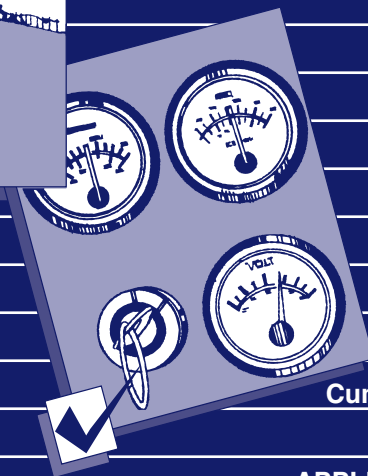
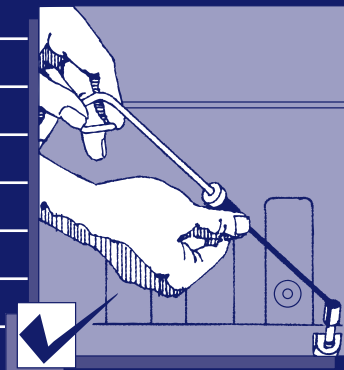
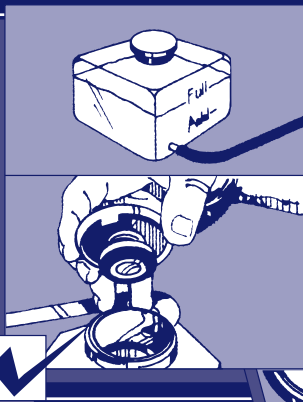




# Owners Manual ISV5.0 CM3230 V104



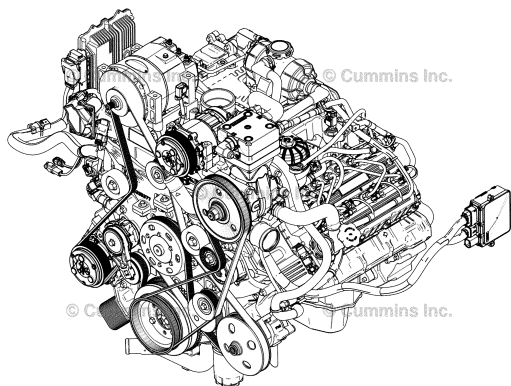
Cummins Customer Assistance Center

1-800-DIESELS™ (1-800-343-7357)

APPLICABLE ONLY IN U.S.A. AND CANADA



# Owners Manual ISV5.0 CM3230 V104



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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

## Section Contents

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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.**



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.

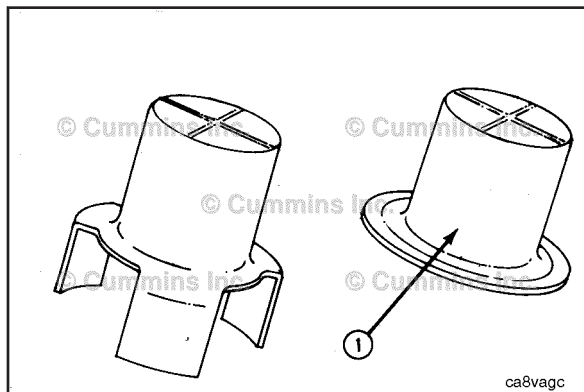
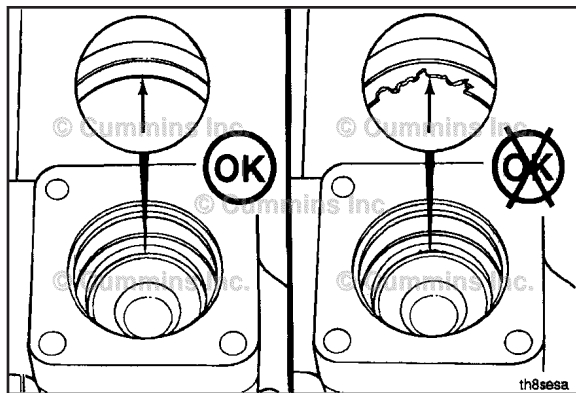


**PERFORM** an electrical **MEASUREMENT**.

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.

<b>ANSI</b>	American National Standards Institute
<b>API</b>	American Petroleum Institute
<b>ASTM</b>	American Society of Testing and Materials
<b>ATDC</b>	After Top Dead Center
<b>BTU</b>	British Thermal Unit
<b>BTDC</b>	Before Top Dead Center
<b>°C</b>	Celsius
<b>CAN</b>	Controller Area Network
<b>CO</b>	Carbon Monoxide
<b>CCA</b>	Cold Cranking Amperes
<b>CARB</b>	California Air Resources Board
<b>C.I.B.</b>	Customer Interface Box
<b>C.I.D.</b>	Cubic Inch Displacement
<b>CNG</b>	Compressed Natural Gas
<b>CPL</b>	Control Parts List
<b>cSt</b>	Centistokes
<b>DEF</b>	Diesel Exhaust Fluid

<b>DOC</b>	Diesel Oxidation Catalyst
<b>DPF</b>	Diesel Particulate Filter
<b>ECM</b>	Engine Control Module
<b>EFC</b>	Electronic Fuel Control
<b>EGR</b>	Exhaust Gas Recirculation
<b>EPA</b>	Environmental Protection Agency
<b>°F</b>	Fahrenheit
<b>ft-lb</b>	Foot-Pound Force
<b>FMI</b>	Failure Mode Identifier
<b>GVW</b>	Gross Vehicle Weight
<b>Hg</b>	Mercury
<b>hp</b>	Horsepower
<b>H<sub>2</sub>O</b>	Water
<b>inHg</b>	Inches of Mercury
<b>in H<sub>2</sub>O</b>	Inches of Water
<b>ICM</b>	Ignition Control Module
<b>IEC</b>	International Electrotechnical Commission
<b>km/l</b>	Kilometers per Liter
<b>kPa</b>	Kilopascal
<b>LNG</b>	Liquid Natural Gas
<b>LPG</b>	Liquified Petroleum Gas

<b>LTA</b>	Low Temperature Aftercooling
<b>MCRS</b>	Modular Common Rail System
<b>MIL</b>	Malfunction Indicator Lamp
<b>MPa</b>	Megapascal
<b>mph</b>	Miles Per Hour
<b>mpq</b>	Miles Per Quart
<b>N•m</b>	Newton-meter
<b>NOx</b>	Mono-Nitrogen Oxides
<b>NG</b>	Natural Gas
<b>O2</b>	Oxygen
<b>OBD</b>	On-Board Diagnostics
<b>OEM</b>	Original Equipment Manufacturer
<b>OSHA</b>	Occupational Safety and Health Administration
<b>PID</b>	Parameter Identification Descriptions
<b>ppm</b>	Parts Per Million
<b>psi</b>	Pounds Per Square Inch
<b>PTO</b>	Power Takeoff
<b>REPTO</b>	Rear Power Take Off
<b>RGT</b>	Rear Gear Train
<b>rpm</b>	Revolutions Per Minute
<b>SAE</b>	Society of Automotive Engineers



<b>SCA</b>	Supplemental Coolant Additive
<b>SCR</b>	Selective Catalytic Reduction
<b>STC</b>	Step Timing Control
<b>SID</b>	Subsystem Identification Descriptions
<b>TDC</b>	Top Dead Center
<b>VDC</b>	Volts of Direct Current
<b>VGT</b>	Variable Geometry Turbocharger
<b>VS</b>	Variable Speed
<b>VSS</b>	Vehicle Speed Sensor

# Section E - Engine and System Identification

## Section Contents

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## Engine Identification

### Engine Dataplate

<b>MANUFACTURED BY</b> CUMMINS INC. Assembled in the USA	<b>SPL</b>	<b>Model</b>	<b>ISV</b>	<b>REF. NO.</b>	<b>Engine No.</b>	<b>FEL</b>	<b>EPA/CARB</b>
	<b>Rated HP</b>	<b>at</b>	<b>rpm</b>	<b>Min Speed (rpm)</b>	<b>Family</b>	<b>NOx</b>	
	<b>Fuel Rate at adv. HP</b>	<b>HP</b>	<b>MIN</b>	<b>E.C.S.</b>	<b>Timing</b>	<b>ELECTRONIC</b>	<b>NOx-HRHC</b>
	<b>Date of Mfg.</b>	<b>G.I.D./L</b>	<b>/</b>	<b>Plant Code</b>	<b>12784563</b>	<b>PH</b>	

**WARNING:** Injury may result and warranty is voided if fuel rate, rpm or altitudes exceed published maximum values for this model and application.

**IMPORTANT ENGINE INFORMATION:** This engine is exempt from the prohibitions of sections 205, 206, 207, 208, 209 of the Clean Air Act as amended. See the Exemption Label Information for Exemption No. and Effective Date.

00s00018

The engine dataplate shows specific facts about an engine. The dataplate is located on the engine air intake connection. The engine serial number provides data for ordering parts and service. The engine dataplate **must not** be changed unless approved by Cummins Inc.

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

The image shows a Cummins engine identification label with five numbered callouts: 1 points to the 'CPL' field, 2 points to the 'Model' field, 3 points to the 'Engine No.' field, 4 points to the 'Horsepower' field, and 5 points to the 'Firing Order' field.

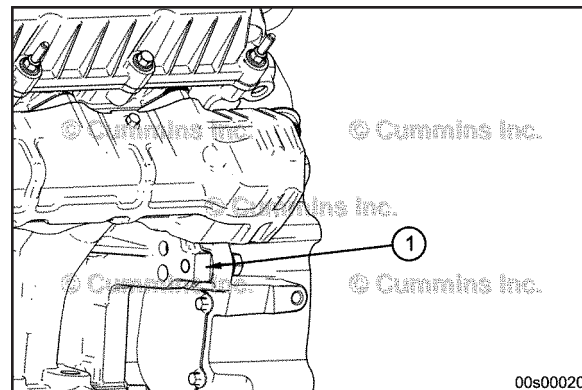
MANUFACTURED BY CUMMINS INC.		CPL	Model	ISV	REF. NO.	Engine No.	FEL	REPAIR/CRS
Assembled in the USA		40331111	Advertised HP	HP	rpm	Idle Speed (rpm)	Family	MO
WARNING: Injury may result and warranty is voided if fuel rate, rpm or altitudes exceed published maximum values for this model and application.		Part. Rate at 1500 rpm	min	max	E.C.E.	Timing: ELECTRONIC	NOISE	
		Class of Use	C/V	D/L	Eng. Code	12784583	PN	
<p>IMPORTANT ENGINE INFORMATION: This engine is exempt from the prohibitions of sections 203 (a), 203 (b), &amp; (c) of the Clean Air Act as amended. See Exemption Label information for Exemption No. and Effective Date.</p>								

00s00019

- 1 Engine control parts list (CPL)
- 2 Engine model information
- 3 Engine serial number (ESN)
- 4 Horsepower rating
- 5 Firing order.

If the engine dataplate (1) is **not** legible, the engine serial number can be found on the back of the engine block below the left side exhaust manifold.

Additional engine information is available by reading the engine control module (ECM) dataplate.

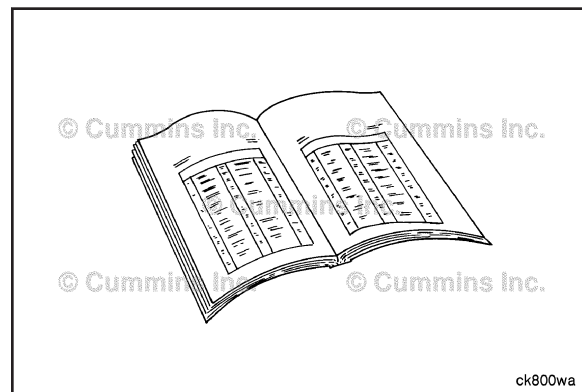


00s00020

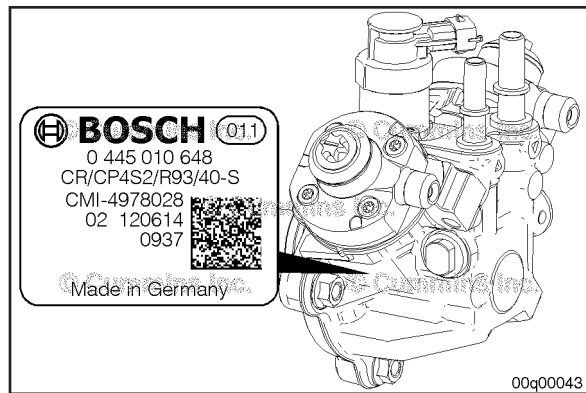
## Cummins® Engine Nomenclature

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 the manual. Refer to Procedure 100-006 in Section E.



ck800wa

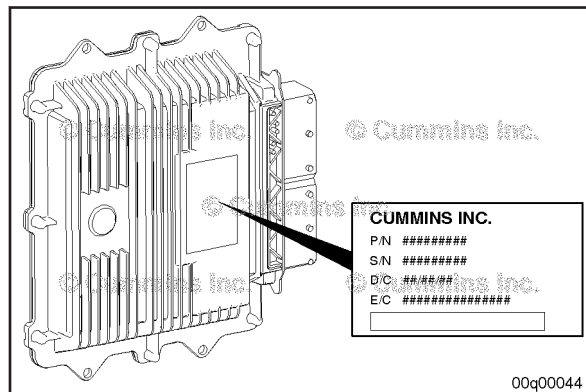


## Fuel Injection Pump Dataplate

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

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

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



## Engine Control Module Dataplate

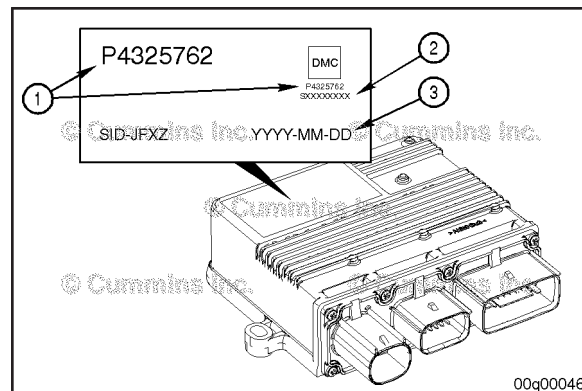
Engines covered by this manual are equipped with a CM3230A ECM. A CM3230A ECM has a 105-pin connector for engine inputs and outputs **only**. The 91-pin connector is for after treatment and vehicle inputs and outputs.

The ECM is remotely mounted and location is dependent on the original equipment manufacturer (OEM). Refer to the OEM manual to identify the ECM location.

## Glow Plug Controller

This engine is equipped with a glow plug controller which commands and delivers power to the glow plugs. This controller can be identified by:

- 1 Cummins® part number
- 2 Glow plug controller serial number
- 3 Manufacturing date.

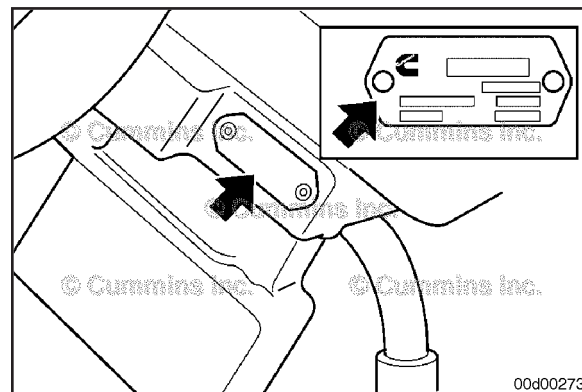


## Air Compressor

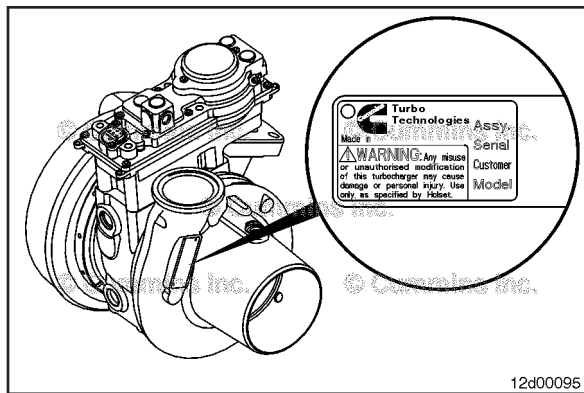
**NOTE:** Not all engines are equipped with an air compressor.

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

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







## Variable Geometry Turbocharger

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

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

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

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

## Exhaust System

The diesel oxidation catalyst (DOC)/diesel particulate filter (DPF) aftertreatment assembly has information etched on the canister towards the inlet of the DOC/DPF.

The etching contains:

- Part number
- Part serial number.

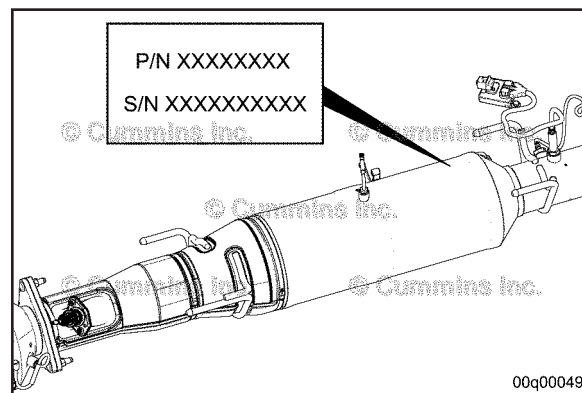
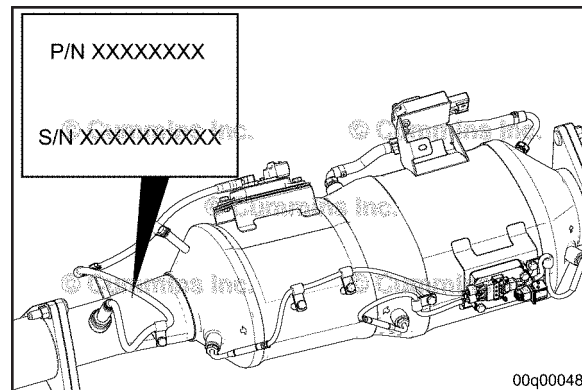
**NOTE:** Some aftertreatment components may **only** have the CES part number. For cross-referencing and part number identification, reference QuickServe™ Online.

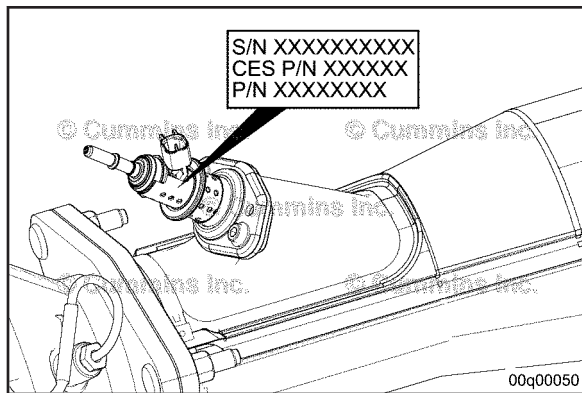
The aftertreatment decomposition tube and selective catalytic reduction (SCR) assembly identification has information etched on the canister towards the outlet of the assembly on the main body of the SCR.

The etching contains:

- Part number
- Part serial number.

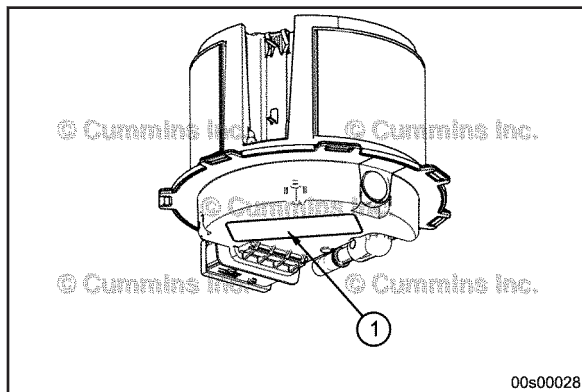
**NOTE:** Some aftertreatment components may **only** have the CES part number. For cross-referencing and part number identification, reference QuickServe™ Online.





The aftertreatment DEF dosing valve identification is located on the side of the valve and contains the following information to assist in servicing or replacement:

- DEF injector serial number
- CES part number
- Cummins® part number.



The aftertreatment DEF dosing unit identification is located on the bottom of the doser (1). The doser is installed at the bottom of the DEF tank.

The label contains:

- Type
- DEF dosing unit serial number
- CES part number
- Cummins® part number.

## 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.



<b>MANUFACTURED BY CUMMINS INC.</b> <small>ISO 9001:2015</small> <small>DATE OF MFG</small> <small>WARNING: Injury may result and warranty is voided if fuel rate, rpm or altitudes exceed published maximum values for this model and application.</small>	Engine No.	Ref. No.	MODEL	Fuel Rate at Adv. HP	Int'l Code			CPL
	Idle Speed (rpm)	Advertised HP	at rpm	Family	FEL	EPA	CARB	
	Pining Order	Wiring: F.D.C	ELECTRONIC	Catalyst No.	Warranty			
	Valve lash code	Int.	Exh.	I.D.A. / E.C.S.	PM			
<small>IMPORTANT ENGINE INFORMATION: This engine is exempt from the prohibitions of sections 203 (a) (1) (2) &amp; (4) of the Clean Air Act as amended. See exemption label information for exemption no. and effective date.</small>								

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

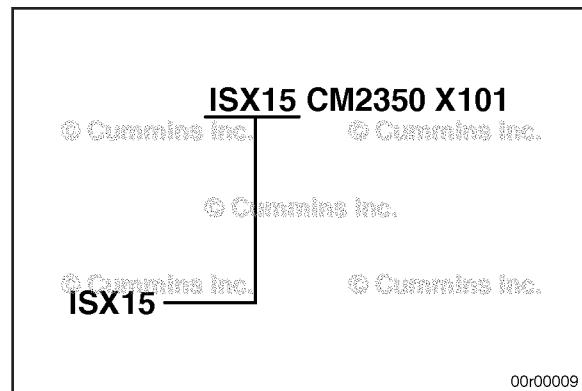
Marketing engine model names (2) can be found on the engine dataplate, Cummins® brochures, and Cummins® promotional literature.

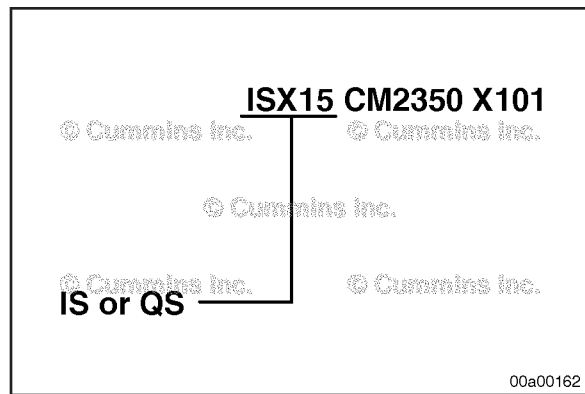
Examples of Cummins® service information and products that use service model names:

- 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

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 and 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

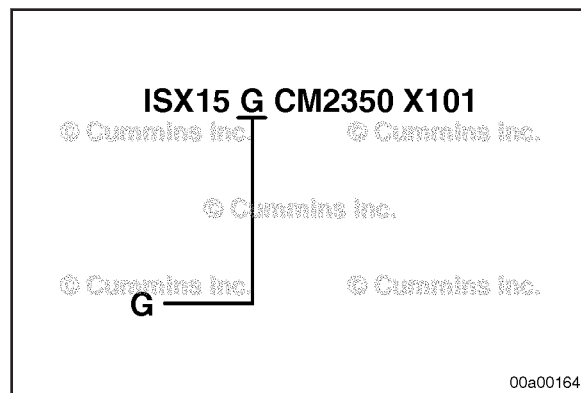
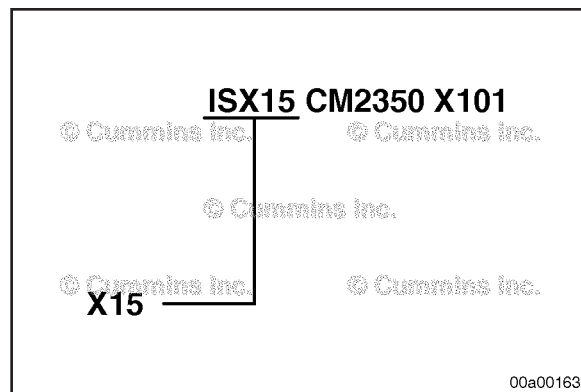
**NOTE:** Some legacy engines will use the cubic inch rather than liter for engine displacement.

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

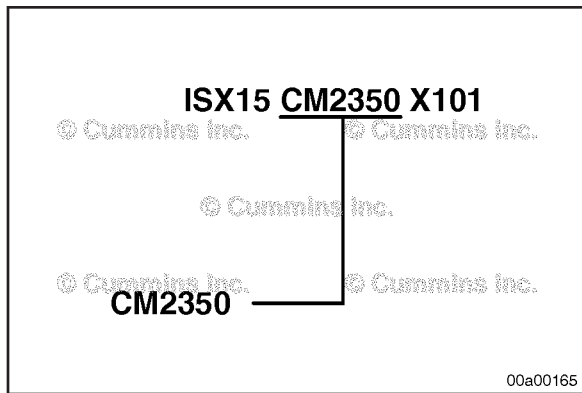
**NOTE:** Not all engines fueled by natural gas will have a “G” located after the displacement.

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.

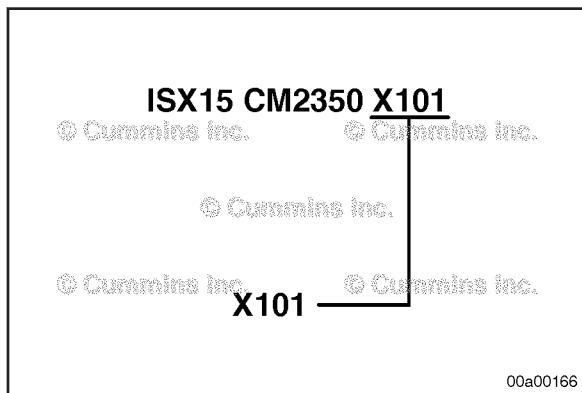






The engine control system is identified with the letters "CM" followed by the control system model number.

**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 **ISV5.0 CM3230 V104**.

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

#### United States and Canada

- EPA 2013.

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

- Charge-Air Cooler
- 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

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- Number of Cylinders - 8
- Engine Configuration - Vee
- Cylinder Block Material - Compacted Iron Graphite
- Cylinder Head Material - Aluminum
- Camshaft Location - Cylinder Head
- Variable Geometry Turbocharger Brake Option
- Accessory Drive Option
- Crankcase Ventilation System - Closed.

#### **Electronic Control System**

- ECM: CM3230
- Electrical System Voltage - 12 VDC
- Engine Coolant Temperature Sensor
- Engine Oil Pressure Switch
- Crankcase Pressure Sensor
- Camshaft Speed and Position Sensor
- Crankshaft Position Sensor
- Fuel Rail Pressure Sensor
- Fuel Temperature Sensor
- Fuel Pump Actuator

- Water-in-Fuel Sensor
- EGR Differential Pressure Sensor
- Exhaust Gas Pressure Sensor
- EGR Temperature Sensor
- Intake Manifold Air 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
- Aftertreatment Intake Mono-Nitrogen Oxides (NOx) Sensor
- Aftertreatment Outlet NOx Sensor.

### **Air Handling**

- Turbocharger (Single)
  - Variable Geometry
- Charge-Air Cooler
- Glow Plugs
- Engine Intake Throttle Actuator.

### **Fuel System**

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- Diesel
- Common Rail Fuel System
  - Bosch™ Common Rail Fuel System.

### **Exhaust System**

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

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

### **Automotive**

- Truck - Conventional Truck
- 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.

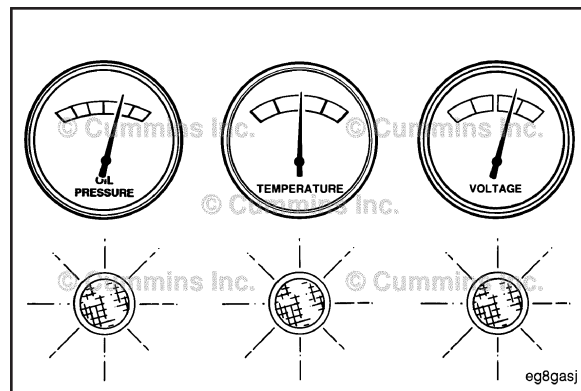
Follow the daily maintenance checks listed in Maintenance Guidelines (Section 2).

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.

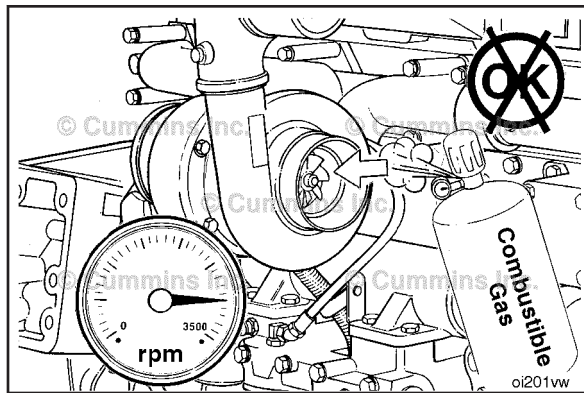
Check the oil pressure indicators, temperature indicators, warning lights, and other gauges daily to make sure they are operational.



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.

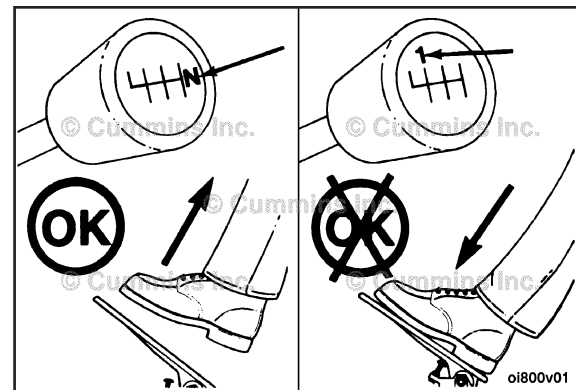
Cummins recommends the installation of an air intake shutoff device or a similar safety device to minimize the risk of overspeeding when an engine is operating in a combustible environment, such as due to a fuel spill or gas leak.

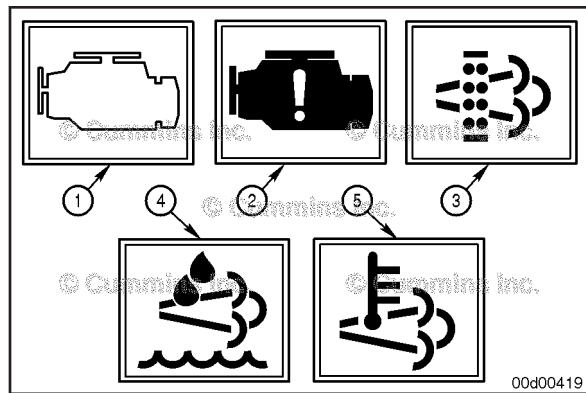
## Normal Starting Procedure

### 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.





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

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

Additionally, some engines have an additional lamp, (5) HIGH EXHAUST SYSTEM TEMPERATURE, which is amber in color.

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

**⚠CAUTION⚠**

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

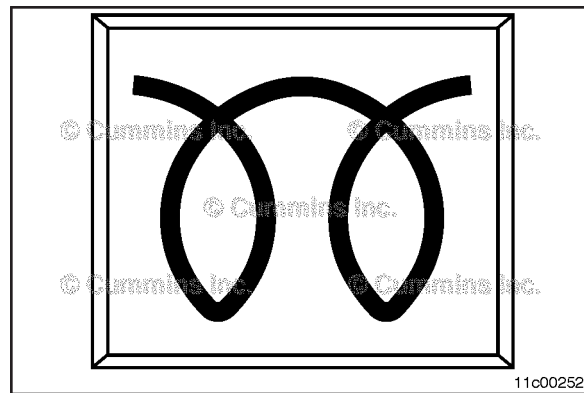
Under cold conditions, the Wait-to-Start lamp (generally a yellow lamp using a symbol similar to the graphic, or the words WAIT TO START) will also illuminate at key ON, and will stay on for a period of up to 30 seconds.

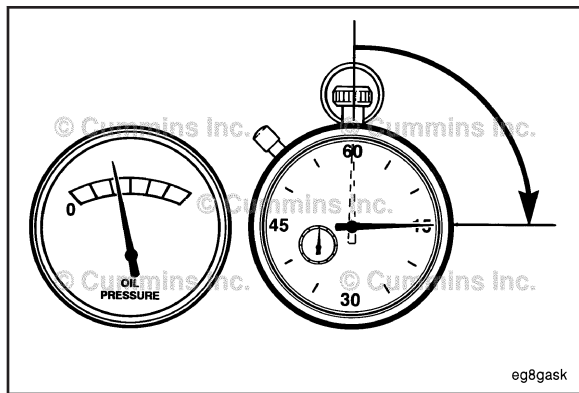
**NOTE:** The length of time the Wait-to-Start lamp remains illuminated depends on the ambient temperature. The lower the ambient temperature, the longer the lamp will be illuminated.

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

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

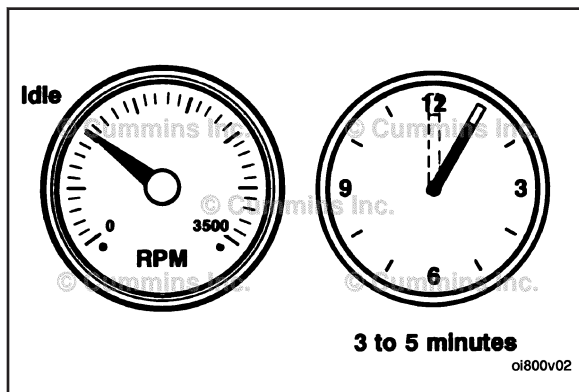
**NOTE:** Engines equipped with air starting motors require a minimum of 480 kPa [70 psi].





### ⚠CAUTION⚠

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



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

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

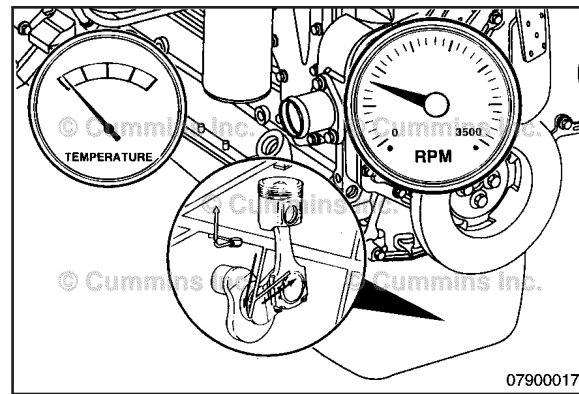
After starting a cold engine, increase the engine speed (rpm) slowly to provide adequate lubrication to the bearings and to allow the oil pressure to stabilize.

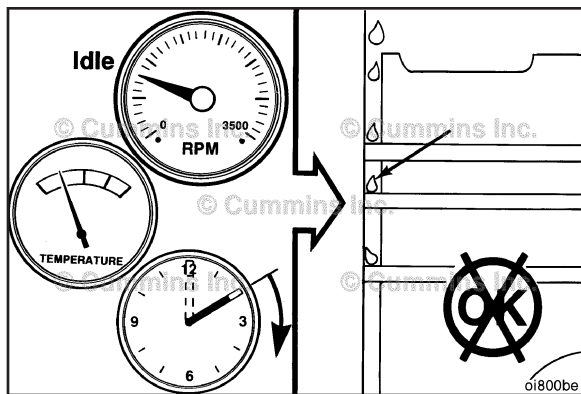
**NOTE:** For engines equipped with engine warm-up protection feature; this feature limits engine speed and torque following engine start-up until sufficient oil pressure is available to the engine components. This feature reduces the risk of engine part damage due to operating at engine speeds too high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

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

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

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





### ⚠CAUTION⚠

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

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

## Jump Starting



### WARNING

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



### CAUTION

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

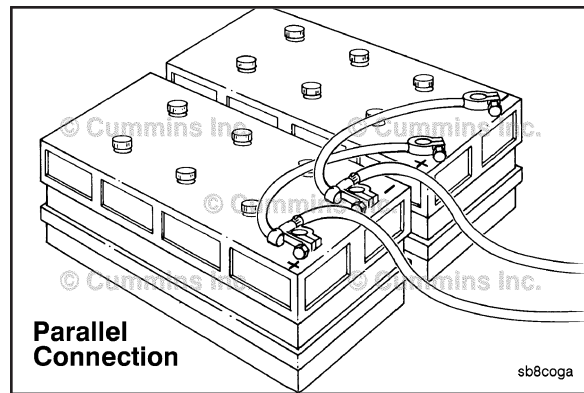


### CAUTION

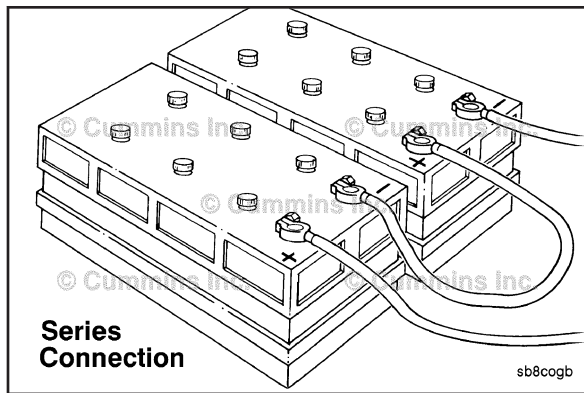
To reduce the possibility of damage to engine parts, do not connect the jumper starting or battery charging cable to any fuel system or electronic component.

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

**NOTE:** Always reference the relevant 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

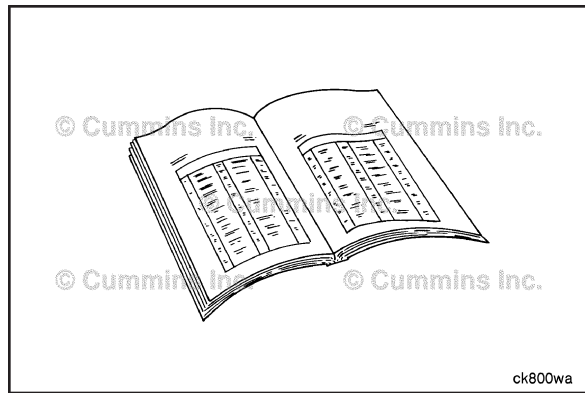
### General Information

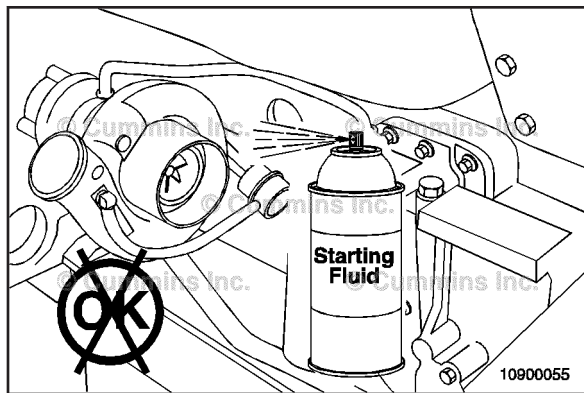
#### **⚠CAUTION⚠**

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.





## 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

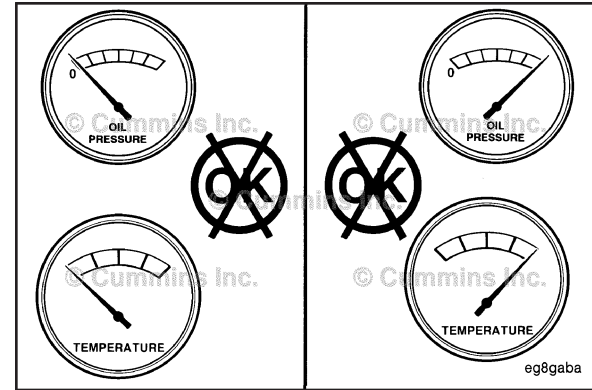
Follow the Normal Starting Procedure in this section. The engine will run at idle **only** until the minimum oil pressure is detected by the engine control module (ECM).

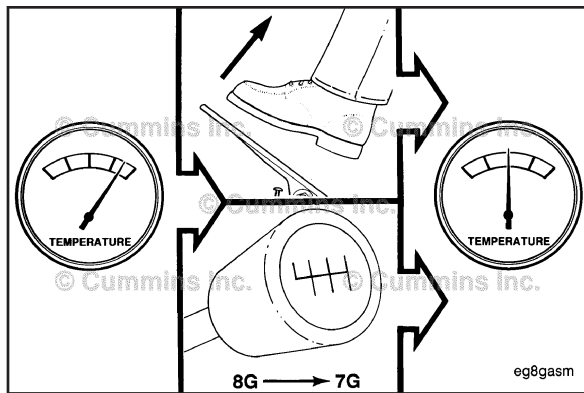
## Operating the Engine

### Normal

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

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





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

### ⚠CAUTION⚠

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

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]**

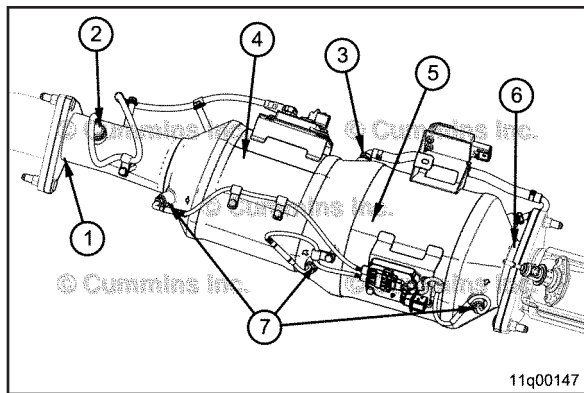
Use 60-percent ethylene glycol antifreeze and 40-percent water for the engine coolant mixture.

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 seven main components:

- 1 Aftertreatment inlet
- 2 Aftertreatment mono-nitrogen oxides (NO<sub>x</sub>) sensor
- 3 Aftertreatment diesel particulate filter (DPF) differential pressure sensor
- 4 Aftertreatment diesel oxidation catalyst (DOC)
- 5 Aftertreatment DPF
- 6 Aftertreatment outlet
- 7 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 inlet NOx sensor measures the NOx levels in the exhaust flowing into the aftertreatment system.

The aftertreatment DPF differential pressure sensor measures the restriction across the aftertreatment DPF.

The aftertreatment DPF captures the soot and ash from the engine exhaust.

The aftertreatment DOC 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 partially burned particles of fuel that occur during normal engine operation (black smoke).

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

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

The aftertreatment DPF loading status and regeneration status will be displayed as a message on the dashboard.

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

Ultra-low sulfur diesel fuel is required for an engine equipped with an aftertreatment DPF. If ultra-low sulfur diesel is **not** used, the aftertreatment DPF or aftertreatment DOC 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 life of the aftertreatment DPF, 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 DPF cleaning intervals for the engine being serviced. Refer to Procedure 102-002 in Section 2.

## 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 two hours of engine idle operation, the engine speed will increase to 1000 to 1100 revolutions per minute (rpm), and remain at this speed for 20 minutes. During this time, the aftertreatment system is warmed up enough to evaporate any water that has condensed in the system.

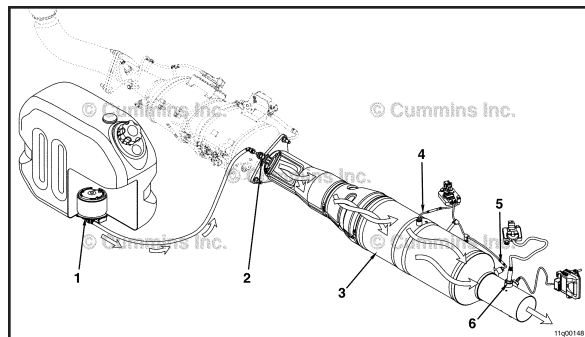
The aftertreatment warm up function can be stopped by depressing the throttle, clutch, or brake pedal. If the engine continues to idle, the aftertreatment warm up function will try again to raise the idle speed until the aftertreatment temperatures are suitable.

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

### General Information

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

- 1 Aftertreatment diesel exhaust fluid (DEF) dosing unit
- 2 Aftertreatment DEF dosing valve
- 3 Aftertreatment SCR catalyst
- 4 Aftertreatment exhaust gas temperature sensors
- 5 Aftertreatment outlet NOx sensor.



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

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

- DEF may have a slight ammonia smell.
- DEF is colorless.
- DEF is non-toxic and non-polluting.
- DEF is non-flammable.
- Urea is naturally occurring and is biodegradable.

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.

The aftertreatment DEF dosing valve sprays DEF into the exhaust.

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

Messages on the dash will be displayed to alert the operator of the level of DEF in the tank. As the DEF tank level approaches empty, the aftertreatment DEF level message displays on the dashboard and engine power is reduced. Attempting to operate the vehicle with no DEF in the tank will result in the vehicle speed being limited to a low speed.

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

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

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

After turning the keyswitch OFF on a vehicle with SCR, a pumping sound will possibly be heard from beneath the vehicle. This sound is the aftertreatment DEF dosing unit purging any unused DEF from the system and returning it to the tank. This is normal system operation. The purge process takes approximately 60 seconds to complete. Do **not** disconnect the vehicle batteries during this process to reduce the possibility of system damage.

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

## Unique Operating Characteristics of an Engine with On-Board Diagnostic

### General Information

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

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

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

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

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

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

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

**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.

## 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.

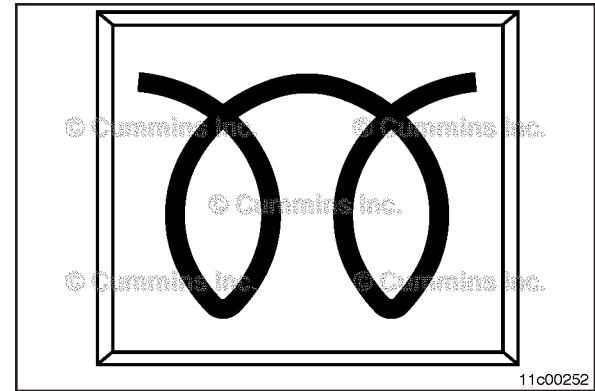
### Wait to Start Lamp

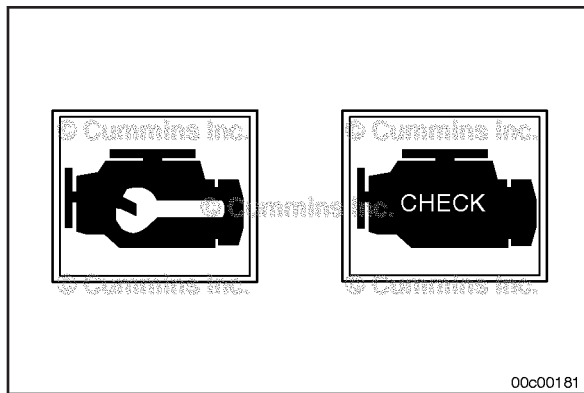
The WAIT TO START lamp illuminates when the glow plugs need to warm the cylinder combustion chambers prior to starting the engine.

For vehicles equipped with an engine starting motor protection feature, another function of the WAIT TO START lamp is to flash for two minutes if the starting motor is engaged for 30 seconds or more.

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.

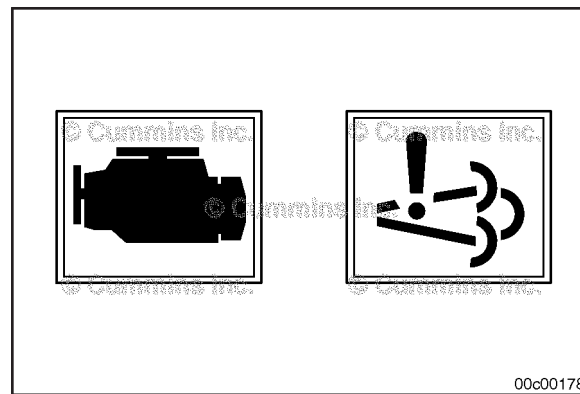
### Malfunction Indicator Lamp

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

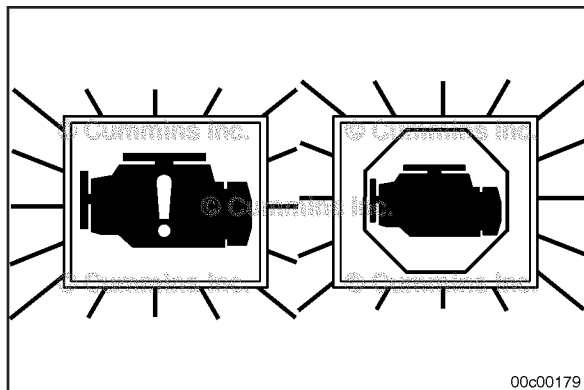
- A symbol of an engine, similar to the illustration.
- A symbol of exhaust flow featuring an exclamation point, similar to the illustration.

For applications equipped with On-board Diagnostics (OBD), 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.

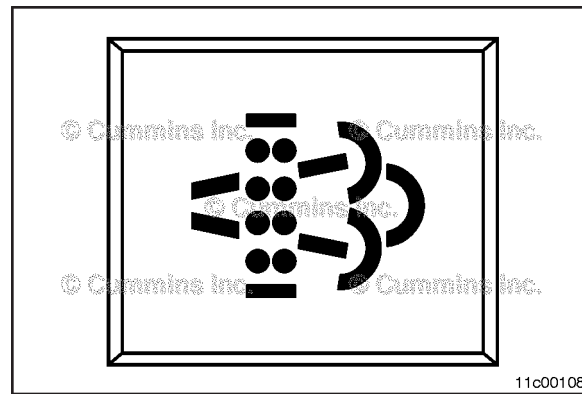
### Aftertreatment Diesel Particulate Filter Lamp

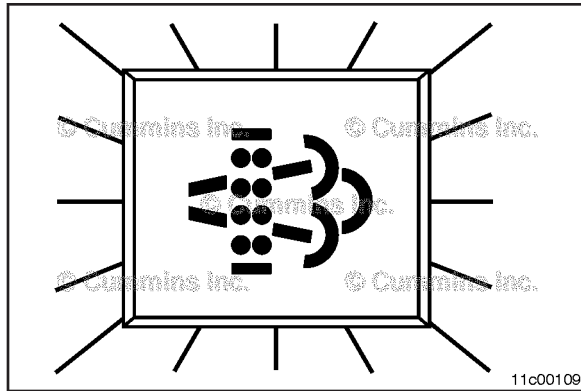
The AFTERTREATMENT DIESEL PARTICULATE FILTER lamp indicates, when illuminated or flashing, that the aftertreatment diesel particulate filter requires regeneration.

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:

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

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





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

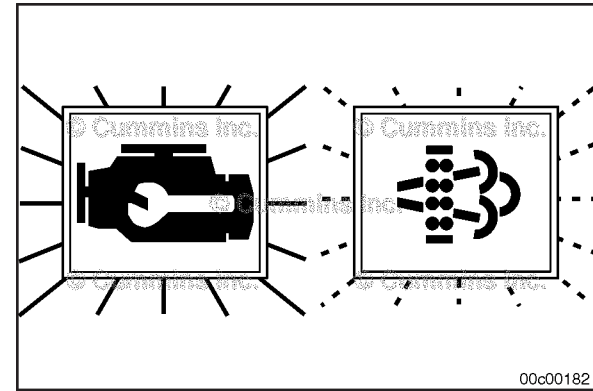
When this lamp is flashing, the operator should:

- 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.

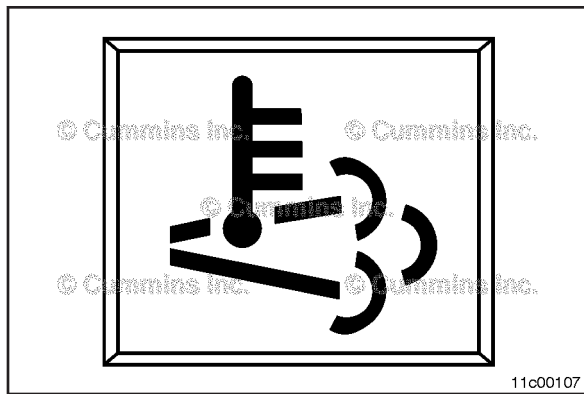
A flashing AFTERTREATMENT DIESEL PARTICULATE FILTER lamp combined with an illuminated WARNING or CHECK ENGINE lamp indicates that the aftertreatment diesel particulate filter needs be regenerated immediately. Engine power will be reduced automatically.

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.



00c00182



### High Exhaust System Temperature Lamp



**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.

### Aftertreatment Diesel Exhaust Fluid Lamp

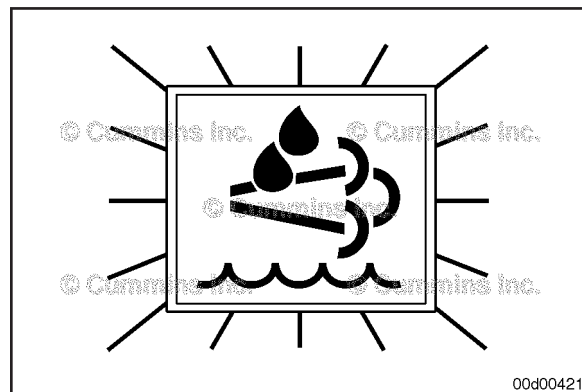
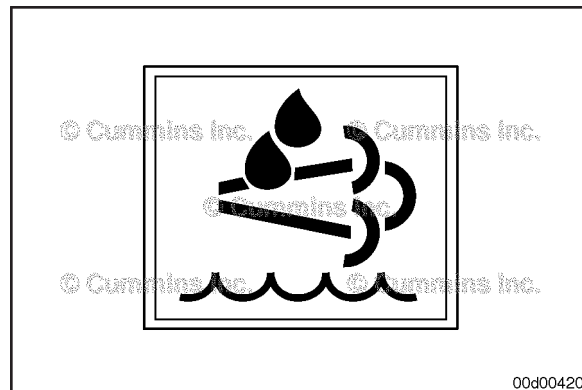
The AFTERTREATMENT DIESEL EXHAUST FLUID lamp indicates, when illuminated or flashing, that the diesel exhaust fluid (DEF) level is low.

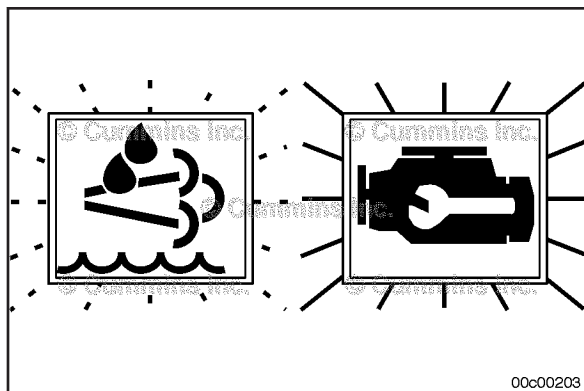
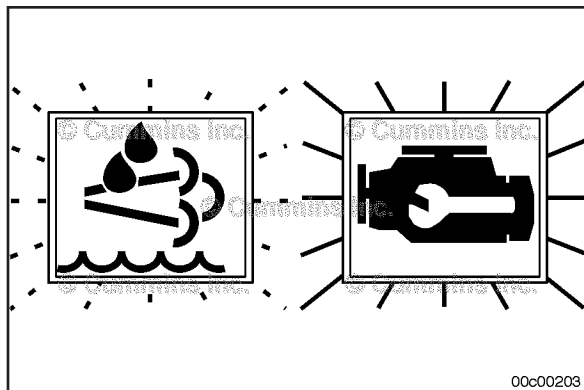
An illuminated AFTERTREATMENT DIESEL EXHAUST FLUID lamp indicates that the DEF level has fallen below the initial warning level. This can be corrected by filling the DEF tank with DEF.

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

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

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





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

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

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

**NOTE:** On OBD certified products, the malfunction indicator lamp (MIL) may become illuminated for a loss of prime condition.

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

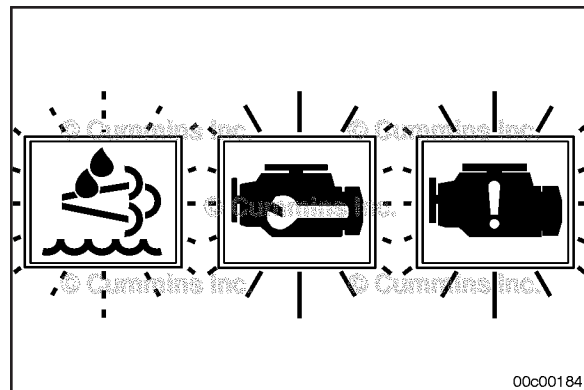
If the engine has been shut down or has idled for an extended period of time after the DEF tank has been emptied, the STOP ENGINE lamp will also be illuminated along with the flashing AFTERTREATMENT DIESEL EXHAUST FLUID lamp and illuminated CHECK ENGINE lamp. The engine power will continue to be limited automatically. The vehicle speed will also be limited to 8 kph [5 mph].

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

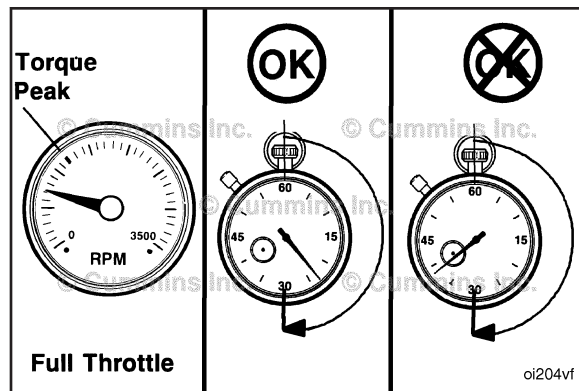
**NOTE:** In order to remove the 8 kph [5 mph] speed limit, the DEF tank **must** be filled to at least 10 percent volume of the tank.

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

**NOTE:** The MALFUNCTION INDICATOR LAMP may also be illuminated.







## 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.

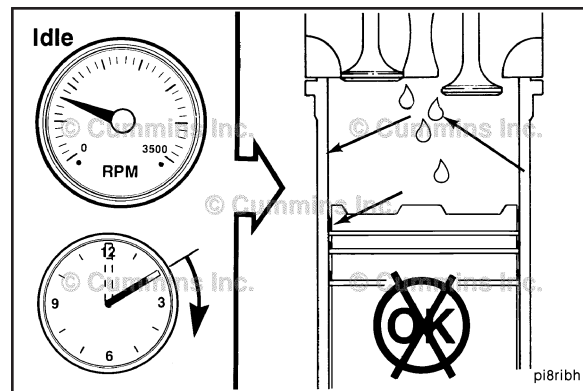
Cummins® engines are designed to operate successfully at full throttle under transient conditions down to peak torque engine speed. This is consistent with recommended operating practices.

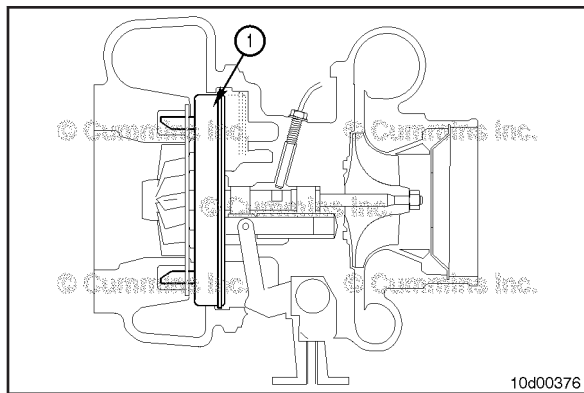
#### ⚠CAUTION⚠

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

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

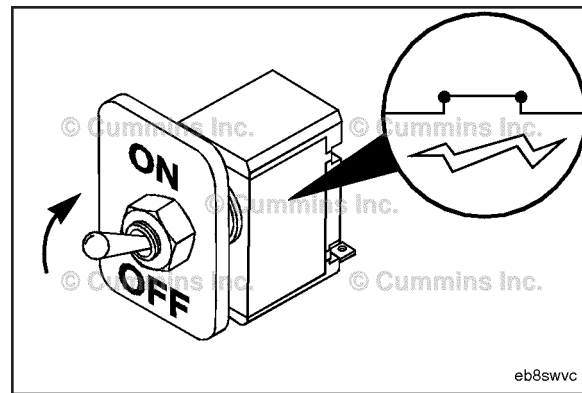
This feature, if the vehicle is equipped, allows the VGT to act as an exhaust brake. An engine VGT exhaust brake retards the speed of the engine during motoring conditions to provide additional vehicle braking power and to extend the life of the vehicle service brakes.

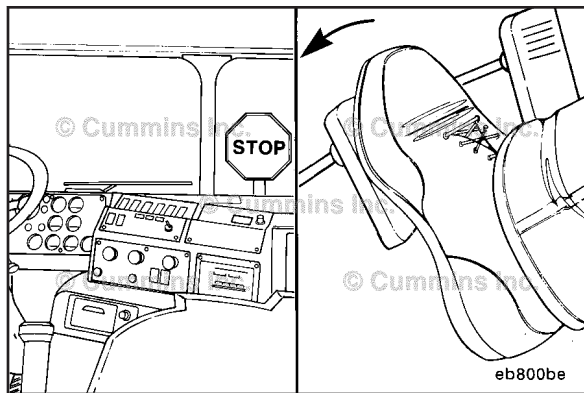
An engine VGT exhaust brake works to retard engine speed by creating high exhaust back pressure. This back pressure is obtained by restricting airflow through the turbine housing of the turbocharger. This restriction through the turbine housing of the turbocharger is created through positioning of the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

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

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

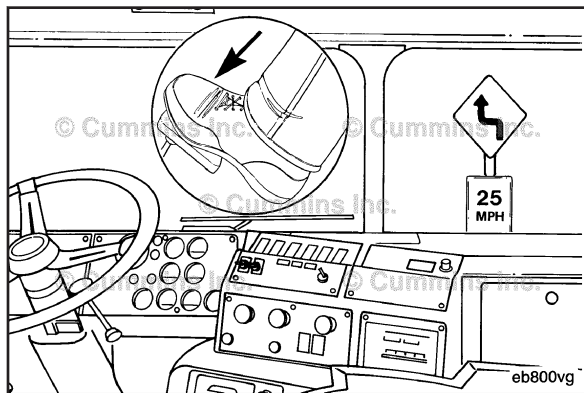
**NOTE:** The exhaust brake can only be activated when the accelerator pedal is at its low idle position. With the throttle at low idle position, fueling commands to the cylinders will **not** detract from the braking power of the brake system.





**NOTE:** The engine VGT exhaust brake is 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.



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

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

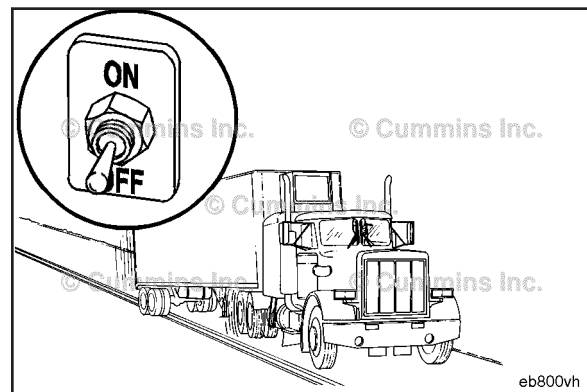
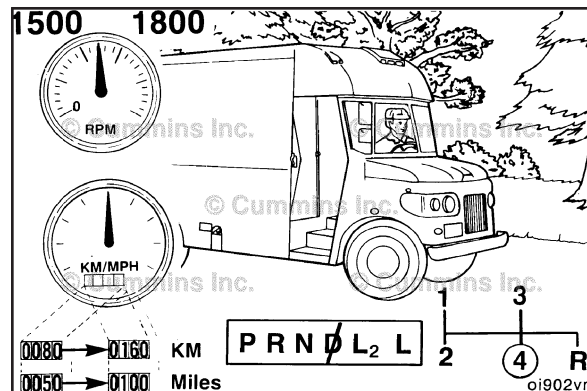


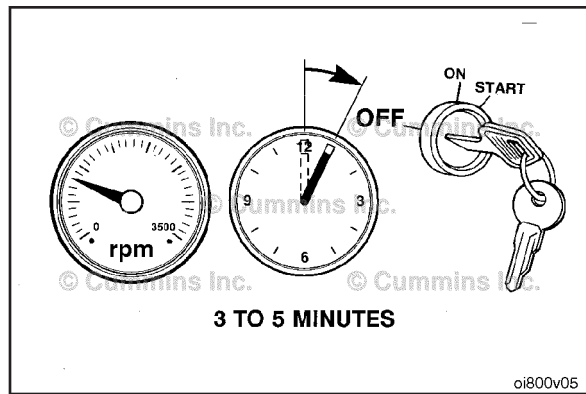
**Exceeding governed engine speed can cause engine damage.**

The optimum braking power of the engine VGT exhaust break is reached at the highest governed engine speed (3600 rpm). Correct gear selection, therefore, is critical.

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

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





## 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.

## Electronic Controlled Fuel System

### General Information

The engine addressed by this manual has an electronically controlled fuel system that provides many operator and vehicle features.

The base functions of the control system include fueling and timing control, limiting the engine speed operating range between the low- and the high-idle set points, and optimizing engine performance while maintaining emissions compliance. The system also controls the engine brakes.

The control system uses inputs from the operator and its sensors to determine the fueling and timing required to operate at the desired engine speed at the required emissions level.

### **Engine Control Module Inputs**

The engine control module (ECM) is the control center of the system. It processes all of the inputs and sends commands to the fuel system, vehicle and engine control devices.

The ECM performs diagnostic tests on most of its circuits and will activate a fault code if a problem is detected in one of these circuits. Along with the fault code identifying the problem, a snapshot of engine operating parameters at the time of fault activation is also stored in the memory.

Active fault codes will cause a diagnostic lamp to activate as a signal to the operator.

The ECM can communicate with service tools and some other vehicle controllers (such as transmissions, ABS, ASR, electronic dash displays, and so on) through the SAE J1939 data link.

Some vehicles and equipment will have SAE J1939 networks on them that link many of the "smart" controllers together. The vehicle control device can temporarily command engine speed or torque to perform one of its functions (that is, transmission shifting, anti-lock braking and so on).

The control system uses a number of sensors to provide information on engine operating parameters. These sensors include:

- Engine coolant temperature sensor
- Intake manifold temperature/pressure sensor
- Engine oil pressure switch



- Engine speed (crankshaft position) sensor
- Camshaft position sensor
- Ambient air pressure/temperature sensor
- Fuel rail pressure sensor
- Water-in-fuel sensor
- Turbocharger speed sensor
- Variable geometry turbocharger actuator
- Exhaust gas recirculation (EGR) valve
- Exhaust pressure sensor
- EGR temperature sensor
- EGR differential pressure sensor
- Crankcase pressure sensor
- Aftertreatment temperatures sensor(s)
- Aftertreatment diesel particulate filter differential pressure sensor
- Oil pressure sensor
- Accelerator pedal/lever position sensor
- Exhaust brake selector switches
- Engine coolant level sensor
- Vehicle speed sensors

- Feature control switches (i.e. cruise control switches)
- Fan control switch
- Air conditioner pressure switch
- Remote accelerator
- Remote PTO.

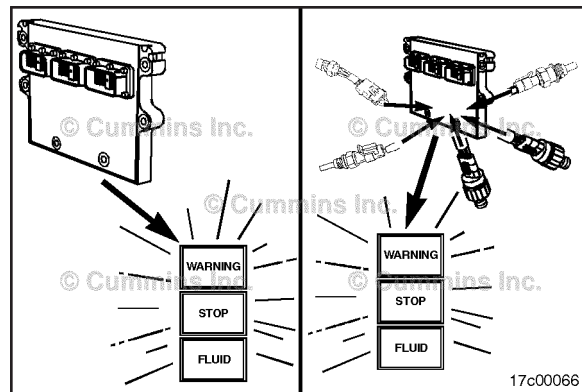
**NOTE:** These inputs are application dependent. Some applications will **not** use all of these inputs.

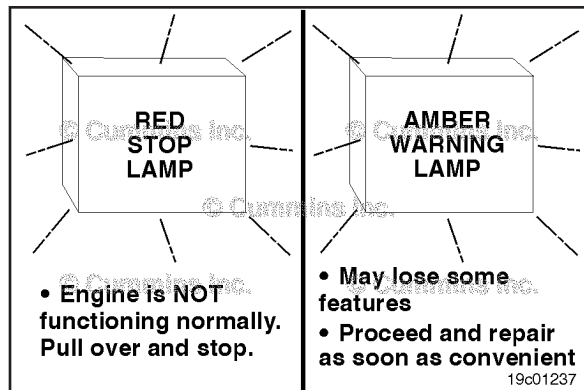
## Diagnostic Fault Codes

The electronic engine control system can display and record certain detectable fault conditions. These failures are displayed as fault codes, which make troubleshooting easier. The fault codes are retained in the ECM.

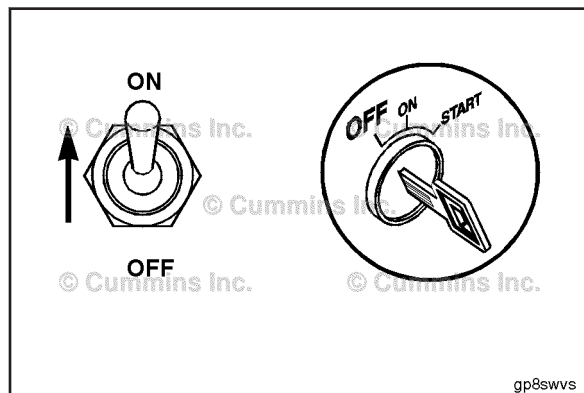
There are two types of diagnostic codes:

- Engine electronic control system fault codes are to inform the operator that there is a problem with the control system that will require troubleshooting.
- Information and engine protection fault codes are to inform the operator that the control system has detected an engine condition outside the normal operating range.





All fault codes recorded will either be active (fault code is presently active on the engine) or inactive (fault code was active at some time, but is **not** presently active).



Fault codes can be accessed in at least two different ways; with the electronic service tool or the fault code flash out.

To check for active engine electronic fuel system and engine protection system fault codes, turn the keyswitch OFF and move the diagnostic switch to the ON position.

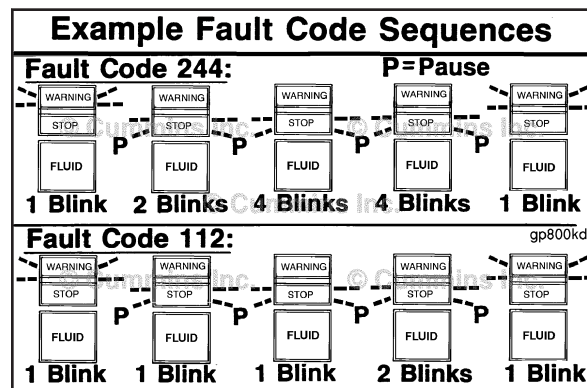
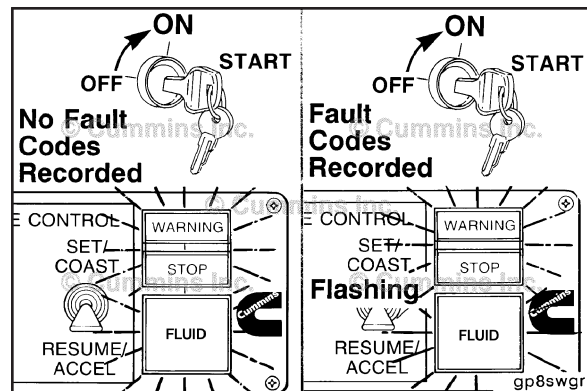
Turn the vehicle keyswitch to the ON position.

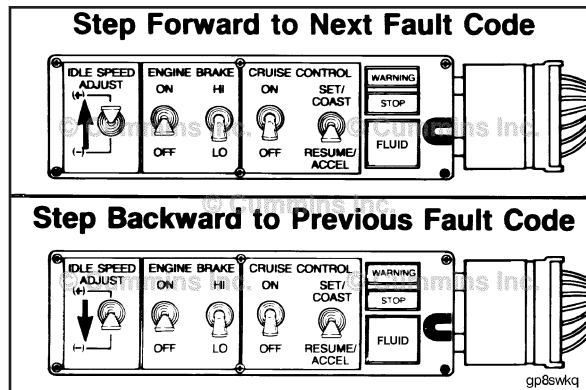
If no active fault codes are recorded, both lights will come on and stay on.

If active fault codes are recorded, both lights will come on momentarily, then begin to flash the code of the recorded faults.

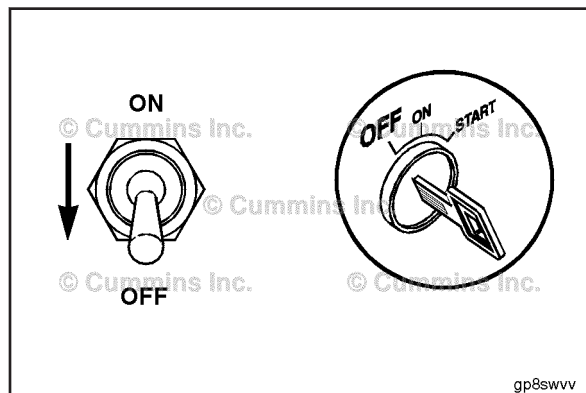
The fault code will flash in the following sequence:

- First, a WARNING (amber) light will flash.
- Then there will be a short one or two second pause after which the number of the recorded fault code will flash in STOP (red).
- There will be a one or two second pause between each number.
- When the number has finished flashing in red, an amber light will appear again.





The lights flash each fault code out three times before advancing to the next code. To skip to the next fault code, move the Increment/Decrement switch, if equipped, momentarily to the increment (+) position. You can go back to the previous fault code by momentarily moving the Increment/Decrement switch, if equipped, to the decrement (-) position. If only one active fault is recorded, the same fault code will continuously be displayed when either (+) or (-) switch is depressed.



When **not** using the diagnostic system, turn off the diagnostic switch.

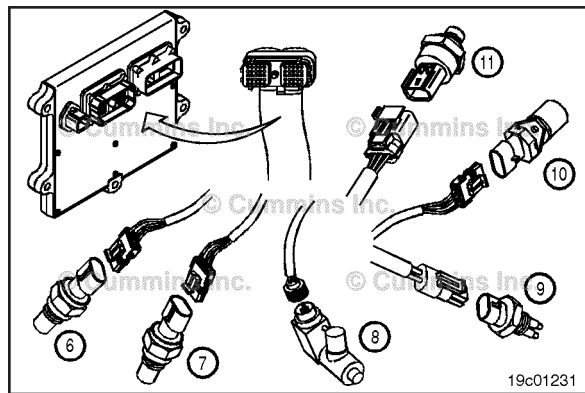
## Engine Protection System

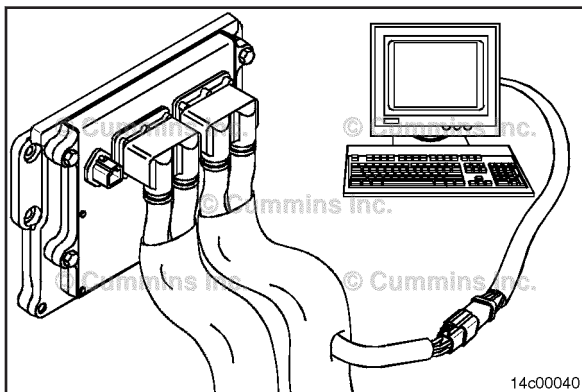
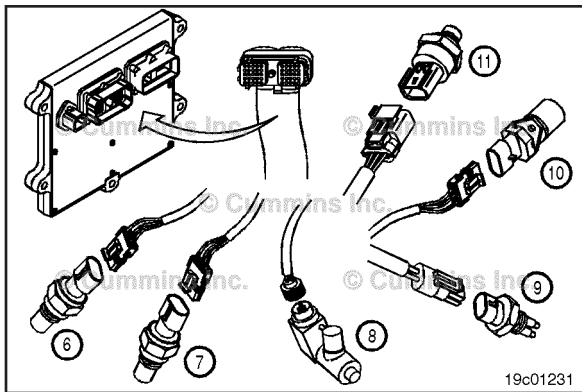
### ⚠CAUTION⚠

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

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

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





## Fault Code Snapshot Data

When a diagnostic fault code is recorded in the ECM, the ECM input and output data is recorded from all sensors and switches. Snapshot data allows the relationships between ECM inputs and outputs to be viewed and used during troubleshooting.

Fault code snapshot data can **only** be viewed using INSITE™ electronic service tool.

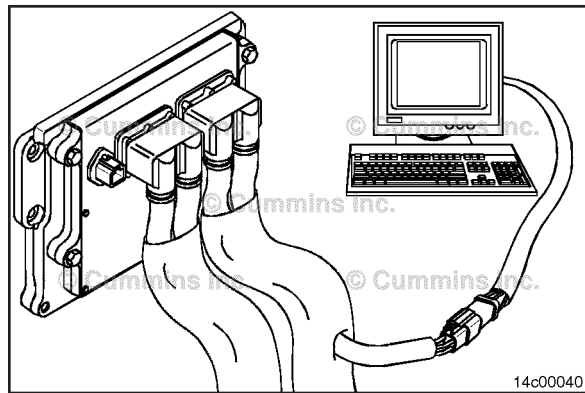
## INSITE™ Electronic Service Tool Description

INSITE™ electronic service tool is a service tool for the electronic engine control system. Use INSITE™ electronic service tool to:

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

## INSITE™ Electronic Service Tool Monitor Mode

The INSITE™ electronic service tool monitor mode is a useful troubleshooting aid that displays the key ECM inputs and outputs. This feature is used to spot constant or abnormally fluctuating values.



## 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.

# Section 2 - Maintenance Guidelines

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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

### General Information

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

- Air Tanks and Reservoirs - Drain
- Coolant Level - Check
- Fuel-Water Separator - Drain
- Lubricating Oil Level - Check
- Diesel Exhaust Fluid (DEF) Level - Check

#### Maintenance Procedures at 8000 Kilometers [5000 Miles], 250 Hours, or 3 Months

- Air Cleaner Restriction - Check
- Charger-Air Piping - Check
- Charge-Air Cooler - Check
- Air Intake Piping - Check
- Aftertreatment Exhaust Piping - Check
- Fan, Cooling - Inspect for Reuse
- Crankcase Breather Tube - Check

#### Maintenance Procedures at 16,000 Kilometers [10,000 Miles], 500 Hours, or 6 Months

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- Lubricating Oil and Filters - Change <sup>1</sup>
- Batteries - Check
- Battery Cables and Connections - Check
- Fuel Filter (Stage 1) - Change
- Fuel Filter (Stage 2) - Change

**Maintenance Procedures at 32,000 Kilometers [20,000 Miles], 1000 Hours, or 1 Year**

- Radiator Pressure Cap - Inspect for Reuse
- Cooling System - Flush
- Radiator Hoses - Inspect for Reuse

**Maintenance Procedures at 48,000 Kilometers [30,000 Miles], 1500 Hours, or 2 Years**

- Air Compressor Discharge Lines - Check
- Cooling Fan Belt Tensioner - Check
- Drive Belt, Cooling Fan - Check
- Air Compressor Drive Belt - Check
- Radiator Hoses - Inspect for Reuse
- Fuel Rail to Fuel Rail Supply Line (High-Pressure) - Check
- Injector Supply Lines (High-Pressure) - Check
- Fuel Rail Supply Line (High-Pressure) - Check

**Maintenance Procedures at 112,700 Kilometers [70,000 Miles] or 2500 Hours**

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- Crankcase Ventilation Filter - Change

**Maintenance Procedures at 241,000 Kilometers [150,000 Miles] or 6500 Hours**

- Aftertreatment Diesel Particulate Filter - Check

<sup>1</sup> The oil drain interval can be extended to 1 year for RV applications if the mile/hour target is **not** yet reached on the oil.

## Maintenance Record Form

### Maintenance Data

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

<b>Key to table headings:</b>
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



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# Section L - Service Literature

## Section Contents

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## Additional Service Literature

### General Information

The following publications can be purchased:

Additional Service Literature	
4367291	ISV5.0 CM3230 V104 Service Manual
4367294	ISV5.0 CM3230 V104 Fault Code Troubleshooting Manual
4367295	ISV5.0 CM3230 V104 Wiring Diagram
4367292	ISV5.0 CM3230 V104 Operation and Maintenance Manual
4367293	ISV5.0 CM3230 V104 Owners Manual
2883397	Maintenance Monitor Feature Description and Manual Reset Procedure
2883408	On-Board Diagnostics (OBD) for EPA/ARB Certified Engines
3379000	Air for Your Engine
3379001	Fuels for Cummins® Engines
3379009	Operation of Diesel Engines in Cold Climates
3666132	Cummins® Coolant Requirements and Maintenance
3387266	Cold Weather Operation
3810340	Cummins® Engine Oil and Oil Analysis Recommendations
4021566	Diesel Exhaust Fluid Specifications for Cummins® Selective Catalytic Reduction Systems

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**Service Literature Ordering Location  
Contact Information**

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

## 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 QSQL 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.



Notes

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# Section V - Maintenance Specifications

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## General Engine

### Specifications

Listed below are the general specifications for this engine.

Horsepower.....	Refer to engine dataplate
Bore and Stroke.....	94 mm [3.7 in] X 90 mm [3.54 in]
Displacement.....	5.0 liters [305.12 C.I.D.]
Firing Order.....	1-2-7-8-4-5-6-3
Approximate Engine Dry Weight (without standard accessories).....	380 kg [836 lb]
Crankshaft Rotation (viewed from the front of the engine).....	<b>Clockwise</b>
Maximum Overspeed Capability (15 seconds maximum).....	4750 rpm
Minimum Ambient Air Temperature for Unaided Cold Start.....	19°C [66.2°F]
Typical Engine Cranking Speed.....	100 rpm
Engine Idle Speed.....	Minimum 600 rpm to Maximum 1000 rpm
Maximum Operating Engine Angularity.....	30 degrees

## Lubricating Oil System

### Specifications

#### Oil Pressure

Low Idle (minimum allowed).....	69 kPa [10 psi]
At Rated Speed (minimum allowed).....	279 kPa [40 psi]
Oil Regulating Valve Opening Pressure Range.....	310 kPa [45 psi] to 379 kPa [55 psi]
Oil Filter Differential Pressure to Open Bypass.....	345 kPa [50 psi]

#### Lubricating Oil Capacity (Standard Rear Sump Pan)

Pan Only .....	4.18 liters [4.4 qt]
Total System.....	10.4 liters [11 qt]
High to Low (on dipstick).....	0.95 liters [1 qt]
Lubricating Oil Filter Capacity.....	0.726 liters [0.767 qt]

#### Lubricating Oil Capacity (Optional Front Sump Pan)

Pan Only .....	4.12 liters [4.35 qt]
Total System.....	10.4 liters [11 qt]
High to Low (on dipstick).....	0.95 liters [1 qt]
Lubricating Oil Filter Capacity.....	0.726 liters [0.767 qt]

#### Oil Consumption

##### Maximum Acceptable Oil Consumption

Miles per Quart.....	400
Miles per Liter.....	425
Kilometers per Quart.....	650
Kilometers per Liter.....	675
Hours per Quart.....	10.0
Hours per Liter.....	10.6

# Cooling System

## Specifications

Coolant Capacity (Includes cylinder block, cylinder head, water pump volute, exhaust gas recirculation (EGR) cooler, EGR plumbing, turbocharger, and air compressor).....	7.3 liters [1.93 gal]
Standard Modulating Thermostat - Range.....	79 to 93°C [175 to 200°F]
Maximum Allowed Operating Temperature.....	118°C [245°F]
Minimum Recommended Operating Temperature.....	71°C [160°F]
Recommended Pressure Cap.....	103 kPa [15 psi]

## Cummins®/Fleetguard® Filter Specifications

### General Information

#### Filter Part Numbers

<b>Lubricating Oil Filter</b>	
Cummins® Part Number	4378319
<b>Fuel Filter (Stage 1)</b>	
Cummins® Part Number	4360105
<b>Fuel Filter (Stage 2)</b>	
Cummins® Part Number	4335493
<b>Crankcase Ventilation Filter Element</b>	
Cummins® Part Number	4359676
<b>Remote Mounted Fuel Filter (For remote Stage 2 fuel filter applications)</b>	
Cummins® Part Number	4335559

## Diesel Exhaust Fluid Recommendations and Specifications

### General Information



#### WARNING

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



#### WARNING

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



#### CAUTION

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

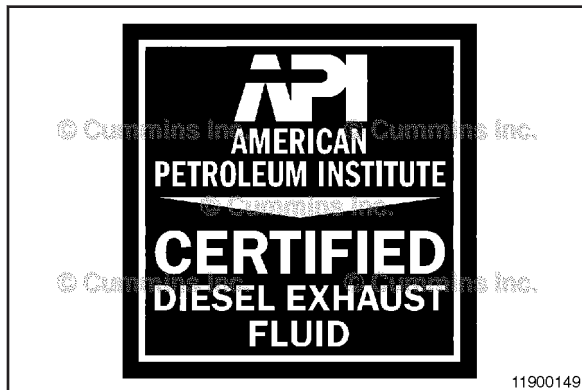
Cummins Inc. requires the use of Diesel Exhaust Fluid meeting ISO 22241-1. There is NO acceptable substitute.

**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.

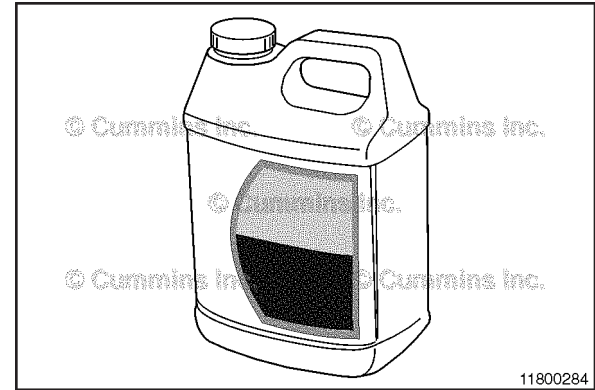


For engines using SCR operating in the United States and Canada, it is also strongly recommended that the Diesel Exhaust Fluid (DEF) used be certified by the American Petroleum Institute (API). This would be indicated by a symbol on the container/dispensing system as shown.

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.

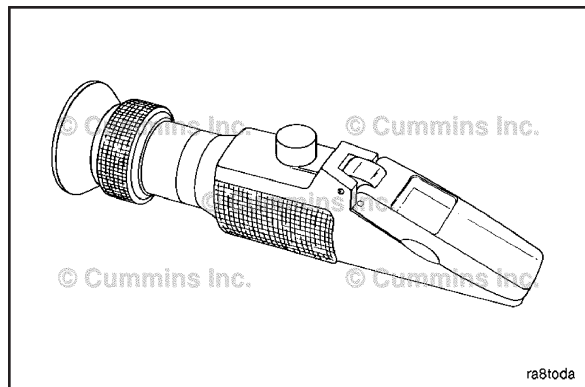
Percent Urea Concentration: 32.5 +/- 1.5%

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.

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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.



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



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



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

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

The engine has been optimized for use with an aftertreatment system to meet the 2010 U.S. Environmental Protection Agency (EPA) regulations. In order to meet these regulations, ultra-low sulfur diesel fuel is required for correct

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

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

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

The following chart lists acceptable fuel types for this engine.

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

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

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

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

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

For information on alternative fuels, such as biodiesel, and additional information for fuel recommendations and specifications, refer to Fuels for Cummins® Engines, Bulletin 3379001.

## 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. Use the following procedure to determine which oil drain interval to use. 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 CEA 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® Engineering Standard Classifications (CES)	American Petroleum Institute Classification (API)	Comments
CES-20071, CES-20072, CES-20076, CES-20077	API CH-4/SJ	<b>Not</b> recommended. Lubricating oil drain interval <b>must</b> 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 that the lubricating oil used meets the CES 20081 requirement in addition to the API performance classification CJ-4/SL.

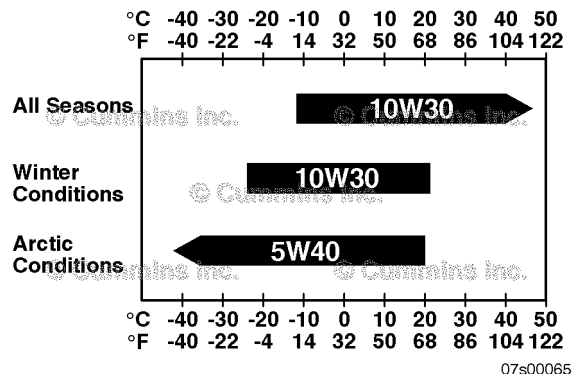
Cummins Inc. recommends the use of a high-quality SAE 10W-30 heavy-duty engine oil, such as Valvoline Premium Blue™.

**NOTE:** If a non-low ash lubricating oil meeting the American Petroleum Institute (API) performance classification CI-4/SK and/or CES 20078 is used, the service intervals for the aftertreatment systems will be reduced.

The primary Cummins Inc. recommendation is for the use of 10W-30 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 than monograde oils, it is important to use multigrade oils, to be certain the engine will meet applicable emissions requirements.

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 that are applied to petroleum (mineral) based engine oils **must** be applied to synthetic 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.



While the preferred viscosity grade is 10W-30, a 5W-40 full synthetic oil is recommended for use in colder climates. This oil **must** meet CES20081.

Some oil suppliers might claim better performance or fuel economy with the use of different types of oils. Cummins Inc. can neither approve nor disapprove any product **not** manufactured by Cummins Inc. These claims are between the customer and the 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.

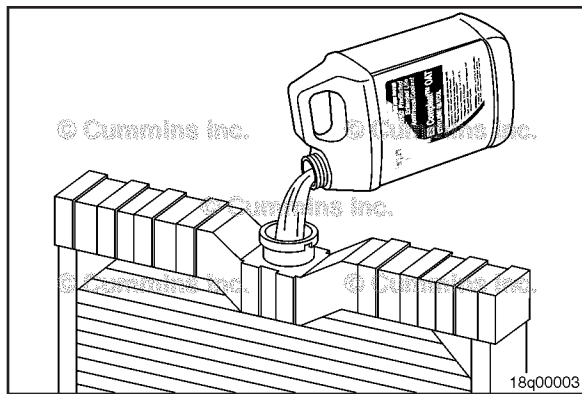
## New Engine Break-in Oils

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 period as is to be used in normal operation.

## AfterMarket Oil Additive Usage

Cummins Inc. does **not** recommend the use of aftermarket oil additives. Present high-quality fully additive engine lubricating oils are very sophisticated, with precise amounts of additives blended into the lubricating oil to meet stringent requirements. These 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 finished oil's ability to protect the engine.





## Coolant Recommendations and Specifications

### Fully Formulated Coolant/Antifreeze

Cummins Inc. recommends the use of fully formulated antifreeze/coolant meeting Cummins Engineering Standards (C.E.S.) 14636. For further details and discussion of coolant for Cummins® engines, refer to Coolant Requirements and Maintenance, Bulletin 3666132.

Typically, antifreeze/coolants meeting ASTM D6210 criteria are acceptable antifreeze/coolants for engines covered by the manual.

Low-silicate antifreeze/coolants meeting ASTM D4985 (GM6038M specification) are **not** adequate for extended service intervals.

Cummins Inc. recommends using a 50/50 mixture of good-quality water and fully formulated antifreeze when filling the cooling system. The fully-formulated antifreeze or coolant **must** meet TMC RP329 specifications and **must** be nitrite free.

Good-quality water is important for cooling system performance. Excessive levels of calcium and magnesium contribute to scaling problems, and excessive levels of chlorides and sulfates cause cooling system corrosion.

Water Quality	
Calcium Magnesium (hardness)	Maximum 170 ppm as (CaCO <sub>3</sub> + MgCO <sub>3</sub> )
Chloride	40 ppm as (Cl)
Sulfur	100 ppm as (SO <sub>4</sub> )

Cummins Inc. recommends the use of Fleetguard® ES Compleat™ OAT (Organic Acid Technology). It is available in ethylene glycol form, complies with TMC RP329, ASTM D6210, CES 14636, and is nitrite free.

**NOTE:** Coolant **must** be nitrite free.

See the following service bulletin for more engine coolant specifications. Refer to Cummins® Coolant Requirements and Maintenance, Bulletin 3666132.

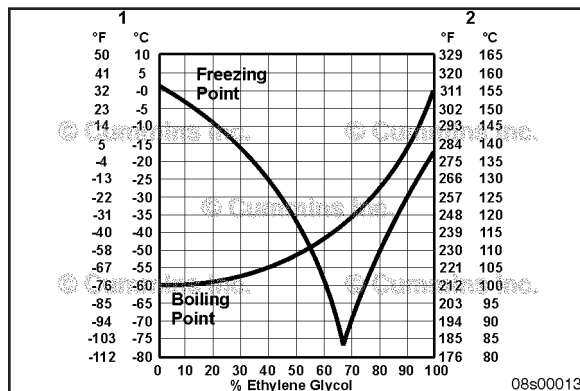
Fully formulated antifreeze **must** be mixed with good-quality water at a 50/50 ratio (40- to 60-percent working range). A 50/50 mixture of antifreeze and water gives a -36°C [-33°F] freezing point and a 108°C [226°F] boiling point, which is adequate for locations in North America. The actual lowest freezing point of ethylene glycol antifreeze is at 68 percent. Using higher concentrations of antifreeze may cause damage to the engine and will not provide any added benefit.

### Legend

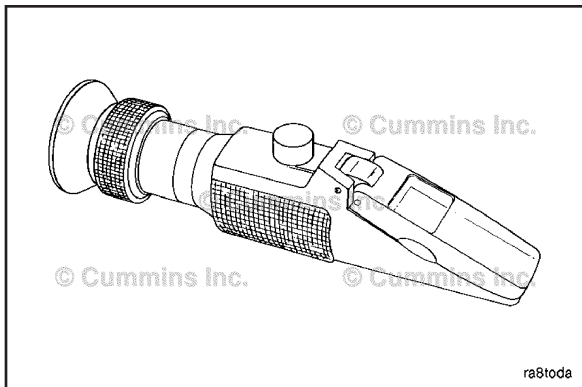
- 1 Freezing Point Temperature Scale
- 2 Boiling Point Temperature Scale



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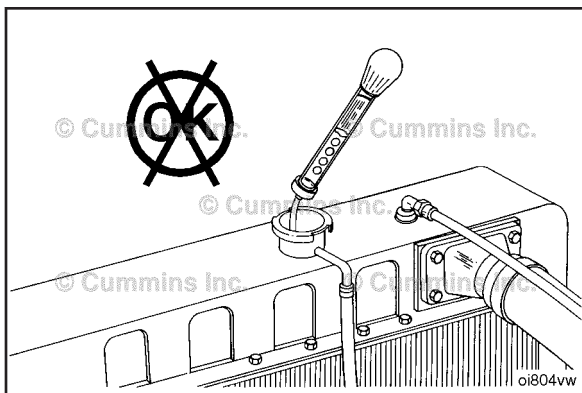


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A refractometer **must** be used to measure the freezing point of the coolant **accurately**. Use Fleetguard® refractometer, Part Number CC8998.

**NOTE:** Although less accurate than a refractometer, Fleetguard® coolant test strips, Part Number CC36158, can also be used to check the freezing point.

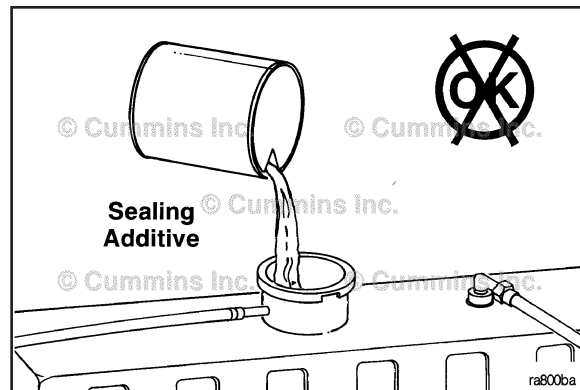


Do **not** use a floating ball hydrometer. The use of floating ball hydrometers can give an incorrect reading.

## Cooling System Sealing Additives

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

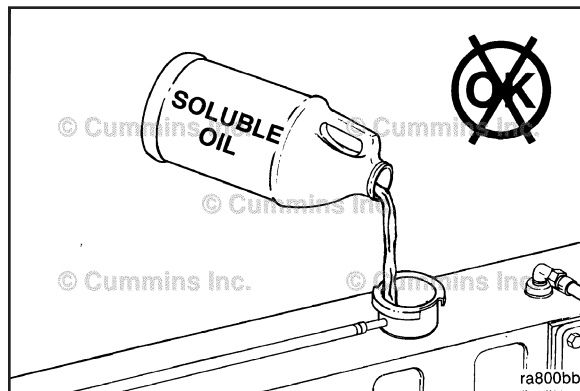
- Buildup in coolant low-flow areas
- Plug the radiator and oil cooler
- Possibly damage the water pump seal.

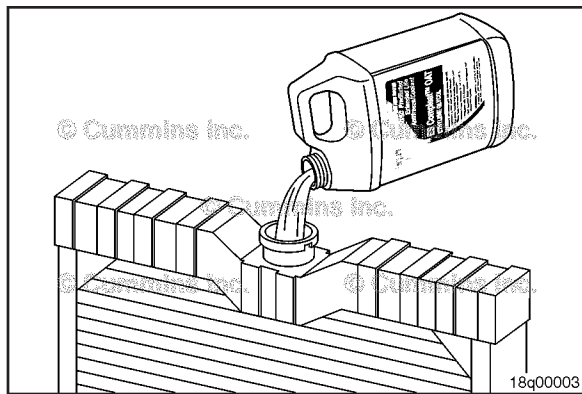


## Cooling System Soluble Oils

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

- Corrode brass and copper
- Damage heat transfer surfaces
- Damage seals and hoses.





## Coolant Replacement Requirements

### ⚠ WARNING ⚠

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

### ⚠ CAUTION ⚠

Improper coolant and improper coolant maintenance will likely lead to corrosion and result in engine failure.

The Fleetguard® 3-Way OAT (Organic Acid Technology) Test Strip, Part Number CC36158, can be used to measure pH, nitrite contamination, and freeze point, of Fleetguard® ES Compleat™ OAT (Organic Acid Technology) coolant and automotive OAT (Organic Acid Technology) coolants. This test kit should be used according to the manufacturers' maintenance schedule and will detect levels out of specification that require coolant replacement.

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

## ISV5.0 CM3230 V104

### Section V - Maintenance Specifications

## Coolant Recommendations and Specifications

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#### 3-Way OAT (Organic Acid Technology) Test Strip Procedure

- 1 Collect a coolant sample from the radiator or petcock. Do **not** collect the sample from the coolant recovery or overflow system. Coolant **must** be between 10°C [50°F] and 54°C [130°F] when tested.
- 2 Tear one foil packet open and remove the strip. Do **not** touch the pads on the end of the strip. **Discard the strip if the nitrite pad has turned brown.**
- 3 Dip the strip in the coolant sample for 3 seconds, then remove and shake the strip briskly to remove excess liquid.
- 4 Compare and record the results 45 seconds after dipping the strip. Use the following order:
  - a Compare the pH (end pad) test to the color chart and record the result.
  - b Compare the Nitrite (second pad) test to the color chart and record the result.
  - c Compare the Freezepoint test to the color chart and record the result.
- 5 All reading **must** be completed no later than 75 seconds after dipping strip.
- 6 It is acceptable to estimate a value between the color blocks. Choose the lower numbered block if uncertain about the color match.
- 7 For best results, follow the test times carefully. Use a stopwatch or clock with a sweep second hand. Comparing the test strip to the color chart too soon before, or too late after the required test time will result in incorrect readings.

The recommended pH range for OAT (Organic Acid Technology) coolants is 6.5 to 10.0. If the coolant pH is outside of this specified range, drain the system and refill with new coolant.

Color change on the nitrite pad, the second pad on the 3-way OAT (Organic Acid Technology) test strip, indicates treatment of the system with a nitrite containing coolant. If the nitrite pad changes color, drain the system and refill with new nitrite-free coolant.

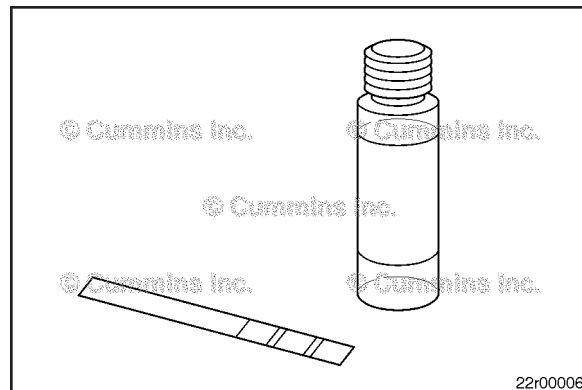
Cummins Inc. recommends a 50/50 mixture of good-quality water and fully formulated antifreeze when filling the cooling system. If the freezepoint reading on the test strip indicates a glycol level below 40 percent or above 60 percent, drain the cooling system and refill with new coolant.

**NOTE:** Some OAT (Organic Acid Technology) coolants use high levels of organic acids for corrosion protection and do **not** use nitrite and/or molybdate. A positive result for nitrite indicates the coolant has been contaminated with nitrites. Cummins Inc. **only** recommends the use of Fleetguard® ES Compleat™ OAT (Organic Acid Technology) coolant.

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

Some coolant suppliers may claim similar performance with the use of different types of coolants. Cummins Inc. can neither approve nor disapprove any product **not** manufactured by Cummins Inc. These claims are between the customer and the coolant supplier. Obtain a commitment from the coolant supplier that the coolant meets Cummins Engineering Standards (C.E.S.) 14636 and will give satisfactory performance in Cummins® engines, or do **not** use the coolant.

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



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## Notes

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# 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](http://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.

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### **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 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](https://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](https://store.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

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**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.

## **ISV Engines United States And Canada Automotive Coverage**

### **Products Warranted**

This Warranty applies to new ISV Series diesel fueled Engines sold by Cummins and delivered to the first user on or after October 1, 2014, 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 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 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 for the first year from 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. 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 from the date of delivery of the Engine to the first user or the duration of the Warranty, whichever occurs first, Owner must also deliver the Engine to the repair facility.

Service locations are listed on the Cummins Worldwide Service Locator at [cummins.com](https://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, Engine exhaust brakes, power steering pumps, non-Cummins fan drives and air compressors.

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

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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 during the first year from the date of delivery of the Engine to the first user or the duration of the Warranty, whichever occurs first.

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

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

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

**CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.**

**CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.**

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

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

## **Emission Warranty**

### **Products Warranted**

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

### **Coverage**

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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 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 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, level and temperature sensors, line heater control)  
DEF Dosing Valve  
Diesel Oxidation Catalyst  
Diesel Particulate Filter (except for ash maintenance)  
Diesel Particulate Filter Differential Pressure Sensor  
DEF Tank and Lines  
NOx Sensors

#### Base Engine System

##### Component

Cam Shaft  
Clean Idle Sticker  
Coolant Temperature Sensor  
Crankcase Breather  
Cylinder Head  
Engine Speed, Position Sensor, Cam Position Sensor

#### EGR System

##### Component

EGR Cooler  
EGR Differential Pressure Sensor  
EGR Mixer/Venturi

**California CARB Diesel**

SCR Catalyst  
Exhaust Gas Piping from Turbocharger out to the Last  
Aftertreatment Device

**Air Handling  
Component**

Ambient Air Temperature Sensor  
Exhaust Gas Pressure Sensor

Exhaust Manifold  
Exhaust Up-Pipe  
Charge Air Cooler and Associated Plumbing

Glow Plugs  
Intake Manifold  
Intake Manifold Temperature/Pressure Sensor  
Throttle Actuator/Valve  
Turbocharger Actuator  
Turbocharger Assembly  
Turbocharger Compressor Intake Pressure/  
Temperature Sensor  
Turbocharger Speed Sensor

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)  
Glow Plug Control Module  
OBD Connector

**Fuel System  
Component**

Fuel Control Valve  
Fuel Lines  
Fuel Pressure Sensor

**California CARB Diesel**

Charge Temperature Sensor

Fuel Pump  
Fueling/Timing Actuators  
Injector

## **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.**

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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.**

**Cummins Inc.**

Box 3005

Columbus, Indiana, U.S.A., 47202

Registered Office

**Cummins Ltd.**

49 - 51 Gresham Road,

Staines,

Middlesex TW18 2BD,

England

Registration 573951 England

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**1-800-DIESELS™ (1-800-343-7357)**

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