

- ECM: CM2350.
- Electrical System Voltage:
 - 12 VDC.
 - 24 VDC.
- Engine Coolant Level Sensor.
- Engine Coolant Temperature Sensor.
- Engine Oil Pressure Switch.

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- Fuel Rail Pressure Sensor.
- Fuel Temperature Sensor.
- Fuel Pump Actuator.
- Water-in-Fuel Sensor.
- Camshaft Position Sensor.
- Crankshaft Position Sensor.
- EGR Differential Pressure Sensor.
- Exhaust Gas Pressure Sensor.
- EGR Temperature Sensor.
- Intake Manifold Pressure/Temperature Sensor.
- Turbocharger Speed Sensor.
- Turbocharger Compressor Intake Pressure/Temperature Sensor.
- Ambient Air Temperature Sensor.
- Aftertreatment Diesel Particulate Filter (DPF) Differential Pressure Sensor.
- Crankcase Pressure Sensor.
- Aftertreatment Exhaust Gas Temperature Sensor.
- Aftertreatment Intake Mono-Nitrogen Oxides (NOx) Sensor.
- Aftertreatment Outlet NOx Sensor.
- Aftertreatment SCR Intermediate NH3 Sensor.

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- Required with Control Parts List (CPL) numbers 3663, 3664, and 3665.
- **Not** required with Control Parts List (CPL) numbers 4524, 4525, and 4526.

Air Handling

- Turbocharger (Single).
 - Variable Geometry.
- Charge-Air Cooler.
- Intake Air Heater.
- Engine Intake Throttle Actuator.
- Air Shutoff Valve.

Fuel System.

- Diesel.
- Common Rail Fuel System.
- Cummins® XPI Common Rail Fuel System.

Exhaust System.

- EGR.
- Aftertreatment Fuel Injection.
 - Internal.
- Diesel Oxidation Catalyst (DOC).
- DPF.

- Full Flow.
- SCR Catalyst.
- Aftertreatment DEF Dosing System.
 - Airless DEF Dosing Unit.
 - Integrated DEF Controller (controlled by the engine's ECM).

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

Automotive

- Truck.
- Fire Truck.
- Bus.
 - Transit Bus.
 - Hybrid Bus.
 - School Bus.
- Recreational Vehicle.

Section 1 - Operating Instructions

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Operating Instructions - Overview

General Information



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

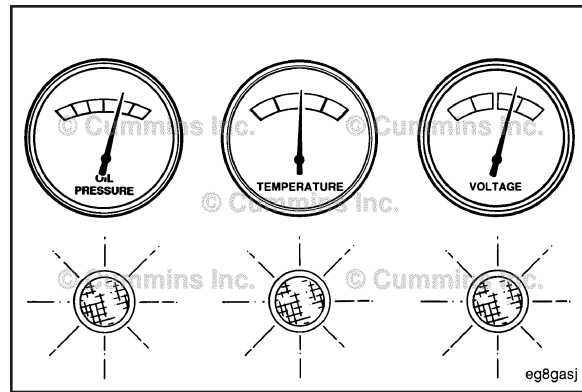
Follow the daily maintenance checks listed in Maintenance Guidelines (Section 2).

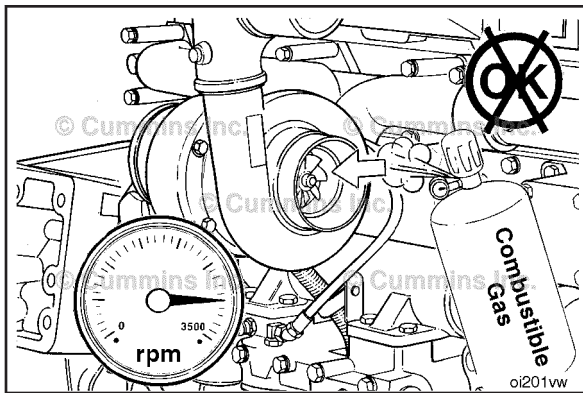
The new Cummins® engine associated with this manual does **not** require a "break-in" procedure. This section of the manual provides all of the necessary information required for proper engine operation.

Check the oil pressure indicators, temperature indicators, warning lights, and other gauges daily to make sure they are operational.



Check the oil pressure, coolant temperatures DEF level, and other engine parameters daily via the OEM front panel to make sure they are operational. Check the panel regularly for any alarm messages. Take appropriate action to rectify the alarm condition or contact your nearest Authorized Cummins® Distributor.





⚠ WARNING ⚠

Do not operate a diesel engine where there are or can BE COMBUSTIBLE vapors. These vapors can be sucked through the air intake system and cause engine acceleration and over speeding that can result in a fire, an explosion, and extensive property damage. Numerous safety devices are available, such as air intake shutoff devices, to minimize the risk of over speeding where an engine, due to its 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 recommends the installation of an air intake shutoff device or a similar safety device to minimize the risk of overspeeding when an engine is operating in a combustible environment, such as due to a fuel spill or gas leak.

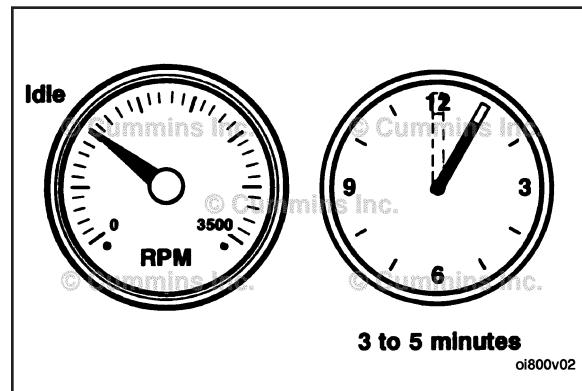
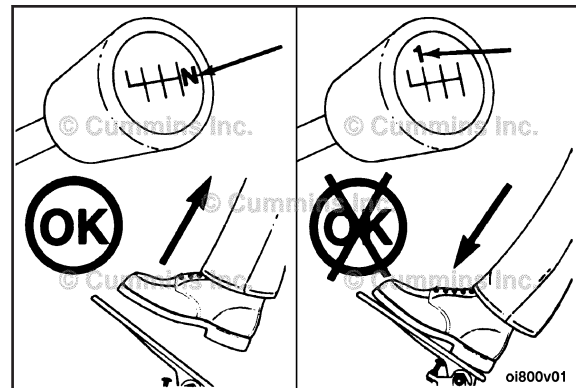
Normal Starting Procedure

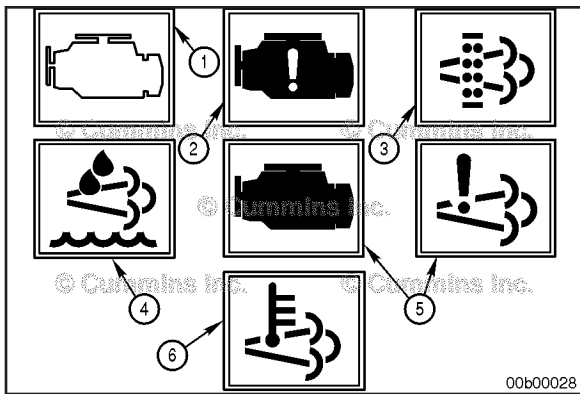
Starting

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

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

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





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

- 1 WARNING (or CHECK ENGINE) lamp, amber in color
- 2 STOP (or STOP ENGINE) lamp, red in color
- 3 AFTERTREATMENT DIESEL PARTICULATE FILTER lamp, amber in color
- 4 AFTERTREATMENT DIESEL EXHAUST FLUID lamp, amber in color
- 5 MALFUNCTION INDICATOR lamp, amber in color.

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

Use the following procedure if any of the lamps remain on or begin to flash. Refer to Procedure 101-048 in Section 1.

▲ CAUTION ▲

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

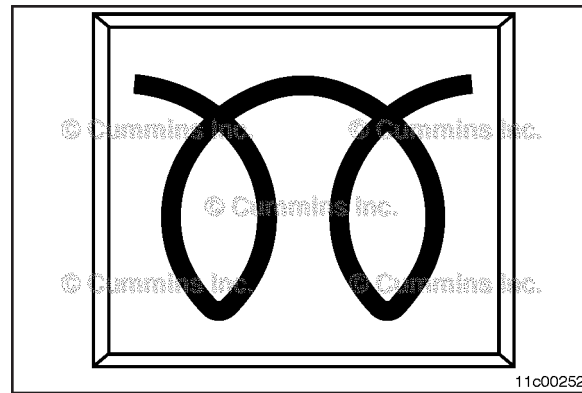
Under cold conditions, the Wait-to-Start lamp (generally a yellow lamp using a symbol similar to the graphic, or the words WAIT TO START) will illuminate at key ON, and will stay on for a period of up to 30 seconds.

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

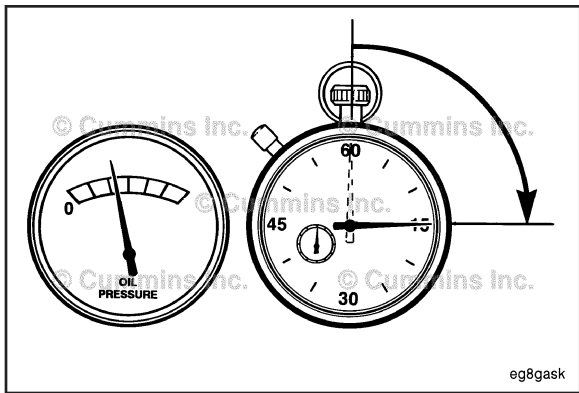
Once the Wait-to-Start lamp turns off, turn the key to the starting position to start the engine.

NOTE: Some vehicles are equipped with an engine starting motor protection feature. If the starting motor is engaged for 30 seconds or more, without the engine starting, the starting motor will stop operating, allowing for proper cooling of the starting motor. During this time, the Wait-to-Start lamp, if equipped, will flash for 2 minutes. Once the lamp stops flashing, the starting motor will be allowed to function.

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

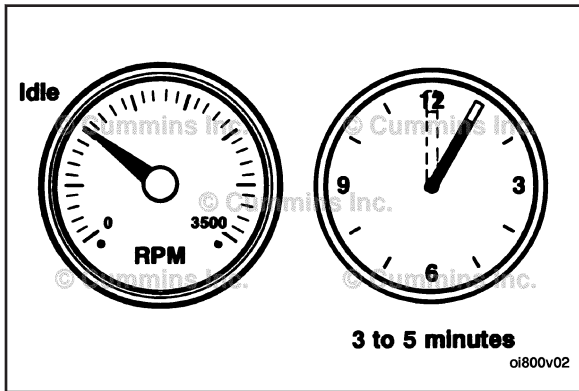


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⚠CAUTION⚠

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



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

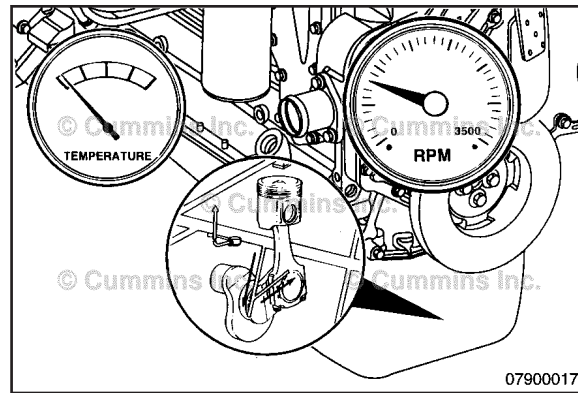
After starting a cold engine, increase the engine speed (rpm) slowly to provide adequate lubrication to the bearings and to allow the oil pressure to stabilize.

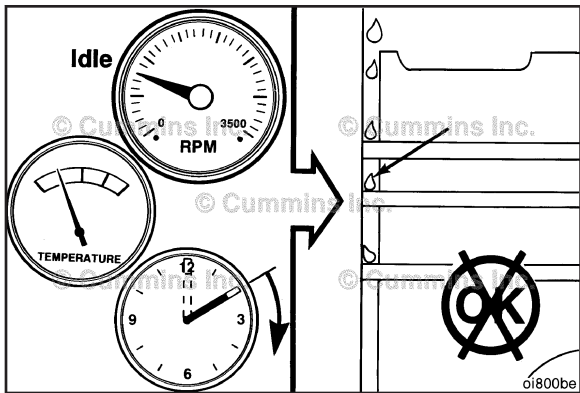
NOTE: For engines equipped with the engine warm-up protection feature; this feature limits engine speed and torque following engine start-up until sufficient oil pressure is available to the engine components. This feature reduces the risk of engine part damage due to operating at engine speeds too high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

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

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

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





⚠ CAUTION ⚠

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

This can result in the following:

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

Jump Starting

⚠ WARNING ⚠

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

⚠ CAUTION ⚠

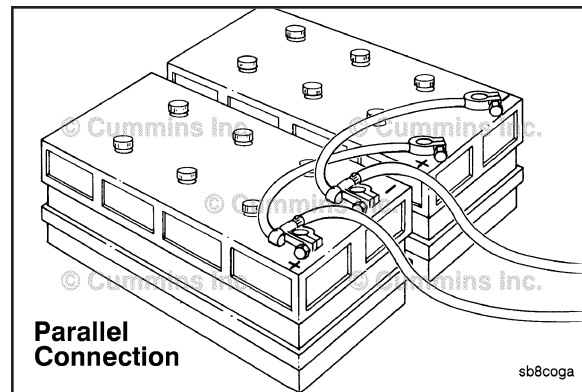
When using jumper cables to start the engine, make sure to connect the cables in parallel: positive (+) to positive (+) and negative (-) to negative (-). When using an external electrical source to start the engine, turn the disconnect switch to the OFF position. Remove the key before attaching the jumper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

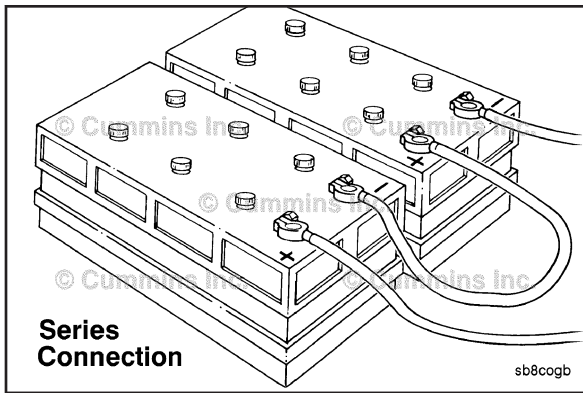
⚠ CAUTION ⚠

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

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

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





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

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

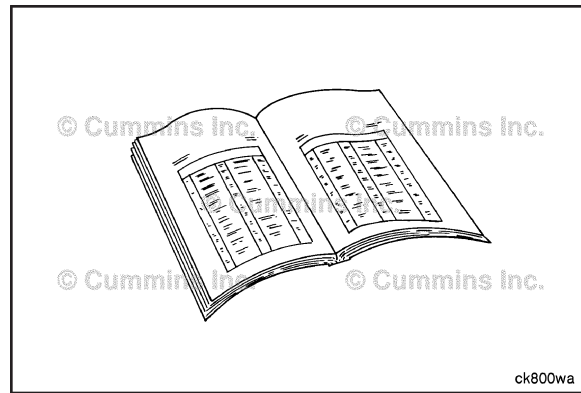
Cold Weather Starting General Information

⚠ CAUTION ⚠

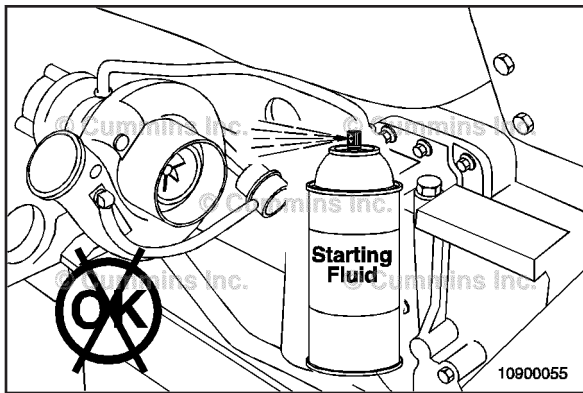
To reduce the possibility of damage to the lubricating oil pan, due to the composite materials used in the manufacture of the lubricating oil pan, under no circumstances should an external heat source be applied directly or indirectly to the lubricating oil pan.

Follow the Normal Starting Procedure in this section. If equipped with an intake air heater, the Wait-To-Start lamp will stay on longer.

Refer to the OEM service manual for any additional cold weather starting procedures.



ck800wa



Using Starting Aids

⚠ WARNING ⚠

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

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

Starting Procedure After Extended Shutdown or Oil Change

General Information

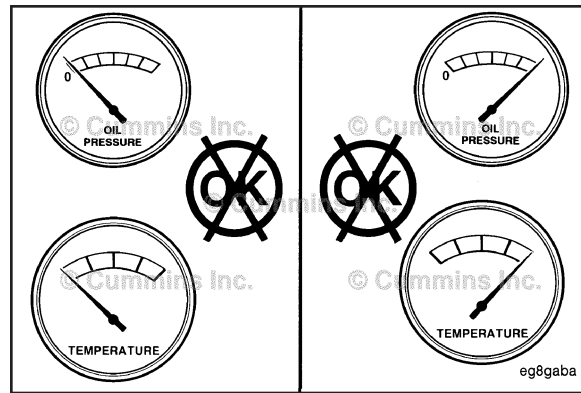
Follow the Normal Starting Procedure in this section. The engine will **not** start until the minimum cranking oil pressure is detected by the ECM. It can take more cranking time to start the engine after an extended shut down or oil change.

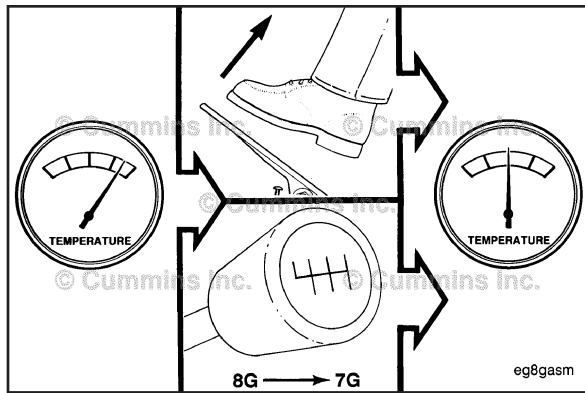
Operating the Engine

Normal

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

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





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

⚠ CAUTION ⚠

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

Internal combustion engines **must not** operate at low idle speed for extended periods of time. This operating condition may 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, it should be done 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.

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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]

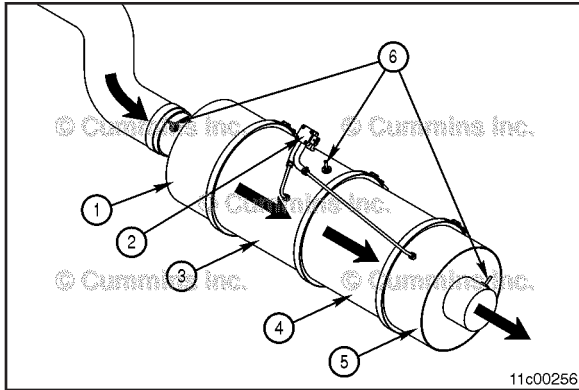
Use 60-percent ethylene glycol antifreeze and 40-percent water for the engine coolant mixture.

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 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).



Unique Operating Characteristics of an Engine with Aftertreatment Diesel Particulate Filter

General Information

The aftertreatment system is used to reduce particulate emissions and is composed of six main components:

- 1 Aftertreatment inlet
- 2 Aftertreatment diesel particulate filter differential pressure sensor
- 3 Aftertreatment diesel oxidation catalyst
- 4 Aftertreatment diesel particulate filter
- 5 Aftertreatment outlet
- 6 Aftertreatment exhaust gas temperature sensors.

The components of the aftertreatment system perform the following functions:

The aftertreatment inlet and outlet adapt the vehicle exhaust piping to the aftertreatment system, and also provide a mounting location for the aftertreatment gas temperature sensors.

The aftertreatment diesel particulate filter differential pressure sensor measures the restriction across the aftertreatment diesel particulate filter.

The aftertreatment diesel particulate filter captures the soot and ash from the engine exhaust.

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

The aftertreatment exhaust gas temperature sensors are used to measure the exhaust gas temperatures at various points in the aftertreatment system.

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 diesel particulate filter and **must** be removed. Soot is removed by a process called regeneration. Ash is removed by removing the aftertreatment diesel particulate filter and cleaning it at specified intervals.

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

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

Ultra low sulfur diesel fuel is required for an engine equipped with an aftertreatment diesel particulate filter. If ultra low sulfur diesel is **not** used, the aftertreatment diesel particulate filter or aftertreatment diesel oxidation catalyst can be damaged.

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

To maximize the maintenance intervals of the aftertreatment diesel particulate filter, Cummins Inc. requires the use of a lubricating engine oil meeting Cummins® Engineering Standard 20081. The use of oil meeting CES 20081 also requires the use of ultra low sulfur diesel fuel to maintain the specified oil drain interval without risk of engine damage.

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

NOTE: Use the following procedure for information on the Maintenance Schedule, which provides the aftertreatment diesel particulate filter cleaning intervals for the engine being serviced. Refer to Procedure 102-002 in Section 2.

Regeneration

Regeneration is the process of converting the soot collected in the aftertreatment diesel particulate filter 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 diesel particulate filter faster than the soot is collected.

Passive regeneration typically occurs when the equipment is operated under heavy loads.

Passive Regeneration

Passive regeneration occurs when the exhaust temperatures are naturally high enough to oxidize the soot collected in the aftertreatment diesel particulate filter faster than the soot is 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 diesel particulate filter faster than it is 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 diesel oxidation catalyst, which creates the heat needed to regenerate the aftertreatment diesel particulate filter.

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 ECM has detected that the aftertreatment diesel particulate filter restriction has reached a specified limit, and may only occur if the vehicle is moving above a speed threshold. The engine ECM 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 kph [5 mph] to 40 kph [25 mph].

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

Active regeneration will occur more frequently in equipment with low load, or stop and go duty cycles

Active regeneration only occurs if the engine ECM has detected that the aftertreatment diesel particulate filter restriction has reached a specified limit. The engine ECM will activate and de-activate active regeneration as needed.

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 equipment OEM.

During active regeneration, the exhaust temperature can be hotter 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.

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

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° [1500°F], which is hot enough to ignite or melt common materials, or to burn people.

Stationary (Parked) Regeneration

Under some operating conditions, such as low speed, low load, or stop and go duty cycles, the engine may **not** have enough opportunity to regenerate the aftertreatment diesel particulate filter during normal vehicle operation. When this occurs, the engine will illuminate the aftertreatment diesel particulate filter lamp to inform the vehicle operator that assistance is required, typically in the form of a stationary (parked) regeneration.

Stationary (parked) regeneration is a form of active regeneration that is initiated by the vehicle operator when the vehicle is **not** moving.

Stationary (parked) regeneration requires an elevated engine speed of approximately 1000 to 1400 RPM. The length of a stationary (parked) regeneration will vary depending on how full the aftertreatment diesel particulate filter is, but will typically take anywhere from 45 minutes to 1.5 hours to complete.

A stationary (parked) regeneration can be initiated one of two ways:

- A vehicle mounted stationary (parked) 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 stationary (parked) regeneration switch will **only** initiate a stationary (parked) regeneration when the aftertreatment diesel particulate filter lamp is illuminated.
- INSITE™ electronic service tool can initiate a stationary (parked) regeneration by starting the "Aftertreatment Diesel Particulate Filter Regeneration Test".



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 the skin. The exhaust and exhaust components can remain hot after the equipment has stopped moving. To avoid the risk of fire, property damage, burns or personal injury, allow the exhaust system to cool before beginning this procedure or repair and make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

To perform a stationary (parked) regeneration, follow the steps listed:

- Select an appropriate location to park the vehicle.
- Choose 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.
- Make sure there are no items within 0.6 m [2 ft] of the exhaust outlet.
- Items that can burn, melt or explode **must** be kept at least 1.6 m [5 ft] from the exhaust outlet (such as gasoline, paper, plastics, fabrics, compressed gas containers, hydraulic lines).
- Make 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, 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 1.6 m [5 ft] from the exhaust outlet during the stationary (parked) 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.
 - PTO or Remote PTO is off.
 - The vehicle speed is 0 MPH.
 - The throttle pedal is released.

- Initiate the stationary (parked) regeneration by toggling the vehicle mounted stationary (parked) regeneration switch or by using INSITE™ electronic service tool.
- Once the stationary (parked) 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 stationary (parked) regeneration as the exhaust temperatures increase.
- When the engine ECM detects that the aftertreatment diesel particulate filter has been regenerated, the engine will automatically return to normal idle speed.
- Monitor the vehicle and surrounding area during the stationary (parked) regeneration. If any unsafe condition occurs, shut OFF the engine immediately.

To stop a stationary (parked) regeneration before it has completed, depress the clutch, brake, or throttle pedal, or turn off the engine.

To stop a manual (non-mission) regeneration before it has completed, depress the clutch, brake, or throttle pedal, set the regeneration permit switch to the Inhibit position, or turn off the engine.

Once the stationary (parked) regeneration is complete, exhaust gas and surface temperatures will remain elevated for 3 to 5 minutes.

Aftertreatment Warm Up

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

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

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

Aftertreatment Switches

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

- A stationary (parked) 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 refer to the vehicle owners manual for the location and presence of these switches.

The stationary (parked) regeneration switch is used to initiate a stationary (or parked) regeneration. Please refer to 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 diesel particulate filter will continue to accumulate soot as the engine operates.

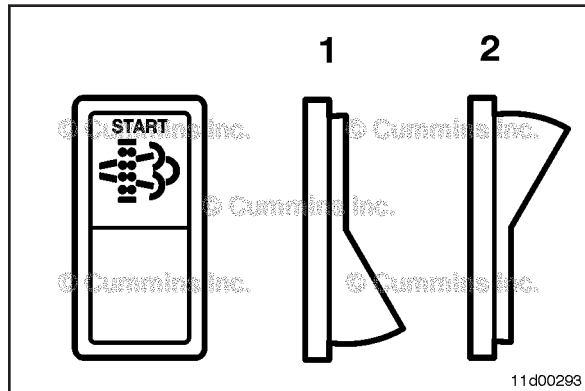
The aftertreatment switches are typically used in two configurations:

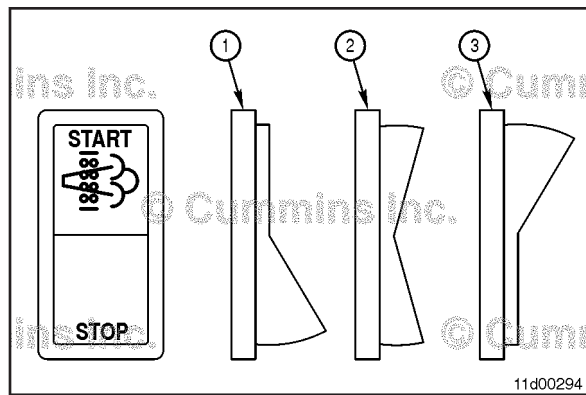
- A two position switch that is used to activate stationary (parked) regeneration.
- A three position switch that is used to activate stationary (parked) regeneration and also disable active regeneration.

The examples below are generic and show two typical switch configurations. Use the vehicle owners 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 stationary (or parked) 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 stationary (or parked) 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 will **not** be allowed.

Engine Indicator Lamps

General Information

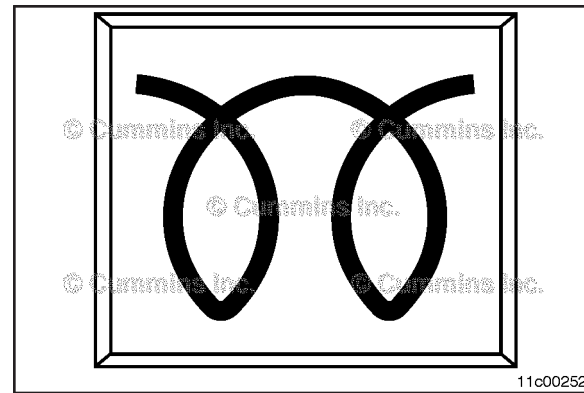
The following engine indicator lamps cover **only** the lamps controlled by the engine control module (ECM). The equipment manufacturer can provide additional indicator lamps. Please refer to the equipment owners manual for additional lamp information.

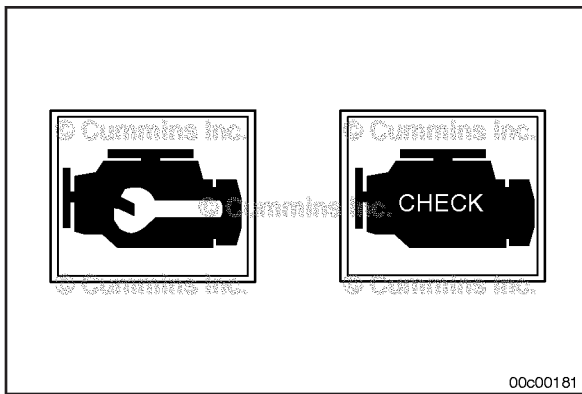
Wait to Start Lamp

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

The WAIT TO START lamp can look like:

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





Check Engine Lamp

The CHECK ENGINE lamp illuminates when the engine needs to be serviced at the first available opportunity.

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

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

Another function of the CHECK ENGINE lamp is to flash for 30 seconds at key ON when one of the following occurs. This flashing function is referred to as the MAINTENANCE lamp. The MAINTENANCE lamp could flash for any of the following reasons:

- Maintenance required (if the Maintenance Monitor is enabled)
- Water-in-fuel is detected
- Coolant level is low.

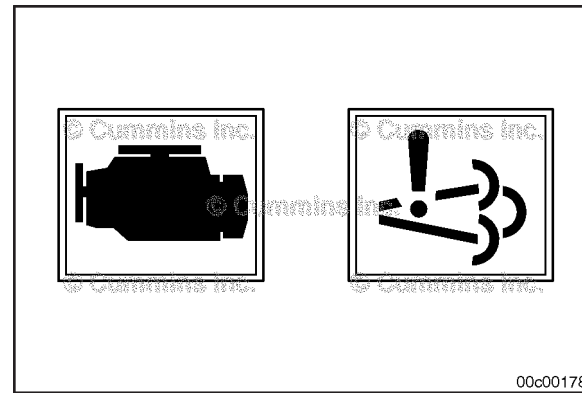
Malfunction Indicator Lamp

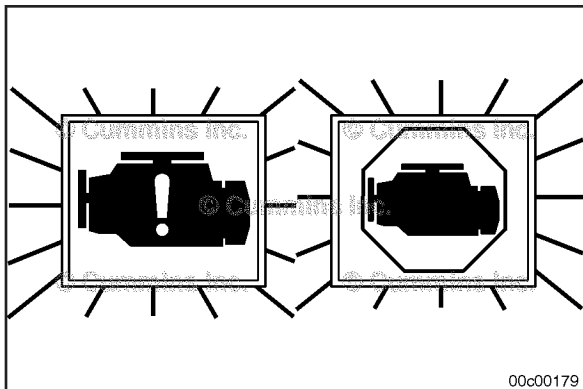
The MALFUNCTION INDICATOR LAMP is amber, and can look like:

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

For applications equipped with On-board Diagnostics, the emissions control system monitors and reports malfunctions that impact the emissions control devices. If the OBD system detects such a malfunction, the on-board diagnostic system illuminates the MALFUNCTION INDICATOR LAMP to indicate that the engine needs to be serviced at the first available opportunity.

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





Stop Engine Lamp

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

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

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

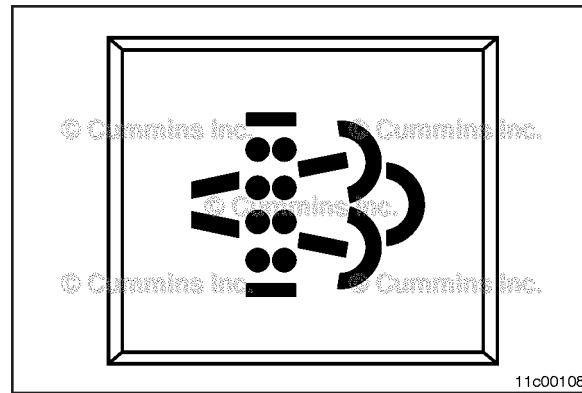
- The words STOP or STOP ENGINE spelled out
- A symbol of an engine with an exclamation point in the center, similar to the graphic illustrated.

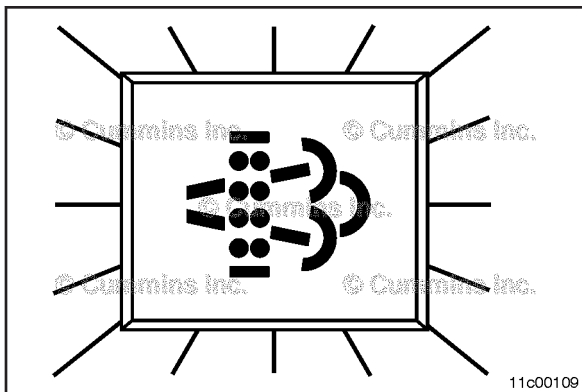
Aftertreatment Diesel Particulate Filter Lamp

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

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

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

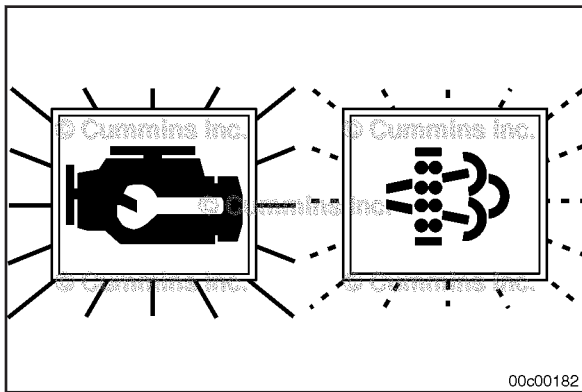




A flashing AFTERTREATMENT DIESEL PARTICULATE FILTER lamp indicates that the aftertreatment diesel particulate filter needs to be regenerated at the next possible opportunity. Engine power may be reduced automatically.

When this lamp is flashing, the operator should:

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



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

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

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

High Exhaust System Temperature Lamp



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

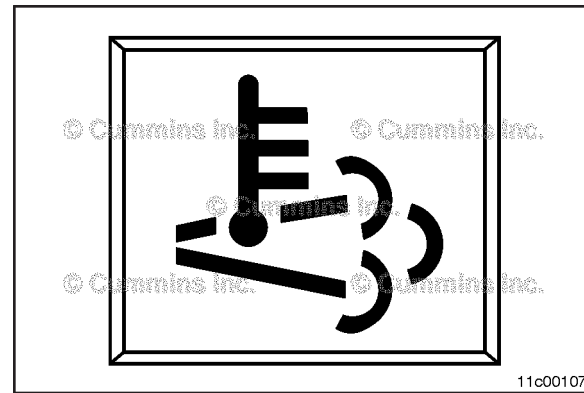
The HIGH EXHAUST SYSTEM TEMPERATURE lamp indicates, when illuminated, that exhaust temperatures are high due to regeneration of the aftertreatment diesel particulate filter. The lamp could illuminate during normal engine operation or during regeneration.

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

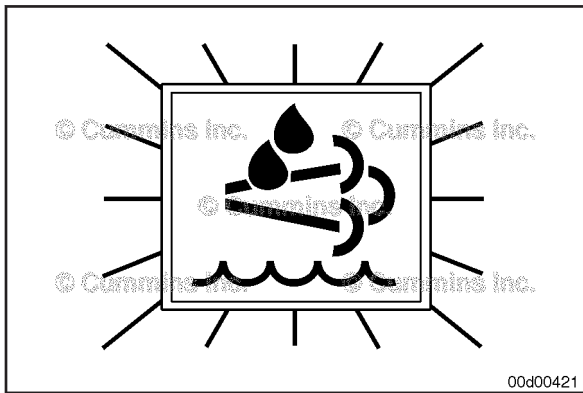
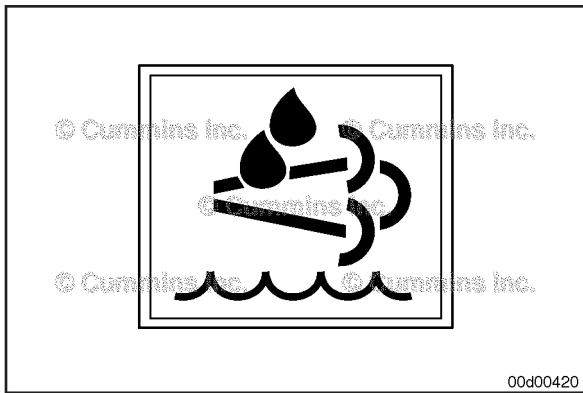
When this lamp is illuminated, be sure the exhaust pipe outlet is **not** directed at any surface or material that can melt, burn, or explode.

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

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



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Aftertreatment Diesel Exhaust Fluid Lamp

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

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

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

A flashing AFTERTREATMENT DIESEL EXHAUST FLUID lamp indicates that the diesel exhaust fluid level has fallen below the critical warning level. This can be corrected by filling the diesel exhaust fluid tank with diesel exhaust fluid.

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

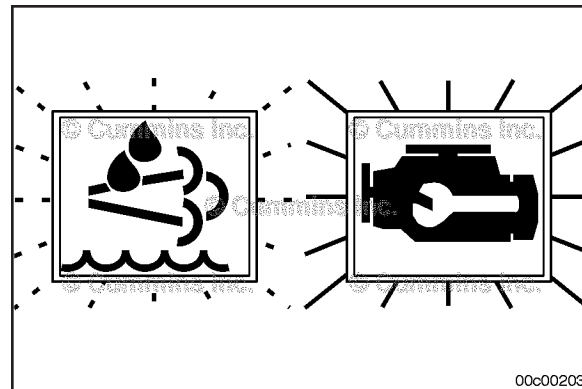
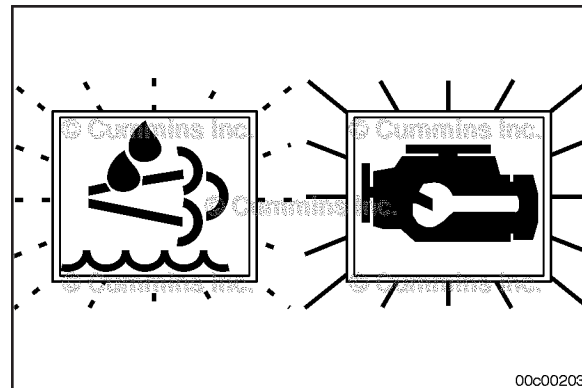
A flashing AFTERTREATMENT DIESEL EXHAUST FLUID lamp combined with an illuminated WARNING or CHECK ENGINE lamp indicates that the diesel exhaust fluid level has fallen below the initial derate level. The engine power will be limited automatically. This can be corrected by filling the diesel exhaust fluid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

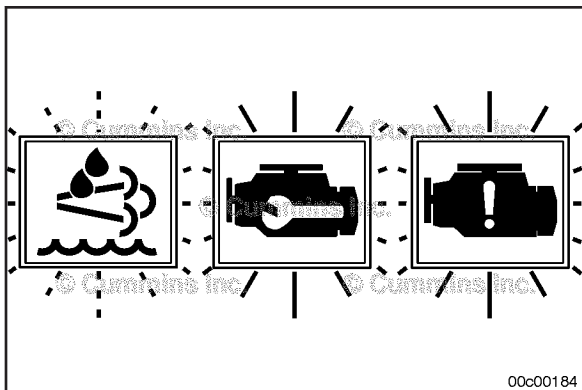
NOTE: It is recommended that the diesel exhaust fluid tank be filled completely full of diesel exhaust fluid in order to correct any fault conditions.

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

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

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





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

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

NOTE: In order to remove the 5 mph speed limit, the diesel exhaust fluid tank must be filled to at least 10 percent volume of the tank.

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

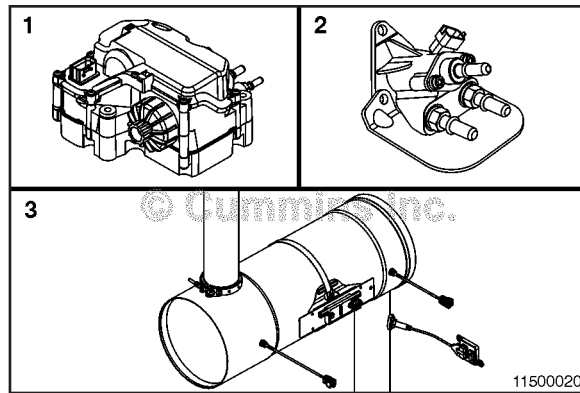
NOTE: The MALFUNCTION INDICATOR LAMP may also be illuminated.

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

General Information

The selective catalytic reduction system is used to decrease the NO_x emissions from the vehicle tailpipe. The system is composed of several main components:

- 1 Aftertreatment diesel exhaust fluid (DEF) dosing unit
- 2 Aftertreatment DEF dosing valve
- 3 Aftertreatment SCR catalyst.



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

DEF is required for an engine equipped with a selective catalytic reduction 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 NO_x emissions over the aftertreatment SCR catalyst to form nitrogen and water.

DEF:

- can have a slight ammonia smell
- is colorless
- is non-toxic and non-polluting
- is non-flammable
- urea is naturally occurring and is biodegradable.

Refer to DEF Recommendations and Specifications in Section V for DEF specifications.

NOTE: Cummins Inc. supplies the aftertreatment DEF dosing unit, aftertreatment DEF dosing valve, and the aftertreatment SCR catalyst. The vehicle manufacturer supplies the DEF tank, the DEF lines, the DEF tank temperature and level sensor, and all wiring between the components.

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

NOTE: Refer to the Maintenance Schedule for the aftertreatment DEF dosing unit filter maintenance interval.

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

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

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The aftertreatment SCR catalyst uses DEF to reduce the NO_x emissions by converting the engine out NO_x into 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, alert the operator to the level of DEF in the 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].

NOTE: See Section 1 for additional information on the aftertreatment diesel fluid lamp and associated engine derates.

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 engine control module (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 purging any unused DEF from the system and returning it to the tank. This is normal system operation. The purge process takes approximately 90 seconds to complete. Do not disconnect the vehicle batteries during this process to avoid system damage.

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

Unique Operating Characteristics of an Engine with Greenhouse Gas Certification

General Information

Beginning in 2013, Cummins® heavy duty diesel automotive engines are compliant with the 2014 Greenhouse Gas Emissions Requirements. These regulations set engine and/or vehicle standards for the emissions of carbon dioxide (CO2), nitrous oxide (N2O), 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 2014 Greenhouse Gas Emissions Requirements can be identified by a sticker, typically located on the vehicle doorjamb.

Vehicles certified under the 2014 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.

Engine Operating Range General Information

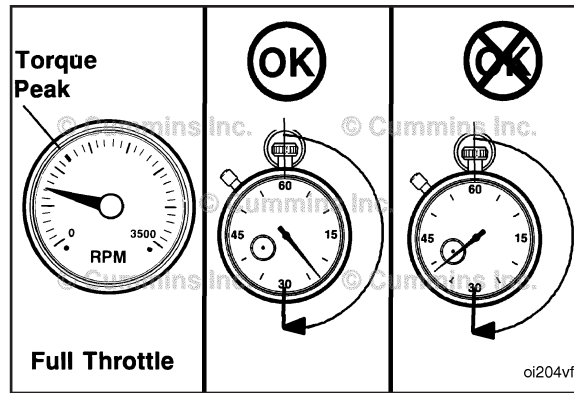
⚠ CAUTION ⚠

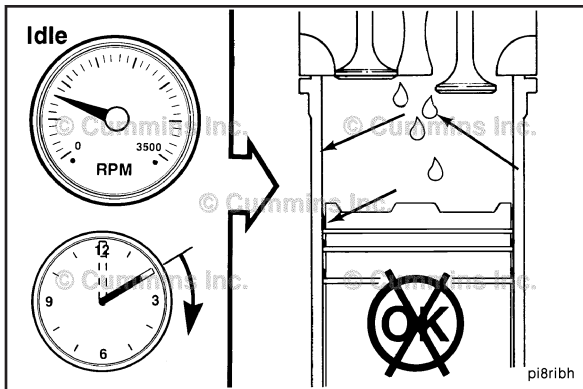
Do not operate the engine at full throttle below peak torque rpm (refer to engine dataplate for peak torque rpm) for more than 30 seconds. Operating the engine at full throttle below peak torque will shorten engine life to overhaul, can cause serious engine damage, and is considered engine abuse.

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 ⚠

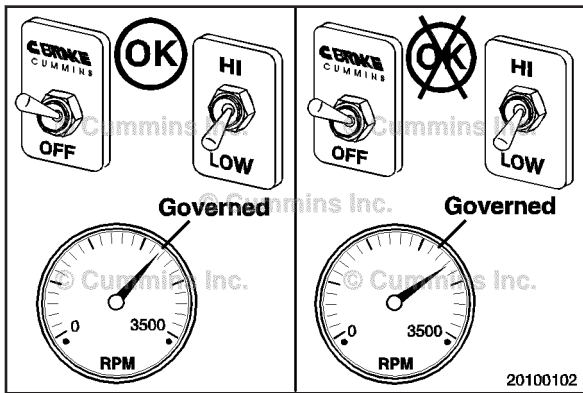
Do not operate the engine beyond the maximum engine speed. Operating the engine beyond the maximum engine speed can cause severe engine damage. Use proper operating techniques for the vehicle, vessel, or equipment to prevent engine overspeed. The maximum engine speed specification is listed in Maintenance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





⚠CAUTION⚠

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



**Engine Braking System
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, see the component manufacturer's manual.

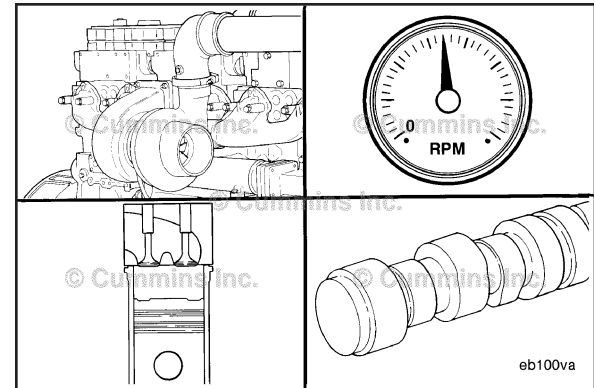
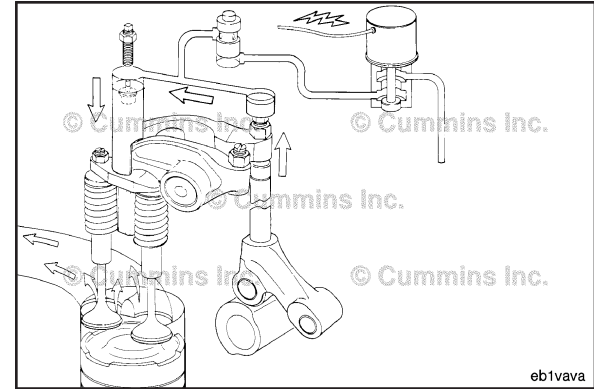
Some engines are equipped with engine brakes.

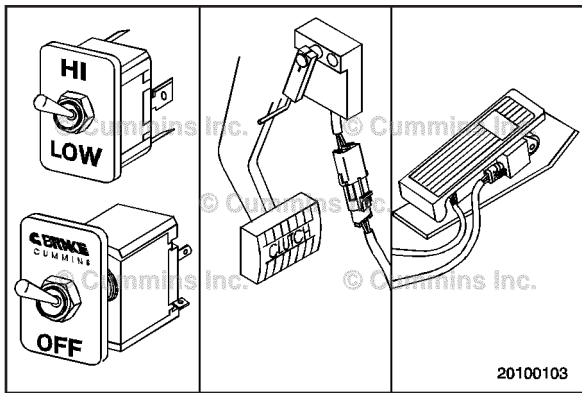
Engine brakes are devices that use the energy of engine compression to provide vehicle retardation. Engine brakes provide the maximum retarding power at rated speed; therefore, gear selection is important.

The engine brakes convert the engine to an energy-absorbing device to reduce vehicle speed.

This is accomplished by a hydraulic circuit that opens the exhaust valves near the end of the compression stroke.

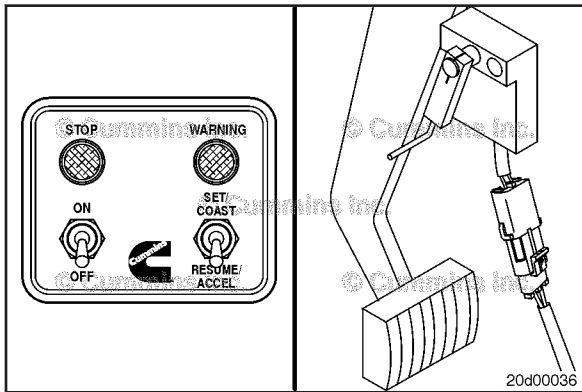
The amount of braking power available in a given engine series varies. Braking power depends on turbocharger boost pressure, engine speed, compression ratio, injector timing, and when the engine brakes open the exhaust valves.





Engine brake controls, with the fuel system, consists of the following:

- A two-position selector switch
- An ON/OFF switch
- A clutch switch
- A throttle sensor.



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

- Cruise control ON/OFF switch (if Cruise Control actuator feature is selected).
- Service brake switch (if service brake actuator feature is selected).

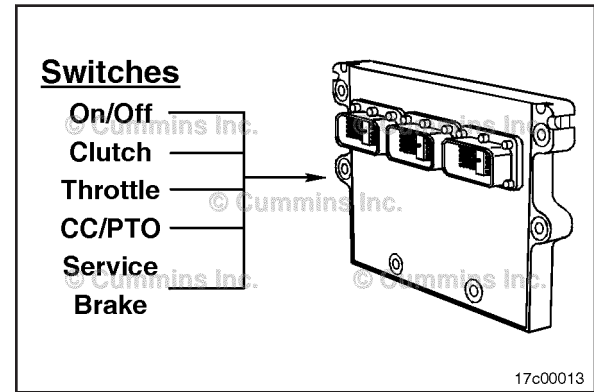
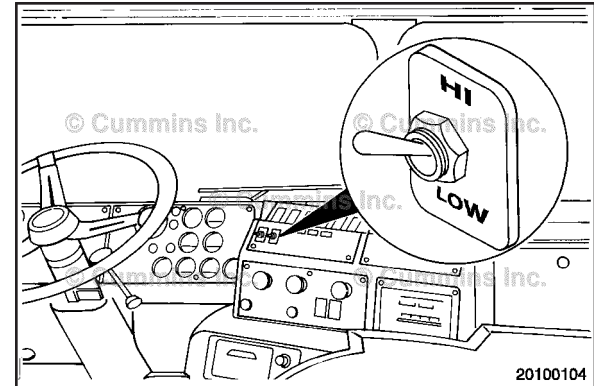
The ECM allows the engine brakes to operate while the cruise control is turned ON.

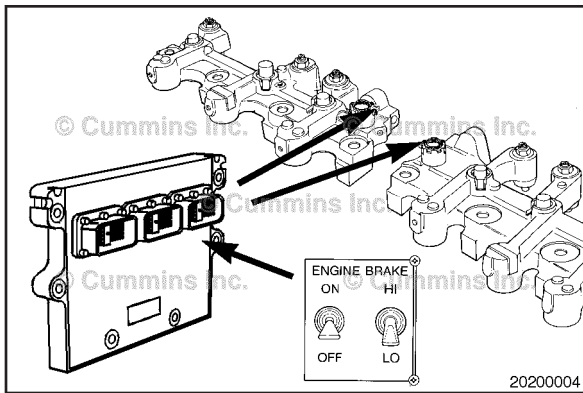
The two-position selector switch is located next to the ON/OFF switch in the cab, and allows you to select the retarding power of one or two brakes.

LOW activates the engine brake on three cylinders, and HI activates the engine brake on six cylinders.

Signals from the ON/OFF switch, clutch switch, throttle sensor, and the cruise/PTO switches are fed into the ECM.

NOTE: Any one of these switches can de-activate the engine brakes.

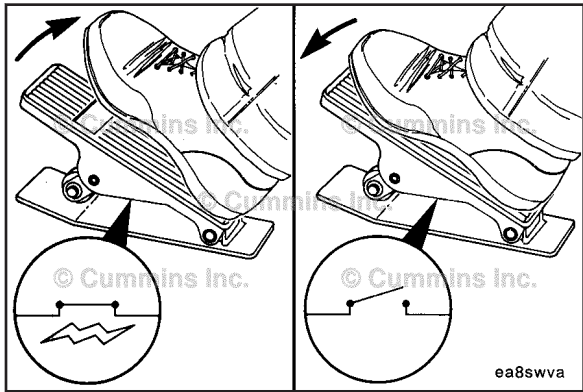




The ECM then electronically enables or disables the engine brakes.

NOTE: Engine brakes can **not** be enabled:

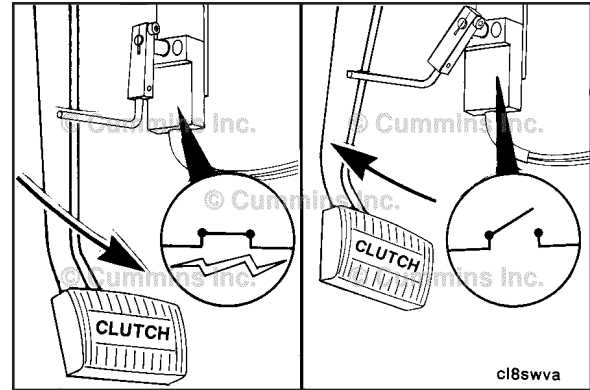
- When cruise control is active and the engine brakes in cruise control feature is turned off
- When engine speed goes below 850 rpm
- When an electronic fault code is active.



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

ISL9 CM2350 L101
Section 1 - Operating Instructions

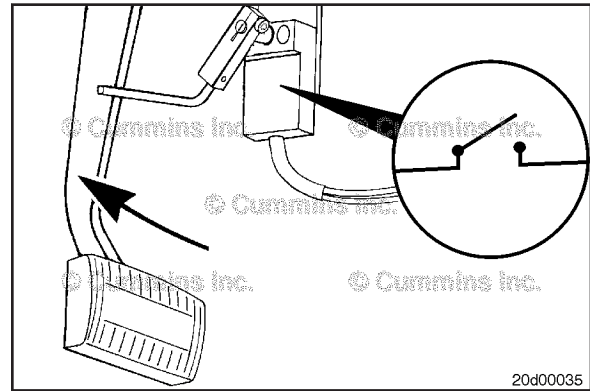
The clutch switch uses the motion of the clutch linkage to deactivate the engine brakes when the clutch pedal is depressed.

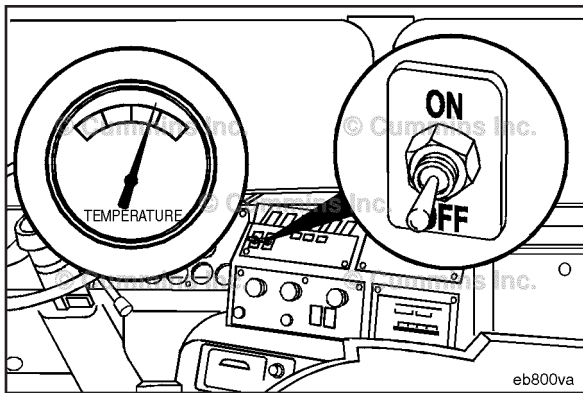


The service brake switch is attached to the service brake.

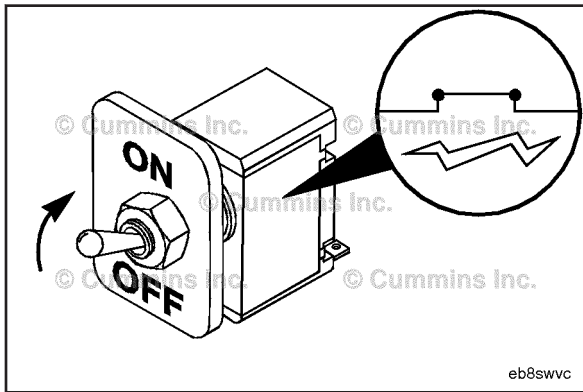
Applying the service brakes while in cruise control will disengage the cruise control and enable the engine brakes.

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” steps 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.

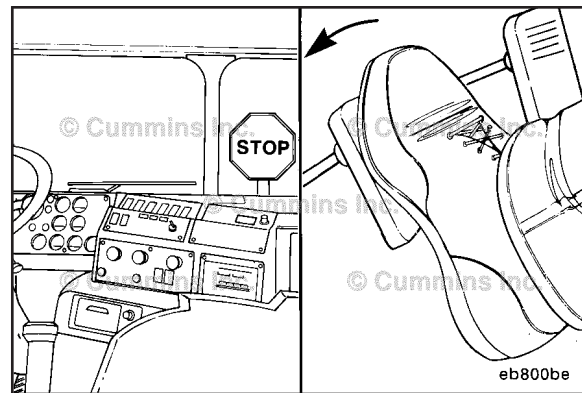
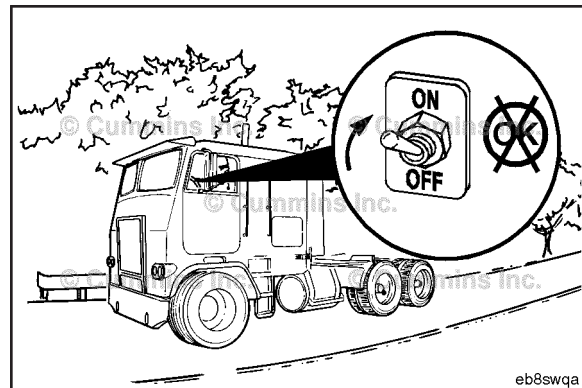
⚠ WARNING ⚠

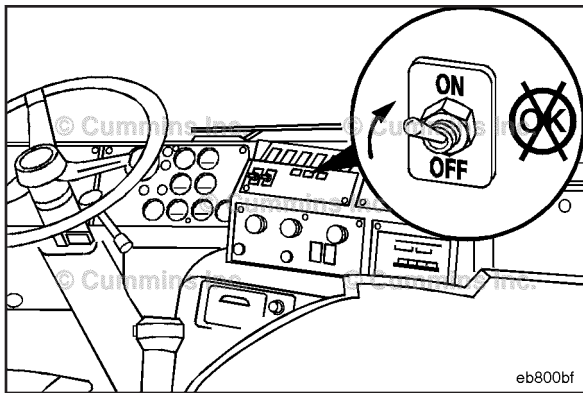
Do not use engine brakes while bobtailing or pulling an empty trailer. With the engine brakes in operation, wheel lockup can occur more quickly when the service brakes are applied, especially on vehicles with single-drive axles.

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

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

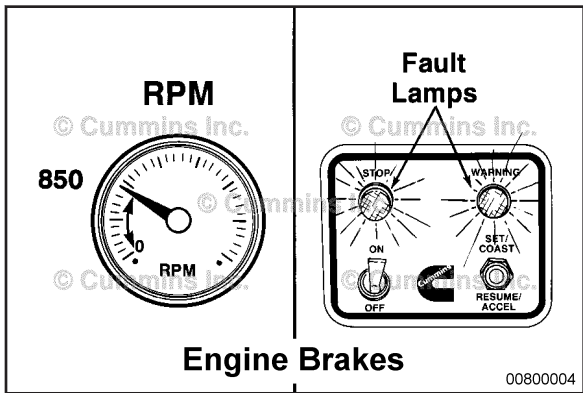
Remember, service brakes will be required to bring the vehicle to a stop.





eb800bf

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



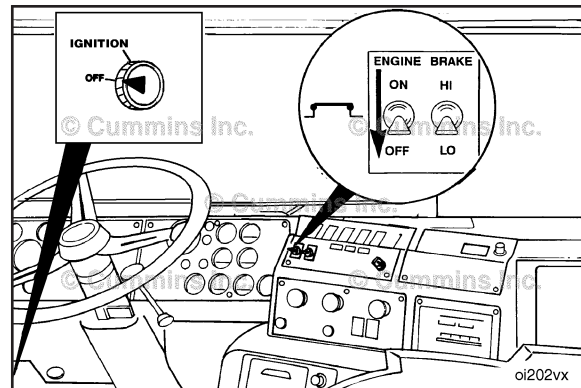
00800004

The ECM will disable the engine brakes when engine speed is below 850 rpm or when an electronic fault code is active.

⚠ CAUTION ⚠

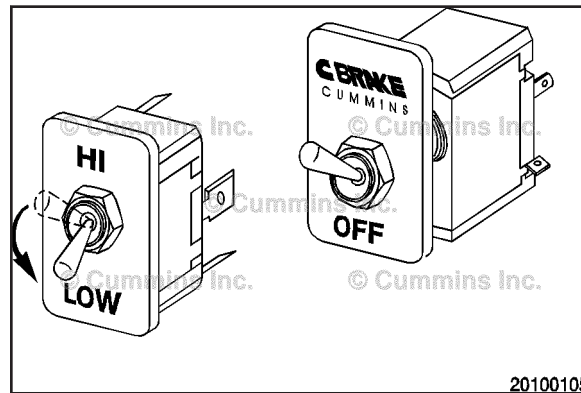
Do not operate the engine if the engine brake will not deactivate. To do so will cause severe engine damage.

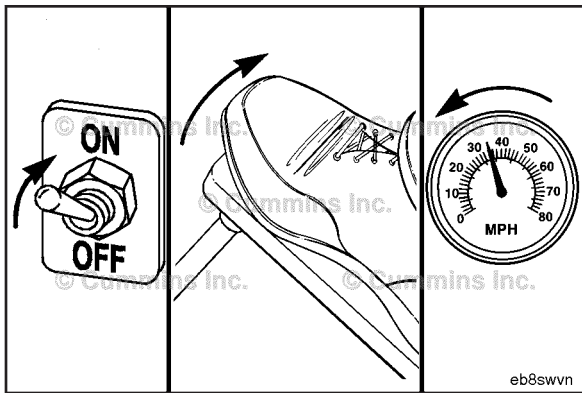
If the engine brakes will **not** shut off, shut off the engine immediately, and contact a Cummins® Authorized Repair Location.



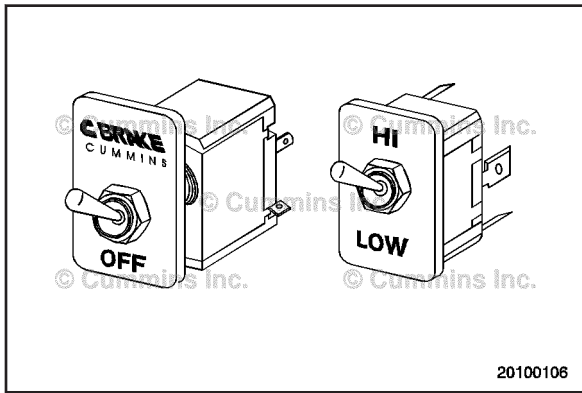
Tips for Operation on Level and Dry Pavement

For operation on dry and relatively flat surfaces, when greater retarding power is **not** required, put the two-position selector switch in the LOW 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 two-position selector switch in the HI position.

Tips for Operation on Grades with Dry Pavement

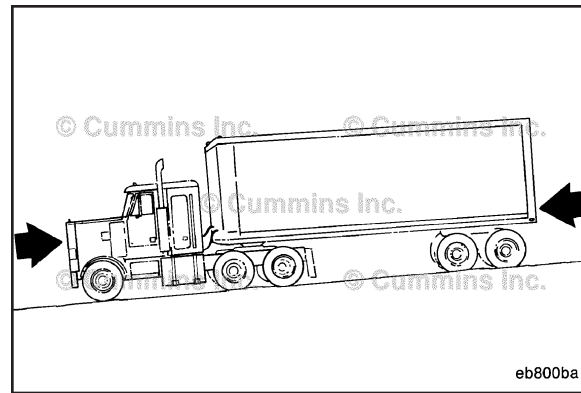
⚠ WARNING ⚠

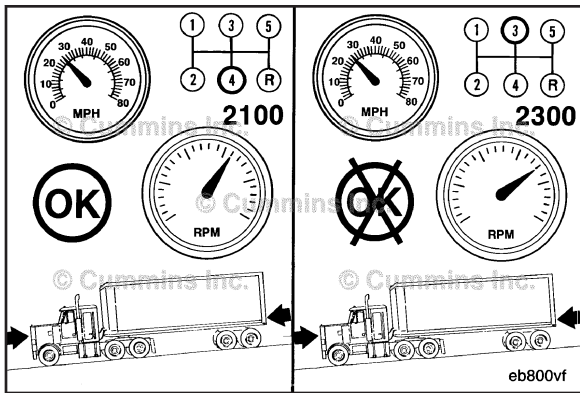
To reduce the possibility of personal injury or property damage, always be prepared to use the vehicle service brakes for emergency stopping. The safe control speed of a vehicle will vary with the size of the load, the type of load, the grade, and the road conditions.

Control speed is the speed at which the forces pushing a vehicle down a grade are equal to the forces holding it back.

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

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



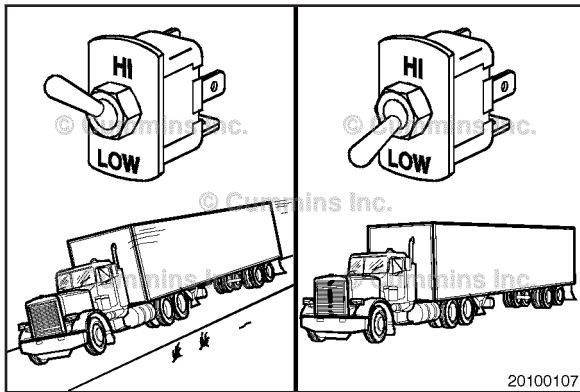


⚠ CAUTION ⚠

Never exceed governed engine speed because engine damage can occur.

Once you have determined what the safe speed is 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.

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

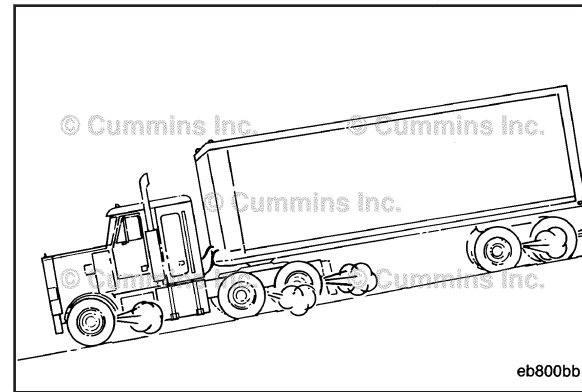
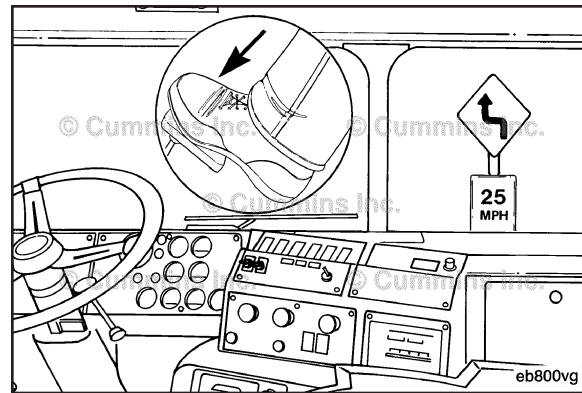


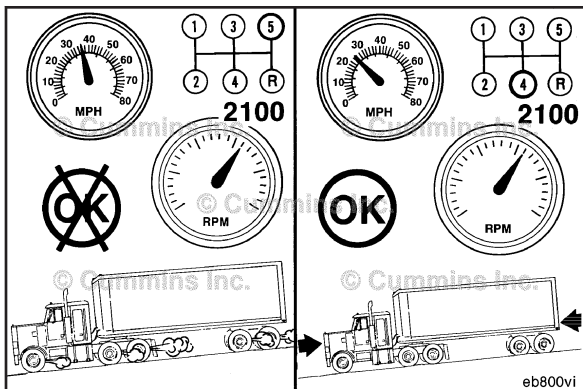
The two-position selector switch can be used to vary braking power as road conditions change.

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

⚠ WARNING ⚠

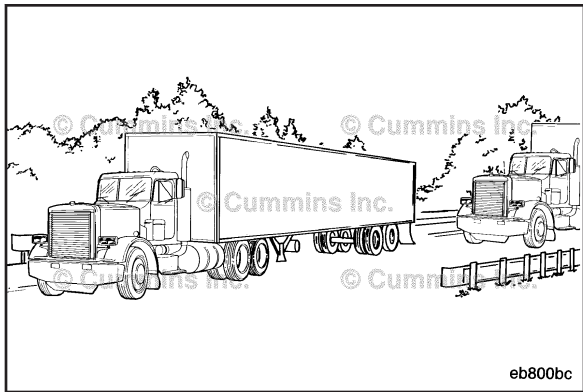
Frequent use of the service brakes will cause them to heat up, reducing their ability to slow or stop the vehicle.





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.

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



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.

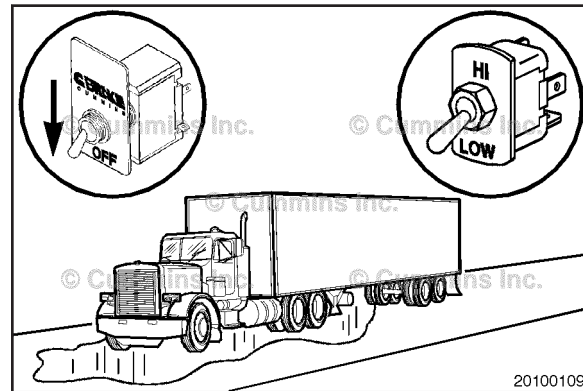
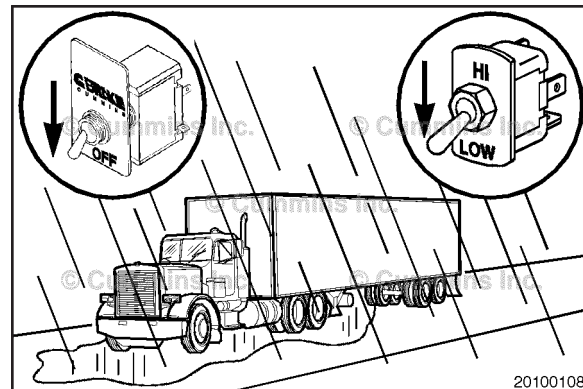
▲ WARNING ▲
To reduce the possibility of personal injury or property damage, always allow for extra distance between your vehicle and other objects when using the service brakes or engine brakes on slick roads.

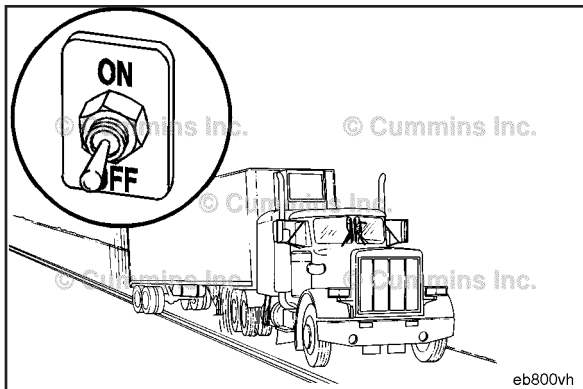
⚠ WARNING ⚠

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 overbraking, especially on vehicles with light loads or single-drive axles. Stopping distance can actually increase, or the vehicle can skid or jackknife.

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

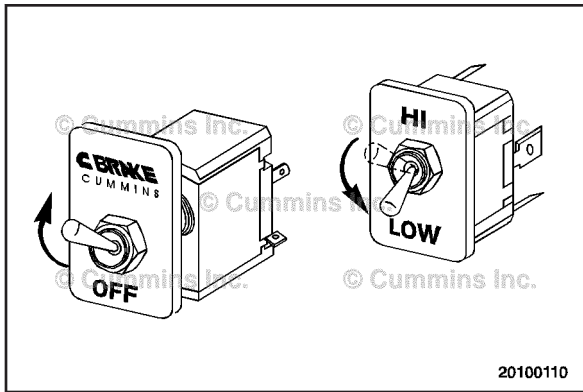
If your tractor is equipped with a twin-screw rear axle, position the power divider switch in the unlocked position.





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

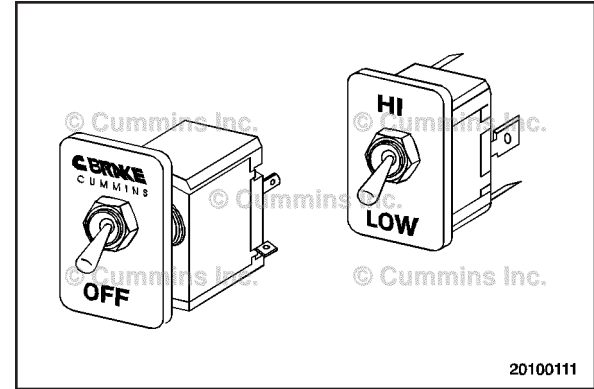
If the vehicle drive wheels begin to skid or if there is a fishtailing motion, do **not** activate the engine brakes.



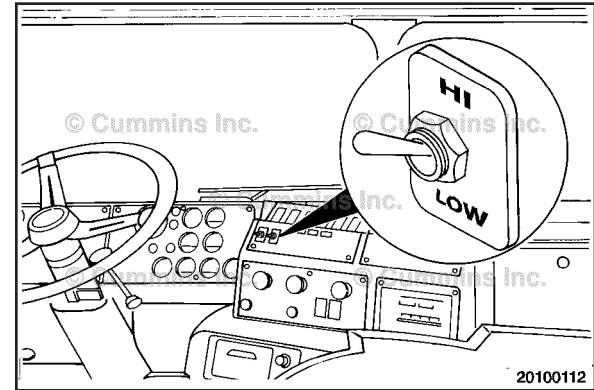
If traction is maintained using the retarding power of the engine alone and more braking power is required, switch the two-position selector switch to the LOW position and activate the engine brakes by switching the ON/OFF switch to the ON position.

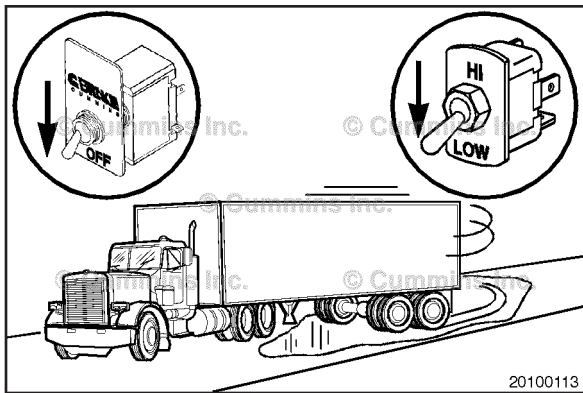
ISL9 CM2350 L101
Section 1 - Operating Instructions

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 HI position.





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

Engine Shutdown

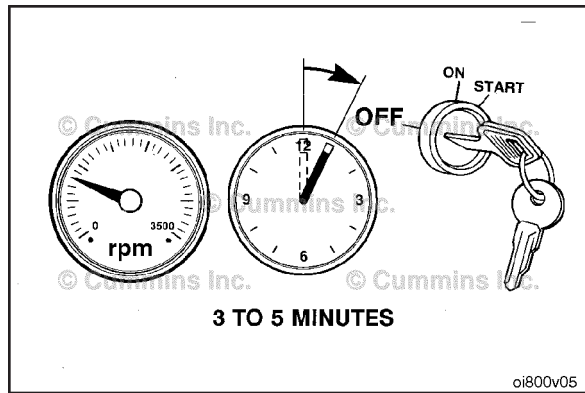
General Information

NOTE: For engines equipped with an electronic control module (ECM) ensure the keyswitch is turned off for a minimum of 100 seconds prior to disconnecting the continuous (unswitched) battery power supply. If the unswitched battery power supply is disconnected in less than 100 seconds after the keyswitch is turned off active fault codes and incorrect ECM information can occur.

Turn the ignition switch to the OFF position. If the engine does **not** shut down, refer to Troubleshooting Symptom (Section TS) in appropriate Operation and Maintenance manual.

▲CAUTION▲

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



Electromagnetic Interference (EMI)

General Information

Some applications utilize accessories such as (CB radios, mobile transmitters, etc.) 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 is **not** liable for any

performance problems with either the electronically controlled systems or the accessory due to EMI. EMI is **not** considered by Cummins to be a system failure and therefore is **not** warrantable.

System EMI Susceptibility

Your Cummins product has been designed and tested for minimum sensitivity to incoming electromagnetic energy. Testing has shown that there is 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 your systems from most, if **not** all, electromagnetic energy-emitting devices that meet the legal requirements.

System EMI Radiation Levels

Your Cummins product has been designed to emit minimum electromagnetic energy. Electronic components are required to pass various Cummins and industry EMI specifications. Testing has shown that when the systems are properly installed, they 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 your area to:
 - 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 your application

- Make sure your accessory equipment model is built for maximum filtering to reject incoming electromagnetic noise.

Unique Operating Characteristics of an Engine with On-Board Diagnostic

General Information

The engines supported by this manual are required to meet Heavy Duty On-Board Diagnostics (OBD) regulations. EPA HD OBD is required for all US vehicles with a gross vehicle weight over 14,000 pounds.

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 a 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 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.

Notes

Lined area for taking notes, consisting of 15 horizontal lines.

Section 2 - Maintenance Guidelines

Section Contents

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Oil Drain Intervals.....	2-5

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Maintenance Guidelines - Overview

General Information

Cummins Inc. recommends that the system be maintained according to the Maintenance Schedule in this section.

If the system is operating in ambient temperatures below -18°C [0°F] or above 38°C [100°F], perform maintenance at shorter intervals. Shorter maintenance intervals are also required if the system is operated in a dusty environment or if frequent stops are made. For gas fueled generator sets, shorter maintenance intervals are also required, if operating at loads below 70% for prolonged periods. Contact your local Cummins® Authorized Repair Location for recommended maintenance intervals.

Some of these maintenance procedures require special tools or must be completed by qualified personnel. Contact your local Cummins® Authorized Repair Location for detailed information.

If your system is equipped with a component or accessory not manufactured or supplied by Cummins Inc., refer to the component manufacturer's maintenance recommendations.

OEM supplied equipment and components can impact on the performance and reliability of the engine if they are not correctly maintained.

Use the chart provided in this section as a convenient way to record maintenance performed.

Maintenance Schedule

Maintenance Service

Perform maintenance at whichever interval occurs first.

At each scheduled maintenance interval, perform all previous maintenance checks that are due for scheduled maintenance.

Maintenance Procedures at Daily Interval

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

Maintenance Procedures at 12,000 Kilometers [7500 Miles], 250 Hours, or 3 Months

- Charge-Air Cooler - Check
- Charge-Air Piping - Check
- Air Cleaner Restriction - Check

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Maintenance Procedures at 24,000 Kilometers [15,000 Miles], 500 Hours, or 6 Months

- Fuel Filter (Spin-On Type) - Change¹
- Lubricating Oil and Filters - Drain²
- Lubricating Oil Filter (Spin-On) - Change²
- Coolant Filter (if equipped) - Change
- Supplemental Coolant Additive (SCA) and Antifreeze Concentration - Check³
- Radiator Pressure Cap - Check
- Batteries - Check⁴
- Battery Cables and Connections - Check⁴

Maintenance Procedures at 48,000 Kilometers [30,000 Miles], 1000 Hours, or 1 Year

- Cooling System - Test⁵
- Drive Belt, Cooling Fan - Check
- Belt Tensioner, Automatic (Water Pump) - Check

Maintenance Procedures at 96,000 Kilometers [60,000 Miles] or 2000 Hours

- Crankcase Breather Element - Change

Maintenance Procedures at 96,000 Kilometers [60,000 Miles], 2000 Hours, or 2 Years

- Engine Steam Cleaning - Clean
- Vibration Damper, Rubber - Check

- Vibration Damper, Viscous - Check
- Radiator Hoses - Check
- Air Compressor Discharge Lines - Clean

Maintenance Procedures at 241,500 Kilometers [150,000 Miles], 5000 Hours, or 4 Years

- Overhead Set - Adjust⁶
- Engine Brake Assembly - Adjust

Maintenance Procedures at 321,500 Kilometers [200,000 Miles], 6,500 Hours

- Aftertreatment Diesel Particulate Filter - Clean⁷
 - Aftertreatment Diesel Exhaust Fluid Dosing Unit Filter - Change
- 1 Replace the suction side and the pressure side fuel filters at the same time. It is recommended to replace the fuel filters at the same interval as the oil and oil filter are changed. Use the following procedure for fuel filter part number information. Refer to Procedure 018-024 in Section V.
 - 2 The lubricating oil and lubricating oil filter interval can be adjusted based on application, fuel consumption, gross vehicle weight, and idle time. Reference the Oil Drain Intervals table in this procedure.
 - 3 For an engine using standard service interval coolant, the supplemental coolant additive (SCA) and antifreeze levels **must** be tested once every 6 months. Antifreeze is essential for freeze, overheat, and corrosion protection. SCA is essential for liner pitting and scaling protection. Use the following procedure for additional coolant information. Refer to Procedure 018-004 in Section V.
 - 4 Follow the manufacturers' recommended maintenance procedures for the starter, alternator, batteries, electrical components, charge-air cooler, radiator, air compressor, air cleaner, refrigerant compressor, and fan clutch.

- 5 Test coolant at once per year to determine if the coolant **must** be replaced. If it is determined that the coolant should be replaced, make sure to flush the coolant system. Contact a Cummins Authorized Repair Location for flushing the coolant system. Use the following procedure for coolant recommendations and specifications. Refer to Procedure 018-004 in Section V.
- 6 Reset the valve lash, if needed, to nominal specifications. Refer to Procedure 018-015 in Section V.
- 7 The aftertreatment diesel particulate filter clean/replace interval is based on the use of lubricating oils that meet the Cummins® Engineering Standard (C.E.S.) 20081 oil specification. If a non-low ash lubricating oil meeting the American Petroleum Institute (API) performance classification CI-4 and/or C.E.S. 20078 is used, the service interval for the aftertreatment systems **must** be reduced to 241,000 Kilometers [150,000 Miles], or 5000 hours.

All low emission EPA 07, EPA 10, EPA 13, EPA Tier 4 Interim/European Union Stage IIIB 2011(174 -751 hp) engine systems equipped with exhaust aftertreatment **must** operate on ultra-low sulfur diesel (ULSD) with a maximum sulfur content of 15 ppm in the United States and 10 ppm in the European Union. Failure to do so can permanently damage engine and aftertreatment systems within a short period of time. This damage could cause the engine to become in operable and affect the warranty coverage on the engine system.

Oil Drain Intervals

See the following table to determine the maximum recommended oil change and oil filter change intervals in kilometers [miles]/hours or months, whichever comes first.

NOTE: Idle time **must** be factored into calculating average vehicle speed.

The intervals are based on the vehicle's average vehicle speed. Locate your vehicle's average vehicle speed in the first column to determine the oil change/filter change interval to use. If the vehicle is equipped with an hour meter, it is acceptable to use the engine hours listed for the oil change and oil filter change interval.

If the average vehicle speed is unknown and the vehicle is **not** equipped with an hour meter:

- 1 Reference the Typical Application(s) column. Use the lowest interval listed for your application.

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- 2 Connect an electronic service tool. The electronic service tool can provide the average vehicle speed recorded by the engine's ECM. This can be done at a Cummins® Authorized Repair Location.

NOTE: A Maintenance Monitor feature is available through the engine's ECM. This feature can be enabled by a Cummins® Authorized Repair Location. Reference Service Bulletin 2883397.

Vehicle Average Speed	Kilometers	Miles	Hours	Months	Typical Application(s)
Below 5 mph Average	2400	1500	500	6	Shuttle or Transit Bus
5 to 10 mph Average	6450	4000	500	6	Shuttle or Transit Bus
10 to 15 mph Average	9650	6000	500	6	Refuse Truck
15 to 20 mph Average	13,700	8500	500	6	Cement Mixer Dump Truck Feedlot Truck Yard Spotter

Vehicle Average Speed	Kilometers	Miles	Hours	Months	Typical Application(s)
20 to 25 mph Average	16,900	10,500	500	6	Cement Mixer Dump Truck
25 to 30 mph Average	19,300	12,000	500	6	Truck Crane Fire Truck/ Emergency Vehicle School Bus Delivery Truck
30 to 40 mph Average	24,100	15,000	500	6	Linehaul Truck Fire Truck/ Emergency Vehicle School Bus Motor Coach Bus
Higher than 40 mph Average	32,200	20,000	500	12	Recreational Vehicle

Cummins Inc. bases the oil drain specifications on duty cycle and oil contamination. This contamination occurs in all engines, at varying rates, regardless of the drain interval.

Maintaining the correct oil and filter change interval is a vital factor in preserving the integrity of an engine. Lubricating oil filters **must** be changed when the oil is changed.

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Maintenance Record Form

Maintenance Data

Maintenance Record	
Product Serial No.:	Product Model:
Owner's Name:	Equipment Model/Number:

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

A	B	C	D	E	F

Section L - Service Literature

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Additional Service Literature

General Information

The following publications can be purchased.

Bulletin Number	Title of Publication
4310787	ISL9 CM2350 L101 Service Manual
4310789	ISL9 CM2350 L101 Fault Code Troubleshooting Manual
4310788	ISL9 CM2350 L101 Wiring Diagram
4310786	ISL9 CM2350 L101 Operation and Maintenance Manual
4310785	ISL9 CM2350 L101 Owners Manual
3379000	Air for Your Engine
3379001	Fuels for Cummins® Engines
3379009	Operation of Diesel Engines in Cold Climates
3666132	Cummins® Coolant Requirements and Maintenance
3810303	Parts Reuse Guidelines
3810340	Cummins® Engine Oil and Oil Analysis Recommendations
4021566	Diesel Exhaust Fluid Specifications for Cummins® Selective Catalytic Reduction Systems

Service Literature Ordering Location Contact Information

Region	Ordering Location
United States and Canada	Cummins Distributors or Credit Cards at https://store.cummins.com
All Other Countries	Cummins Distributors or Dealers

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Cummins Customized Parts Catalog

General Information

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

The catalog cover, as well as the content, is customized with you in mind. You can use it 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 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.

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- 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 no.
- Credit Card No.
- 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 may not have the necessary parts information to compile a catalog. We will contact you if this occurs and explain why we are unable to fill your order.

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

Section V - Maintenance Specifications

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General Engine

Specifications

Listed below are the general specifications for the engine covered in this manual:

Horsepower.....	See engine dataplate
Firing Order.....	1-5-3-6-2-4
Crankshaft Rotation (viewed from front of engine).....	Clockwise
Displacement	
ISL.....	8.9 liters [540 in ³]
Bore and Stroke	
ISL.....	114 mm [4.49 in] x 144.5 mm [5.69 in]
Dry Weight	
ISL.....	769 kg [1695 lb]
Wet Weight	
ISL.....	803 kg [1770 lb]
Overhead Adjustment	
Intake Valve Adjustment.....	0.305 mm [0.012 in]
Exhaust Valve Adjustment.....	0.559 mm [0.022 in]
Engine Brake Adjustment.....	2.286 mm [0.090 in]

Lubricating Oil System

Specifications

Oil Pressure

At Low Idle (minimum allowable).....	69 kPa [10 psi]
At Rated Speed (minimum allowable).....	207 kPa [30 psi]
Regulated Oil Rifle Pressure.....	379 kPa [55 psi]
Lubricating Oil Filter Capacity.....	3.78 liters [4 qt]

Oil Pan Capacity, Low to High

Standard Oil Pan.....	15.1 to 18.9 liters [16 to 20 qt]
Oil Pan with Cylinder Block Stiffener Plate.....	18 to 21.8 liters [19 to 23 qt]
High Capacity Oil Pan.....	18.9 to 22.7 liters [20 to 24 qt]

Total System Capacity (Oil Pan and New Oil Filter)

Standard Oil Pan.....	22.7 liters [24 qt]
Oil Pan with Cylinder Block Stiffener Plate.....	25.6 liters [27 qt]
High Capacity Oil Pan.....	26.5 liters [28 qt]

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

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

Cooling System

Specifications

Coolant Capacity (engine only).....	15.6 liters [16.5 qt]
Standard Modulating Thermostat Range.....	82 to 93°C [180 to 200°F]
Minimum Recommended Pressure Cap.....	.90 kPa [13 psi]
Minimum Fill Rate (without low-level alarm).....	11.4 liters/min [3 gpm]
Maximum Deaeration Time.....	.25 minutes
Maximum Top Tank Coolant Temperature.....	107°C [225°F]

Winterfronts

Minimum allowed air passage area.....	774 cm ² [120 in ²]
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Cummins®/Fleetguard® Filter Specifications

General Information

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

Fleetguard® products meet all Cummins® Source Approval Test standards to provide the quality filtration necessary to achieve the engine's design life. If other brands are substituted, the purchaser should 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.

Lubricating Oil Filter ⁽¹⁾	
Cummins® Part Number	3401544
Cummins Filtration™ Part Number	LF9009
Fuel Filter (Pressure-Side) Square Drive Base ^{(2) (3)}	
Cummins® Part Number	5304214
Cummins Filtration™ Part Number	FF63008
Fuel Filter (Pressure-Side) Hex Drive Base ^{(2) (3)}	
Cummins® Part Number	5303743
Cummins Filtration™ Part Number	FF63009

Fuel Filter (Suction-Side, with Water-In-Fuel Sensor)⁽²⁾	
Cummins® Part Number	4934879
Cummins Filtration™ Part Number	FS1065
Crankcase Breather Element	
Cummins® Part Number	4939749
Cummins Filtration™ Part Number	CV5060300
Aftertreatment Diesel Exhaust Fluid (DEF) Dosing Unit Filter	
Cummins® Part Number	2880298

⁽¹⁾An LF9009 lubricating oil filter **must** be used. A venturi type lubricating oil filter **must** be used in order to benefit from the bypass filtration section of the lubricating oil filter. Do **not** use an LF3000 lubricating oil filter. Engine durability will be reduced by the use of the incorrect lubricating oil filter

⁽²⁾The fuel system requires the use of two fuel filters.

The suction-side filter must have the following characteristics:

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

The pressure-side filter **must** have the following characteristics:

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

⁽³⁾Early production pressure side fuel filters were built with a square drive feature for installation and removal. Later built pressure side fuel filters transitioned to a hex drive feature. The drive feature is the **only** difference between the pressure side fuel filters.

Diesel Exhaust Fluid Recommendations and Specifications

General Information



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).



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.



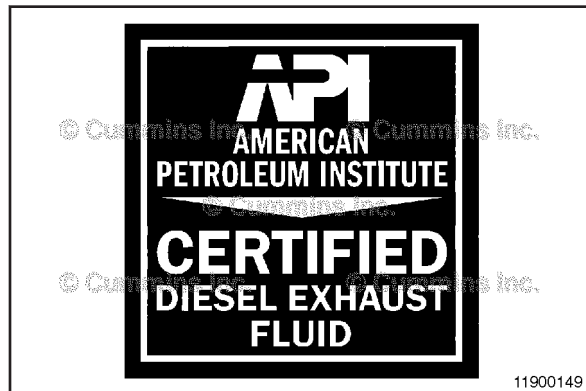
Never attempt to create Diesel Exhaust Fluid by mixing agricultural grade urea with water. Agricultural grade urea does not meet the necessary specifications required and the aftertreatment system may be damaged.

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

NOTE: Some locations may reference the DIN 70070 standard. Diesel Exhaust Fluid 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; lack of maintenance of aftertreatment; improper storage, or shutdown practices; unauthorized modifications of the engine and aftertreatment. Cummins is also not responsible for failures caused by incorrect Diesel Exhaust Fluid or by water, dirt or other contaminants in the Diesel Exhaust Fluid

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

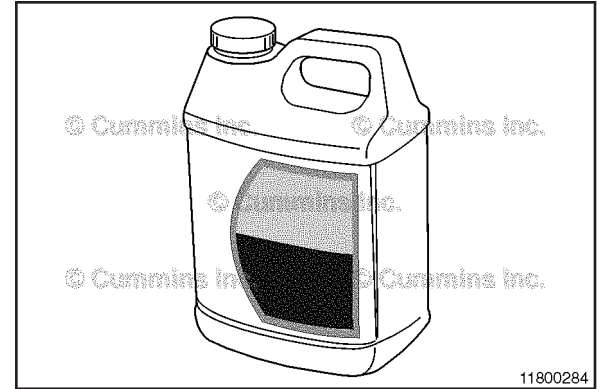


For engines using SCR operating in the United States and Canada, it is also strongly recommended that the Diesel Exhaust Fluid (DEF) used be certified by the American Petroleum Institute (API). This would be indicated by a symbol on the container/dispensing system as shown.

To ensure the correct Diesel Exhaust Fluid (DEF) is used, Cummins Inc. recommends the use of Fleetguard® Diesel Exhaust Fluid. 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 your local Cummins authorized repair location for assistance in locating Diesel Exhaust Fluid (DEF).



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

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

Regardless of what the Diesel Exhaust Fluid is called, the Diesel Exhaust Fluid 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 23°F and 77°F (-5°C and 25°C)
- 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, periodic testing of the Diesel Exhaust Fluid is recommended to be performed to ensure the concentration does not fall out of specification. Follow the Test step of this procedure.

NOTE: 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.

- Make sure to 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.

NOTE: 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 may 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, make sure to wash thoroughly to remove any contaminants and then rinse with distilled water.

NOTE: 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.

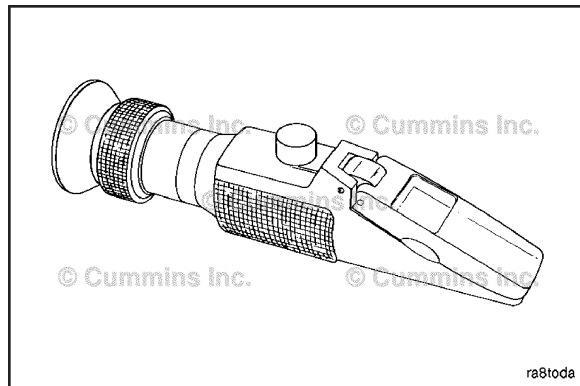
Percent Urea Concentration: 32.5 +/- 1.5%

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.
- It is suspected that water has been added to the Diesel Exhaust Fluid tank



Contamination/Incorrect Fluid



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



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 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.

Fuel Recommendations and Specifications

Fuel Recommendations



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



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.



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



Do not use diesel fuel blended with lubricating oil in engines equipped with an aftertreatment system. Service intervals for aftertreatment systems will be reduced. The engine has been optimized for use with an aftertreatment system to meet the present U.S. Environmental Protection Agency (EPA) regulations. In order to meet these regulations, ultra-low sulfur diesel fuel is required for correct operation of the aftertreatment system. If ultra-low sulfur diesel fuel is not used, and the aftertreatment system may be damaged.

Ultra-low sulfur diesel fuel is required for engines with aftertreatment. Ultra-low sulfur diesel fuel is defined as diesel fuel not exceeding 0.0015 (15 ppm) mass percent sulfur content (ultra-low diesel fuel is also defined by ASTM S-15). There are no acceptable substitutes.

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

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

The following chart lists acceptable types of fuels for this engine.

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

- 1 Any adjustment to compensate for reduced performance with a fuel system using alternate fuel is **not** warrantable.
- 2 Winter blend fuels, such as found at commercial fuel dispensing outlets, are combinations of number 1D and number 2D diesel fuel and are acceptable.
- 3 BTU Content/Degree API Gravity - Low API gravity fuels have a higher thermal energy content (BTU). As a general rule, there is a 3 to 5 percent decrease in BTU content for every 10 degree increase in API gravity. There is also a 0.7 degree API gravity increase with an increase in fuel temperature. This decrease in energy content equates roughly to the same percentage of power loss. Use of fuels with higher API gravity will cause higher than normal fuel consumption.

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

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

NOTE: Cummins Inc. requires all permissible fuels to have adequate fuel lubricity. Lubricity can be measured by ASTM, specification D6079, ISO 12156, High Frequency Reciprocating Rig (HFRR) in which the fuel **must** have a wear scar diameter of 0.52 mm [0.02 in] or less.

For information on alternative fuels, such as biodiesel, and additional information for fuel recommendations and specifications, refer to the latest revision of Fuel for Cummins® Engines Service Bulletin, Bulletin 3379001. See ordering information in the back of this manual.

Lubricating Oil Recommendations and Specifications

General Information



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 quality engine lubricating oils, combined with appropriate oil drain and 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 102-002 in Section 2

NOTE: The responsibility is with the owner. If recommendations are ignored, warranty could be affected.

API: American Petroleum Institute

CES: Cummins® Engineering Standard

Cummins Inc. allows, for midrange applications, the use of lubricating oils that meet or exceed CES 20078 or CES 20081 with no change in oil drain interval. But, if a non-low ash lubricating oil meeting the Cummins® Engineering Standard (CES) classification CES 20078 is used, the service interval(s) for the aftertreatment system will be reduced, Refer to Procedure 102-002 in Section 2.



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To determine if the lubricating oil meets CES 20078 or CES 20081, review the label on the back of the lubricating oil bottle for the CES 20078 or CES 20081 reference. If acquiring the lubricating oil in bulk, contact the supplier for the lubricating oil specifications and confirm that the oil meets CES 20078 or CES 20081.

Also located on the lubricating oil bottle is the API service symbol, which is shown in the accompanying illustration. The upper half of the symbol displays the appropriate oil categories. The center section identifies the SAE oil viscosity grade. The table below shows how the Cummins® Engineering Standard (CES) compares to the American Petroleum Institute (API) classification.

Cummins® Engine Standard Classification (CES)	American Petroleum Institute Classification (API)	Comments
CES-20071, CES-20072, CES-20076, and CES-20077	API CH-4/SJ	Not recommended. Lubricating oil drain interval must be reduced by 50 percent. Aftertreatment maintenance interval will be reduced.
CES-20078	CI-4/SL	Aftertreatment maintenance interval will be reduced
CES-20081	CJ-4/SL	Maximum aftertreatment maintenance interval. No change in lubricating oil drain interval.

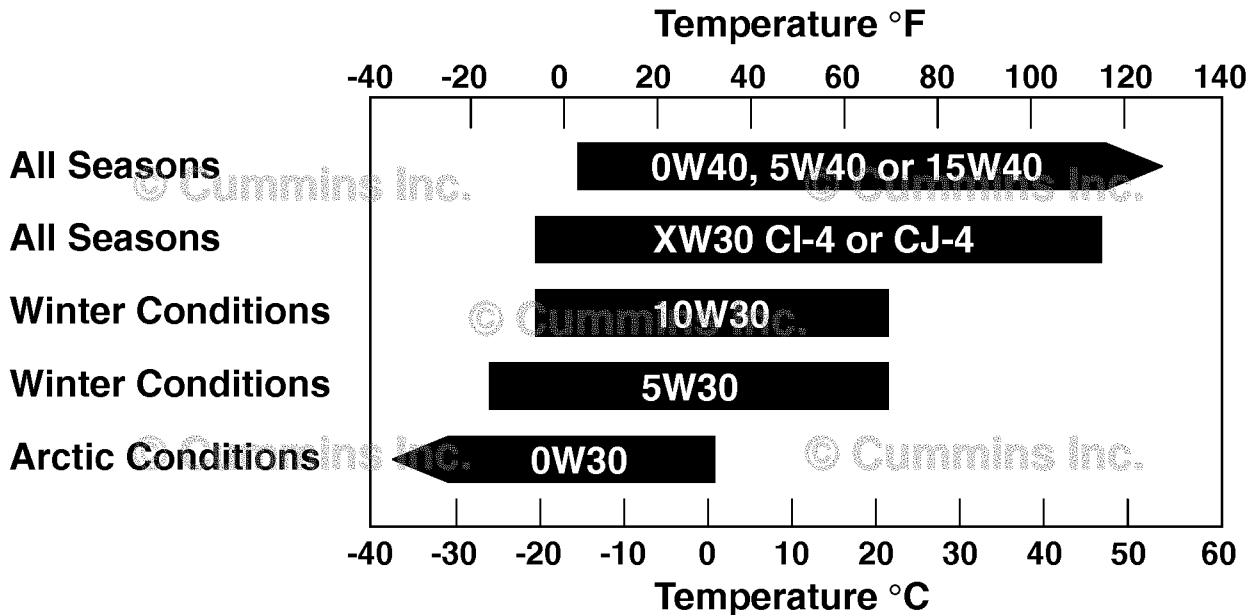
NOTE: A lubricating oil that meets the American Petroleum Institute (API) performance classification CJ-4/SL may **not** meet the CES 20081 requirement. Always make sure the lubricating oil used meets the CES 20081 requirement, in addition to the API performance classification CJ-4/SL.

Cummins Inc. recommends the use of high-quality SAE 15W-40 heavy-duty engine oil, such as Valvoline Premium Blue™.

The primary Cummins Inc. recommendation is for the use of 15W-40 multigrade lubricating oil for normal operation at ambient temperatures above -15°C [5°F]. The use of multigrade oil reduces deposit formation, improves engine cranking in low temperature conditions, and increases engine durability by maintaining lubrication during high temperature operating conditions. Since multigrade oils have been shown to provide approximately 30 percent lower oil consumption compared with monograde oils, it is important to use multigrade oils.

Use of "synthetic engine oils" (those made with API group 3 or group 4 base stocks) is permitted, subject to the same performance and viscosity limitations of petroleum (mineral) based engine oils. The same oil change intervals **must** be applied to synthetic oils that are applied to petroleum (mineral) based engine oils.

For further details and discussion of engine lubricating oils for Cummins® engines, refer to the latest revision of Cummins® Engine Oil Recommendations, Bulletin 3810340.



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While the preferred viscosity grade is 15W-40, lower viscosity multigrade oils can be used in colder climates. See the accompanying chart. Any viscosity grade lower than 15W-40 **must** still meet CES 20081.

Synthetic engine oils, API Group III and Group IV basestocks, are recommended for use in Cummins® engines operating in ambient temperature conditions consistently below -25°C [-13°F]. Synthetic 0W-30 oils that meet the requirements of API Group III or Group IV base stocks, can be used in operations where the ambient temperature **never** exceeds 0°C [32°F]. Multiviscosity oils rated 0W-30 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.

As these oils have directionally thinner oil films than 15W-40 oils, top-quality Fleetguard® filters **must** be used above 20°C [70°F]. Some oil suppliers might claim better fuel economy for these oils. Cummins Inc. can neither approve nor disapprove any product **not** manufactured by Cummins Inc. These claims are between the customer and oil supplier. Obtain a commitment from the oil supplier that the oil will give satisfactory performance in Cummins® engines, or do **not** use the oil.

New Engine Break-in Oils



The use of a synthetic-base oil does not justify extended oil change intervals. Extended oil change intervals can decrease engine life due to factors such as corrosion, deposits, and wear.



A sulfated ash limit of 1.85 percent has been placed on all engine lubricating oils recommended for use in Cummins® engines. Higher ash oils can cause valve and/or piston damage and lead to excessive oil consumption.

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

Additional information regarding lubricating oil availability throughout the world is available in the EMA Lubricating Oils Data Book for Heavy-Duty Automotive and Industrial Engines. The data book can be ordered from: Engine Manufacturers Association, Two North LaSalle Street, Chicago, IL 60602; (312) 827-8733, (www.engine-manufacturers.org).

AfterMarket Oil Additive Usage

Cummins Inc. does **not** recommend the use of aftermarket oil additives. The present high-quality engine lubricating oils are very sophisticated, with precise amounts of additives blended into the lubricating oil to meet stringent requirements. These furnished oils meet performance characteristics that conform to the lubricant industry standards. Aftermarket lubricating oil additives are **not** necessary to enhance engine oil performance and, in some cases, can reduce the furnished oil's capability to protect the engine.

Coolant Recommendations and Specifications

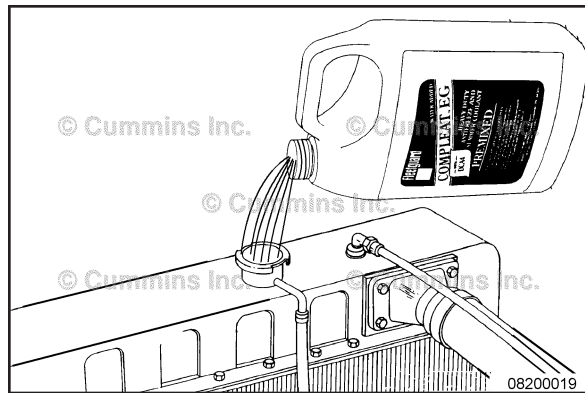
Fully Formulated Coolant/Antifreeze

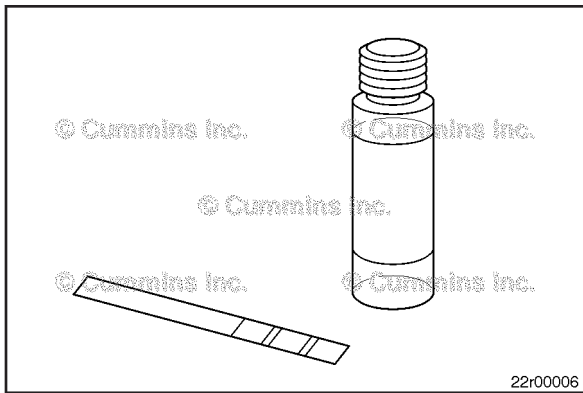
For new vehicles, check with the original equipment manufacturer (OEM) on the type of coolant (ethylene glycol, propylene glycol, Organic Acid Technology (OAT), glycerin, etc.) used for the first fill. This will assist in understanding how to maintain the coolant properly.

Cummins Inc. recommends using either a 50/50 mixture of good quality water and fully formulated antifreeze, or fully formulated coolant when filling the cooling system. The fully formulated antifreeze or coolant **must** meet CES14603 specifications.

Most coolants which meet ASTM D6210 also meet CES14603.

However, some OAT coolants such as Shell™ Rotell ELC, Chevron™ Texaco™ DeloELC and their private label counterparts meet ASTM D6210, but do **not** meet the elastomer compatibility test of CES14603. These coolants are acceptable for use, assuming the OEM added silicate at initial fill. Refer to Bulletin 3666132, Cummins@Coolant Requirements and Maintenance, Section 3, Extended Service Interval, for more details.





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.

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

Water Quality	
Calcium Magnesium (hardness)	Maximum 170 ppm as (CaCO₃ + MgCO₃)
Chloride	Maximum 40 ppm as (Cl)
Sulfate	Maximum 100 ppm as (SO ₄)

Cummins Inc. recommends Cummins Filtration™ antifreeze coolants including Compleat ES™ containing DCA4 Plus, Fleetcool™ EX containing DCA2 Plus, and ES Optimax™ Organic Acid Technology (OAT), which meet the requirements of Cummins® Engineering Standard 14603.

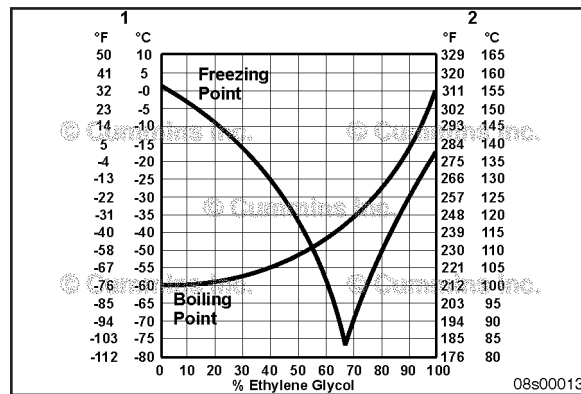


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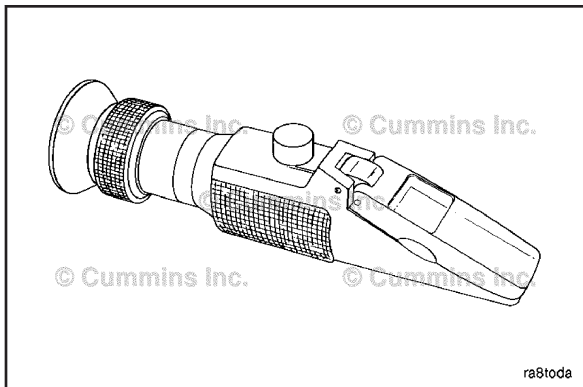
Fully formulated antifreeze **must** be mixed with good quality water at a 50/50 ratio (40- to 60-percent working range). A 50/50 mixture of antifreeze and water gives a -36°C [-33°F] freezing point and a 108°C [226°F] boiling point, which is adequate for locations in North America. The actual lowest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

Legend

- 1 Freezing Point Temperature Scale
- 2 Boiling Point Temperature Scale

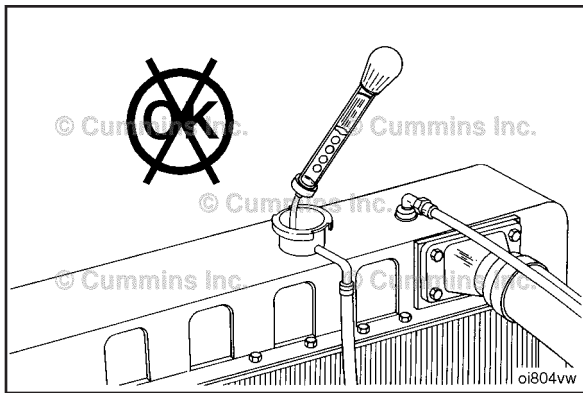


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A refractometer is the preferred tool for measuring the freezing point of ethylene glycol and propylene glycol coolants. Use Fleetguard® refractometer, Part Number CC2800 or CC2806. For glycerin coolants, use Part Number CC36049.

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



Do **not** use a floating ball hydrometer. The use of a floating ball hydrometer can give incorrect readings.

Cooling System Sealing Additives

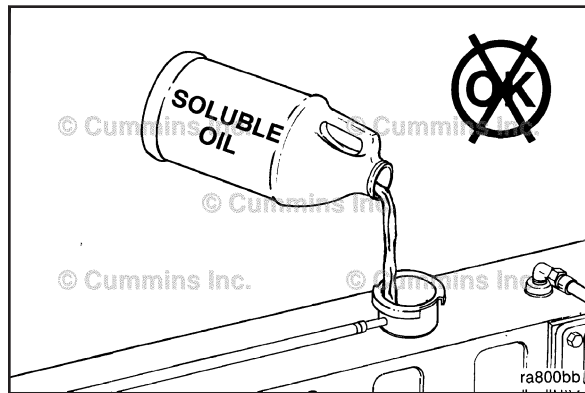
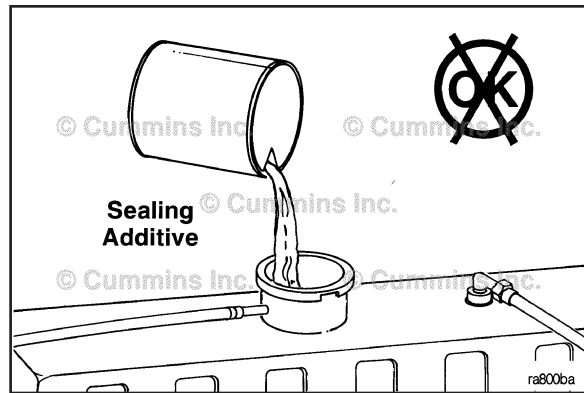
Do **not** use sealing additives in the cooling system. The use of sealing additives will:

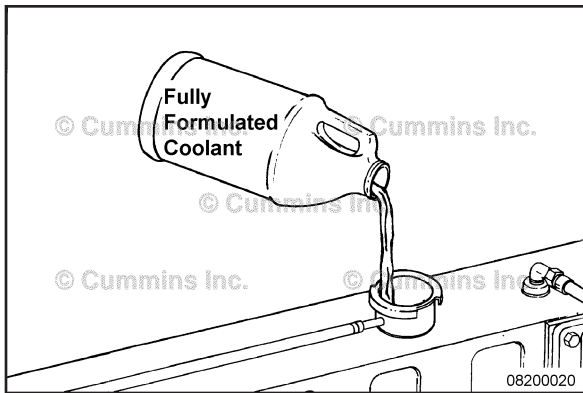
- Build up in coolant low-flow areas
- Clog coolant filters, if equipped.
- Plug radiators and oil coolers
- Possibly damage the water pump seal.

Cooling System Soluble Oils

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

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





Supplemental Coolant Additive (SCA)

⚠ CAUTION ⚠

Improper coolant, concentration of coolant additives, and maintenance will likely result in liner pitting and engine failure.

Fully formulated products contain supplemental coolant additives (SCAs) and are required to protect the cooling system from scale and fouling, solder corrosion, and general corrosion.



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.

Measuring the chemical protection in your engine's cooling system is essential for protection against liner pitting, corrosion, and coolant dilution.

NOTE: Some OAT coolants use high levels of organic acids for liner pitting protection and do **not** use nitrite and/or molybdate. Therefore, these coolants do **not** have SCA numbers. Reference the coolant manufacturer for proper maintenance instructions.

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

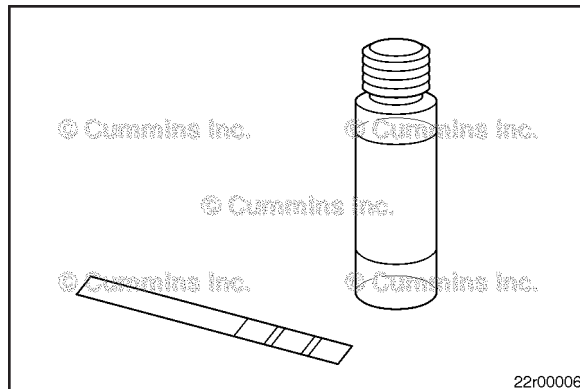
If the SCA concentration is below 1.2 units per gallon, the supplemental coolant additives need to be replenished.

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

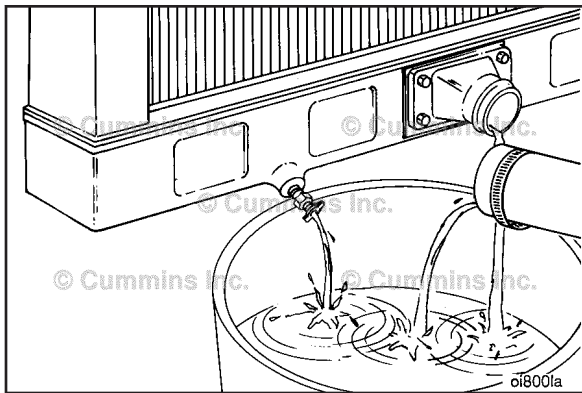
Use Fleetguard® coolant test strips, Part Number CC2602, to check the concentration level. Instructions are included with the test kit.

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

Cummins Inc.	Fleetguard®
1-800-DIESELS	1-800-22FILTER
1-800-343-7357	1-800-223-4583



22r00006



Coolant Replacement Requirements

⚠ WARNING ⚠

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

Replace the coolant **only** if the replacement limits are exceeded.

Fleetguard® Quik-Chek™ test strips, Part Number CC2718, will detect contamination levels that indicate replacement of the coolant is required.

Fleetguard® also offers laboratory coolant testing with the use of Monitor Coolant Testing kits, Part Numbers CC2700 and CC2706.

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

Section W - Warranty

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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 (160,935 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.

Owner is responsible for a \$100 (U.S. Dollars) deductible per each service visit under this plan in the 3rd, 4th and 5th years of Base Engine Warranty. The deductible will not be charged during the first 2 years of the Base Engine Warranty.

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

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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	max. 15 parts per million
EPA Tier 4 Interim / Final	max. 15 parts per million
EU Stage IIIB 2011	max. 15 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.

This Warranty does not apply to accessories supplied by Cummins which bear the name of another company. Such non-warranted accessories include, but are not limited to: alternators, starters, fans, air conditioning compressors, clutches, filters, transmissions, torque converters, vacuum pumps, power steering pumps, fan drives and air compressors. Cummins branded 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 (160,935 kilometers) or 7,000 hours from the date of delivery of the Engine to the first user, whichever of the three occurs first. Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failures of belts and hoses supplied by Cummins are 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 (160,935 kilometers) of operation, whichever occurs first, as measured from the date of delivery of the Engine to the first user or (B) The Base Engine Warranty.

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

Limitations

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

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

EPA 2007/2010/2013	max. 15 parts per million
EPA Tier 4 Interim / Final	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

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

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

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

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

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

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

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

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

Coverage

Products Warranted

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

Base Engine Warranty

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

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

Extended Major Components Warranty

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

Bushing and bearing failures are not covered.

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

Emission Warranty

Additional Coverage is outlined under the Emission Warranty.

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

Cummins Responsibilities

During The Base Engine Warranty

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

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

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

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

During The Extended Major Components Warranty

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

Owner Responsibilities

During The Base Engine Warranty

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

During The Extended Major Components Warranty

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

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

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

During The Base Engine And Extended Major Components Warranties

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

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

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

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

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

Limitations

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

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

EPA 2007/2010/2013	max. 15 parts per million
EPA Tier 4 Interim / Final	max. 15 parts per million
EU Stage IIIB 2011	max. 15 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.

This Warranty does not apply to accessories which bear the name of another company. Such non-warranted accessories include, but are not limited to: alternators, starters, fans, air conditioning compressors, clutches, filters, transmissions, torque converters, vacuum pumps, power steering pumps and air compressors.

Excessive oil consumption for B Series Engines is covered for the duration of the Coverage or 100,000 miles (160,935 kilometers) or 7,000 hours from the date of delivery of the Engine to the first user, whichever of the three occurs first. Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failures of belts and hoses supplied by Cummins are covered for the first year from the date of delivery of the Engine to the first user.

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

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

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

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

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

Emission Warranty

Products Warranted

This Emission Warranty applies to new diesel, LPG, compressed or liquid natural gas fueled Engines marketed by Cummins that are used in the United States* or Canada in vehicles designed for transporting persons or property on a street or highway. This Warranty applies to Engines delivered to the first user on or after January 1, 1999.

Coverage

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

operation, whichever occurs first, as measured from the date of delivery of the Engine to the first user, or (B) The Base Engine Warranty.

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

Limitations

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

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

EPA 2007/2010/2013	max. 15 parts per million
EPA Tier 4 Interim / Final	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

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

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

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

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

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

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

All Engines United States And Canada School Bus Coverage

Products Warranted

This Warranty applies to new diesel, LPG, compressed or liquid natural gas fueled Engines sold by Cummins Inc. or Cummins Westport and delivered to the first user on or after September 15, 1996, that are used in school bus* applications in the United States** or Canada.

Base Engine Warranty

The Base Engine Warranty covers any failures of the Engine which result, under normal use and service, from a defect in material or factory workmanship (Warrantable Failure). This Coverage begins with the sale of the Engine by Cummins and continues for five years or 100,000 miles (160,935 kilometers), whichever occurs first, from the date of delivery of the Engine to the first user.

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

Extended Major Components Warranty

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

Bushing and bearing failures are not covered.

This Coverage begins with the expiration of the Base Engine Warranty and ends three years or 300,000 miles (482,805 kilometers), whichever occurs first, from the date of delivery of the Engine to the first user.

Emission Warranty

Additional Coverage is outlined under the Emission Warranty.

THESE WARRANTIES ARE MADE TO ALL OWNERS IN THE CHAIN OF DISTRIBUTION AND COVERAGE CONTINUES TO ALL SUBSEQUENT OWNERS UNTIL THE END OF THE PERIODS OF COVERAGE.

Cummins Responsibilities

During The Base Engine Warranty

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

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

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

Cummins will pay reasonable costs for towing a vehicle disabled by a Warrantable Failure to the nearest authorized repair location when necessary to make the repair for the first 2 years from the date of delivery of the Engine to the first user. In lieu of towing expenses, Cummins will pay reasonable costs for mechanics to travel to and from the location of the vehicle, including meals, mileage and lodging, when the repair is performed at the site of the failure.

During The Extended Major Components Warranty

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

Owner Responsibilities

During The Base Engine Warranty

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

During The Extended Major Components Warranty

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

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

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

During The Base Engine And Extended Major Components Warranties

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

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

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

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

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

Limitations

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

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

EPA 2007/2010/2013	max. 15 parts per million
EPA Tier 4 Interim / Final	max. 15 parts per million
EU Stage IIIB 2011	max. 15 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.

This Warranty does not apply to accessories which bear the name of another company. This category includes, but is not limited to: alternators, starters, fans, air conditioning compressors, clutches, filters, transmissions, torque converters, vacuum pumps, power steering pumps and air compressors. Cummins branded alternators and starters are covered for the first two years from the date of delivery of the Engine to the first user, or the expiration of the Base Engine Warranty, whichever occurs first.

Excessive oil consumption for ISV and B Series Engines is covered for the duration of the Coverage. Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

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

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

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

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

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

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

Emission Warranty

Products Warranted

This Emission Warranty applies to new Engines marketed by Cummins that are used in the United States** or Canada in vehicles designed for transporting persons or property on a street or highway. This Warranty applies to Engines delivered to the ultimate purchaser on or after January 1, 1996.

Coverage

Cummins warrants to the ultimate purchaser and each subsequent purchaser that the Engine is designed, built and equipped so as to conform at the time of sale by Cummins with all U.S. federal emission regulations applicable at the time of manufacture and that it is free from defects in material or factory workmanship which would cause it not to

meet these regulations within the longer of the following periods: (A) Five years or 100,000 miles (160,935 kilometers) of operation, whichever occurs first, as measured from the date of delivery of the Engine to the ultimate purchaser, or (B) The Base Engine Warranty.

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

Limitations

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

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

EPA 2007/2010/2013	max. 15 parts per million
EPA Tier 4 Interim / Final	max. 15 parts per million
EU Stage IIIB 2011	max. 15 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.

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

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

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

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

* A vehicle used to transport students to and from school. Vehicle must be painted yellow, should have warning lights and the words 'SCHOOL BUS' written on the front and rear roof caps. The requirements pertaining to paint color, warning lights and 'SCHOOL BUS' inscription would not apply if the vehicle is exclusively used to transport students for school related activities and it is owned by a school district.

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

All Electronic Diesel Engines United States And Canada Recreational Vehicle Coverage

Products Warranted

This Warranty applies to new electronic diesel Engines sold by Cummins Inc., hereafter "Cummins", and delivered to the first user on or after August 1, 2005, that are used in recreational vehicle* applications in the United States** or Canada.

Base Engine Warranty

The Base Engine Warranty covers any failures of the Engine which result, under normal use and service, from a defect in material or factory workmanship (Warrantable Failure). This Coverage begins with the sale of the Engine by Cummins and ends five years or 100,000 miles (160,935 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.

On all Engines covered by this Warranty, except the ISB AD, the Owner is responsible for a \$100 (U.S. Dollars) deductible per each service visit under this plan in the third, fourth and fifth years of Base Engine Warranty. The deductible will not be charged during the first two years of the Base Engine Warranty.

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	max. 15 parts per million
EPA Tier 4 Interim / Final	max. 15 parts per million
EU Stage IIIB 2011	max. 15 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.

This Warranty does not apply to accessories which bear the name of another company. This category includes, but is not limited to: alternators, starters, fans, air conditioning compressors, clutches, filters, transmissions, torque converters, vacuum pumps, power steering pumps and air compressors. Cummins branded 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 (160,935 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.

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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 (160,935 kilometers) of operation, whichever occurs first, as measured from the date of delivery of the Engine to the first user, or (B) The Base Engine Warranty.

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

Limitations

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

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

EPA 2007/2010/2013 max. 15 parts per million

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

EPA Tier 4 Interim / Final max. 15 parts per million

EU Stage IIIB 2011 max. 15 parts per million

Euro 4/5 max. 50 parts per million

Euro 6 max. 10 parts per million

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

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

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

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

Cummins is not responsible for non-Engine repairs, "downtime" expenses, cargo damage, fines, all applicable taxes, all business costs 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.

ISC/ISL/ISL G/C Gas Plus/L Gas Plus U.S. And Canada Automotive Coverage

Products Warranted

This Warranty applies to new ISC/ISL/ISL G/C Gas Plus/L Gas Plus Engines sold by Cummins Inc., hereinafter 'Cummins', and delivered to the first user on or after January 1, 2003, that are used in automotive on-highway applications in the United States* or Canada with three exceptions. Cummins provides different Warranty Coverage for Engines used in fire apparatus truck and crash truck, bus and coach and recreational vehicle applications.

Base Engine Warranty

This Warranty covers any failures of the Engine which result, under normal use and service, from defects in 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, 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.

This Warranty is 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 station for the first year after the date of delivery of the Engine to the first user or the duration of the Warranty, whichever occurs first.

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

Owner Responsibilities

Owner is responsible for the operation and maintenance of the Engine as specified in the applicable Cummins Operation and Maintenance Manual and/or Owners 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 Warrantable Failures during the first year or the duration of the Warranty, whichever occurs first, Owner must 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

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

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

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

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

This Warranty does not apply to accessories supplied by Cummins which bear the name of another company. This category includes, but is not limited to: alternators, starters, fans, air conditioning compressors, clutches, filters, transmissions, torque converters, vacuum pumps, power steering pumps, Engine exhaust brakes, non-Cummins fan drives and air compressors.

Failures resulting in excessive oil consumption are covered for the duration of the Coverage or 250,000 miles (402,336 kilometers) or 6,250 hours after the date of delivery of the Engine to the first user, whichever of the three

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

Failures of belts and hoses supplied by Cummins are covered for the first year after 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 ISC/ISL/ISL G/C Gas Plus/L Gas Plus 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 March 1, 1998.

Coverage

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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 factory workmanship or material which would cause it not to meet these regulations within the longer of the following periods: (A) Five years or 100,000 miles (160,935 kilometers) of operation, whichever occurs first, as measured from the date of delivery of the Engine to the first user, or (B) The Base Engine Warranty. If the vehicle in which the Engine is installed is registered in the state of California, a separate California Emission Warranty also applies.

Limitations

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

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

EPA 2007/2010/2013	max. 15 parts per million
EPA Tier 4 Interim / Final	max. 15 parts per million
EU Stage IIIB 2011	max. 15 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 materials or factory workmanship, are not covered by this Warranty. Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack

of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine.

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

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

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

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

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 2014 and 2015 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

This warranty coverage is provided for five years or 160,935 km (100,000 miles) or 3,000 hours of engine operation, whichever first occurs from the date of delivery of the engine to the first user.

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 1-800-343-7357 or the California Air Resources Board at 9528 Telstar Avenue, El Monte, CA 91731.

A warranted part which is scheduled for replacement as required maintenance is warranted up to the first schedule replacement point.

Prior to the expiration of the applicable warranty, Owner must give notice of any warranted emission control failure to a Cummins® distributor, authorized dealer or other repair location approved by Cummins Inc. and deliver the engine to such facility for repair. Repair locations are listed in Cummins® United States and Canada Service Directory.

Owner is responsible for incidental costs such as: communication expenses, meals, lodging incurred by Owner or employees of Owner as a result of a Warrantable Condition.

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

California Emission Control System Warranty Coverage

This list of emission control parts may be covered by the emission control system warranty under certain failure modes:

NOTE: Where applicable with covered components, associated plumbing, mounting hardware, gaskets, o-rings, and wiring harnesses are covered.

California CARB Diesel

Aftertreatment System

Component

Aftertreatment Electroconnections
Aftertreatment Inlet and Outlet Modules
Aftertreatment Temperature Interface Module
Aftertreatment Temperature Sensors
Decomposition Tube
DEF Dosing Unit (Pump)
DEF Dosing Valve
Diesel Oxidation Catalyst
Diesel Particulate Filter (except for ash maintenance)
Diesel Particulate Filter Differential Pressure Sensor

Base Engine System

Component

Camshaft
Cam Shaft Valve Lobe
Clean Idle Sticker
Coolant Temperature Sensor
Crankcase Breather
Engine Oil Pressure Sensor
Engine Speed, Position Sensor, Cam Position Sensor
Exhaust Valve

EGR System

California CARB Diesel

NH3 Sensor
NOx Sensors
SCR Catalyst
DEF Quality Sensor
DEF Tank Heater Coolant Control Valve
DEF Line Heater Control Relay
DEF Temperature Sensors
DEF Tank/Lines Heating Elements of Heat Exchanger
and pipe
DEF Tank and Lines
DEF Level Sensor
Exhaust Gas Piping from Turbocharger out to the Last
Aftertreatment Device

Air Handling Component

Ambient Air Temperature Sensor
Exhaust Gas Pressure Sensor

Component
EGR Cooler
EGR Differential Pressure Sensor
EGR Mixer/Venturi
EGR Temperature Sensor
EGR Valve

Electronic Control System

Component
Engine Control Module
Wiring Harness Circuits Connected at Both Ends to
Emissions Warrantable Components
Engine Control Module Calibration
Diesel Exhaust Fluid (DEF) Lamp
On Board Diagnostic (OBD) Malfunction Indicator Lamp
(MIL)
OBD Connector

California CARB Diesel

Exhaust Manifold
Charge Air Cooler and Associated Plumbing
Grid Heater
Intake Manifold
Intake Manifold Temperature/Pressure Sensor
Throttle Actuator/Valve
Turbocharger Actuator
Air Handling (cont')
Turbocharger Assembly
Turbocharger Compressor InIntake Pressure/
Temperature Sensor
Turbocharger Speed Sensor

**Fuel System
Component**
Fuel Pump Actuator
Fuel Lines
Fuel Pressure Sensor
Fuel Pump

Fuel System (cont')
Injector
Secondary Fuel Pressure/Temperature Senosor

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

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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.

Acronyms and Abbreviations	i-13	Freezing.....	V-14
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CALIFORNIA
Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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