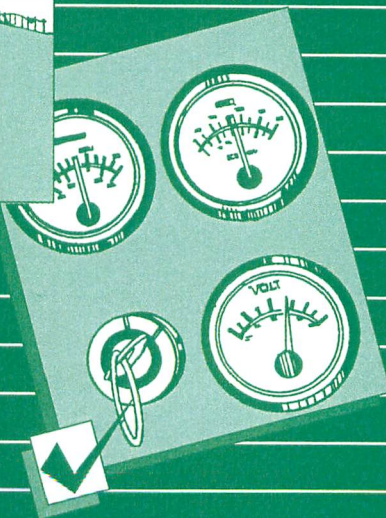
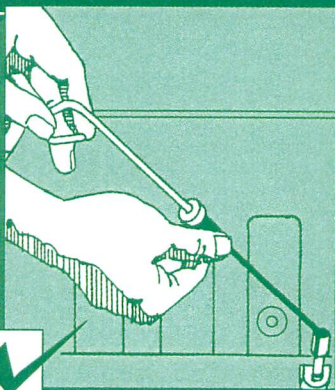
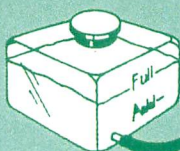
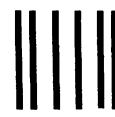




Operation and Maintenance Manual B3.3 and QSB3.3 Series Engines



Cummins Customer Assistance Center
1-800-DIESELS (1-800-343-7357)
APPLICABLE ONLY IN U.S.A. AND CANADA

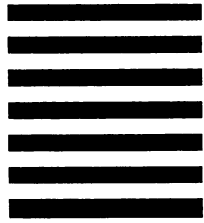


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Home Phone Number (____) _____

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E-mail Address _____

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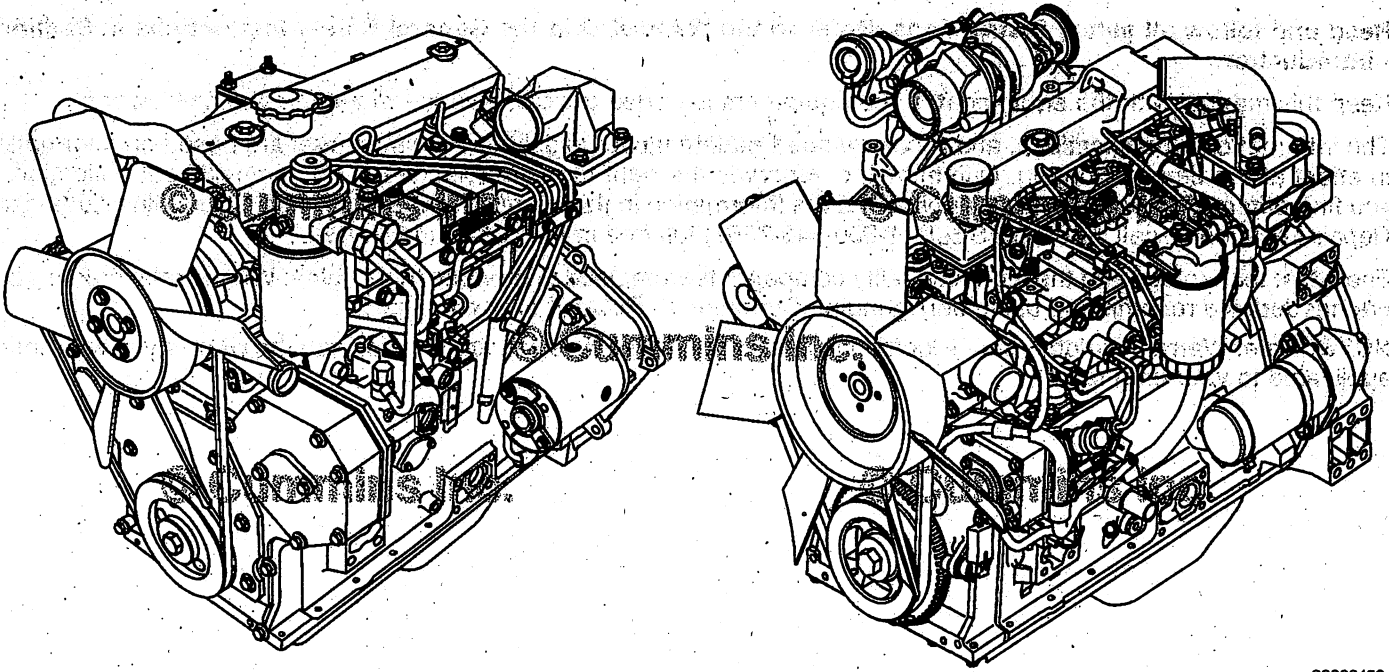
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OR visit our website at www.cummins.com and select "Product Registration" to enter your registration online.

THANK YOU!!



Operation and Maintenance Manual B3.3 and QSB3.3 Series Engines



00900456

Foreword

This manual contains information for the correct operation and maintenance of your Cummins engine. It also includes important safety information, engine and systems specifications, troubleshooting guidelines, and listings of Cummins Authorized Repair Locations and component manufacturers.

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 engine 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 engine. When replacement parts are needed, we recommend using only genuine Cummins or ReCon® exchange parts.

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

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

Section i - Introduction

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Section I - Introduction

Section I - Introduction

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To the Owner and Operator

General Information

Preventive maintenance is the easiest and least expensive type of maintenance. Follow the maintenance schedule recommendations outlined in Maintenance Guidelines (Section 2).

Keep records of regularly scheduled maintenance.

Use the correct fuel, lubricating oil, and coolant in your engine as specified in Maintenance Specifications (Section V). Blending engine oil with fuel is prohibited for engines with an aftertreatment system.

Cummins Inc. uses the latest technology and the highest quality components to produce its engines. Cummins Inc. recommends using genuine Cummins new parts and ReCon® exchange parts.

Personnel at Cummins Authorized Repair Locations have been trained to provide expert service and parts support. If you have a problem that can **not** be resolved by a Cummins Authorized Repair Location, follow the steps outlined in the Service Assistance (Section S).

Product coverage, warranty limitations and owner responsibilities are available in Warranty (Section W).

▲CAUTION▲

Disconnect both the positive (+) and negative (-) battery cables from the battery before welding on the vehicle. Attach the welder ground cable no more than 0.61 meters [2 feet] from the part being welded. Do not connect the ground cable of the welder to the ECM cooling plate or ECM. Welding on the engine or engine mounted components is not recommended.

About the Manual

General Information

This manual contains information needed to correctly operate and maintain your engine as recommended by Cummins Inc. For additional service literature and ordering locations, refer to Service Literature (Section L).

This manual does not cover vehicle, vessel, or equipment maintenance procedures. Consult the original vehicle, vessel, or equipment manufacturer for specific maintenance recommendations.

Both metric and U.S. customary values are listed in this manual. The metric value is listed first, followed by the U.S. customary in brackets.

Numerous illustrations and symbols are used to aid in understanding the meaning of the text. Refer to Symbols in this section for a complete listing of symbols and their definitions.

Each section of the manual is preceded by a Section Contents to aid in locating information.

How to Use the Manual

General Information

This manual is organized according to intervals at which maintenance on your engine is to be performed. A maintenance schedule, that states the required intervals and maintenance checks, is located in Maintenance Guidelines (Section 2). Locate the interval at which you are performing maintenance; then follow the steps given in that section for all the procedures to be performed.

Keep a record of all the checks and inspections made. A maintenance record form is located in Maintenance Guidelines (Section 2).

Engine troubleshooting procedures for your engine are located in Troubleshooting Symptoms (Section TS).

Specifications for your engine are located in Maintenance Specifications (Section V).

Symbols

General Information

The following 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:



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



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



Indicates a **REMOVAL** or **DISASSEMBLY** 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.

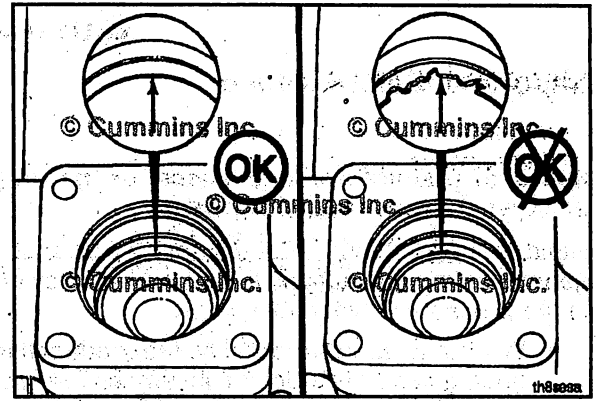


The component weighs 23 kg [50 lb] or more. To avoid personal injury, use a hoist or get assistance to lift the component.

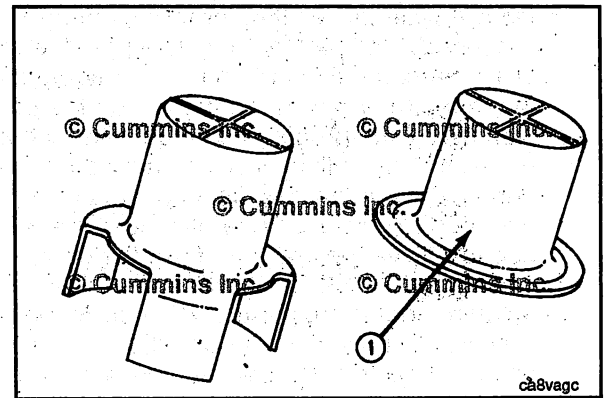
Illustrations

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



WARNING

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.
- **Always** use the same fastener part number (or equivalent) when replacing fasteners. Do **not** use a fastener of lesser quality if replacements are necessary.
- 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.
- Liquefied petroleum gas is heavier than air and can accumulate near the floor, in sumps, and low-lying areas.
- Natural gas is lighter than air and can accumulate under hood and awnings.
- To reduce the possibility of suffocation and frostbite, wear protective clothing and **ONLY** disconnect natural gas and liquefied petroleum gas lines in a well ventilated area.
- 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.

General Repair Instructions

General Information

This engine incorporates the latest technology at the time it was manufactured; yet, it is designed to be repaired using normal repair practices performed to quality standards.

- **Cummins Inc. does not recommend or authorize any modifications or repairs to engines or components except for those detailed in Cummins Service Information. In particular, unauthorized repair to safety-related components can cause personal injury or death. Below is a partial listing of components classified as safety-related:**

1. Air Compressor
2. Air Controls
3. Air Shutoff Assemblies
4. Balance Weights
5. Cooling Fan
6. Fan Hub Assembly
7. Fan Mounting Bracket(s)
8. Fan Mounting Capscrews
9. Fan Hub Spindle
10. Flywheel
11. Flywheel Crankshaft Adapter
12. Flywheel Mounting Capscrews
13. Fuel Shutoff Assemblies
14. Fuel Supply Tubes
15. Lifting Brackets
16. Throttle Controls
17. Turbocharger Compressor Casing
18. Turbocharger Oil Drain Line(s)
19. Turbocharger Oil Supply Line(s)
20. Turbocharger Turbine Casing
21. Vibration Damper Mounting Capscrews

- **Follow all safety instructions noted in the procedures**
 - Follow the manufacturer's recommendations for cleaning solvents and other substances used during the repair of the engine. Some solvents and used engine oil have been identified by government agencies as toxic or carcinogenic. Avoid excessive breathing, ingestion and contact with such substances. Always use good safety practices with tools and equipment.
- **Provide a clean environment and follow the cleaning instructions specified in the procedures**
 - The engine and its components **must** be kept clean during any repair. Contamination of the engine or components will cause premature wear.
- **Perform the inspections specified in the procedures**
- **Replace all components or assemblies which are damaged or worn beyond the specifications**
- **Use genuine Cummins new or ReCon® service parts and assemblies**
 - The assembly instructions have been written to use again as many components and assemblies as possible. When it is necessary to replace a component or assembly, the procedure is based on the use of new Cummins or Cummins ReCon® components. All of the repair services described in this manual are available from all Cummins Distributors and most Dealer locations.
- **Follow the specified disassembly and assembly procedures to reduce the possibility of damage to the components**

Complete rebuild instructions are available in the shop manual which can be ordered or purchased from a Cummins Authorized Repair Location. Refer to Section L — Service Literature for ordering instructions.

Welding on a Vehicle with an Electronic Controlled Fuel System

▲CAUTION▲

Disconnect both the positive (+) and negative (-) battery cables from the battery before welding on the vehicle. Attach the welder ground cable no more than 0.61 meters [2 feet] from the part being welded. Do not connect the ground cable of the welder to the ECM cooling plate or ECM. Welding on the engine or engine mounted components is not recommended or damage to the engine or components can result.

General Cleaning Instructions

Definition of Clean

Parts **must** be free of debris that can contaminate any engine system. This does **not** necessarily mean they have to appear as new.

Sanding gasket surfaces until the factory machining marks are disturbed adds no value and is often harmful to forming a seal. It is important to maintain surface finish and flatness tolerances to form a quality sealing surface. Gaskets are designed to fill small voids in the specified surface finish.

Sanding gasket surfaces where edge-molded gaskets are used is most often unnecessary. Edge-molded gaskets are those metal carriers with sealing material bonded to the edges of the gasket to seal while the metal portion forms a metal to metal joint for stability. Any of the small amounts of sealing material that can stick to the parts are better removed with a blunt-edged scraper on the spots rather than spending time polishing the whole surface with an air sander or disc.

For those gaskets that do **not** have the edge molding, nearly all have a material that contains release agents to prevent sticking. Certainly this is **not** to say that some gaskets are **not** difficult to remove because the gasket has been in place a long time, has been overheated or the purpose of the release agent has been defeated by the application of some sealant. The object however is just to remove the gasket without damaging the surfaces of the mating parts without contaminating the engine (don't let the little bits fall where they can not be removed).

Bead blasting piston crowns until the dark stain is removed is unnecessary. All that is required is to remove the carbon build-up above the top ring and in the ring grooves. There is more information on bead blasting and piston cleaning later in this document.

Cummins Inc. does **not** recommend sanding or grinding the carbon ring at the top of cylinder liners until clean metal is visible. The liner will be ruined and any signs of a problem at the top ring reversal point (like a dust-out) will be destroyed. It is necessary to remove the carbon ring to provide for easier removal of the piston assembly. A medium bristle, high quality, steel wire wheel that is rated above the rpm of the power tool being used will be just as quick and there will be less damage. Yes, one **must** look carefully for broken wires after the piston is removed but the wires are more visible and can be attracted by a magnet.

Oil on parts that have been removed from the engine will attract dirt in the air. The dirt will adhere to the oil. If possible, leave the old oil on the part until it is ready to be cleaned, inspected and installed, and then clean it off along with any attracted dirt. If the part is cleaned then left exposed it can have to be cleaned again before installation. Make sure parts are lubricated with clean oil before installation. They do **not** need to be oiled all over but do need oil between moving parts (or a good lube system priming process conducted before cranking the engine).

Bead blasting parts to remove exterior paint is also usually unnecessary. The part will most likely be painted again so all that needs happen is remove any loose paint.

Abrasive Pads and Abrasive Paper

The keyword here is "abrasive". There is no part of an engine designed to withstand abrasion. That is they are all supposed to lock together or slide across each other. Abrasives and dirt particles will degrade both functions.



Abrasive material must be kept out of or removed from oil passages and parts wear points. Abrasive material in oil passages can cause bearing and bushing failures that can progress to major component damage beyond reuse. This is particularly true of main and rod bearings.

Cummins Inc. does **not** recommend the use of emery cloth or sand paper on any part of an assembled engine or component including but **not** limited to removing the carbon ridge from cylinder liners or to clean block decks or counterbores.

Great care **must** be taken when using abrasive products to clean engine parts, particularly on partially assembled engines. Abrasive cleaning products come in many forms and sizes. All of them contain aluminum oxide particles, silicon carbide, or sand or some other similar hard material. These particles are harder than most of the parts in the engine. Since they are harder, if they are pressed against softer material they will either damage the material or become embedded in it. These materials fall off the holding media as the product is used. If the products are used with power equipment the particles are thrown about the engine. If the particles fall between two moving parts, damage to the moving parts is likely.

If particles that are smaller than the clearance between the parts while they are at rest (engine stopped), but larger than the running clearance then damage will occur when the parts move relative to each other (engine started). While the engine is running and there is oil pressure, particles that are smaller than the bearing clearance are likely to pass between the parts without damage and be trapped in the oil filter. However, particles larger than the bearing clearance will remove material from one part and can become embedded in one of the parts. Once embedded in one part it will

abrade the other part until contact is no longer being made between the two parts. If the damage sufficiently degrades the oil film, the two parts will come into contact resulting in early wear-out or failure from lack of effective lubrication.

Abrasive particles can fly about during cleaning it is very important to block these particles from entering the engine as much as possible. This is particularly true of lubricating oil ports and oil drilling holes, especially those located downstream of the lubricating oil filters. Plug the holes instead of trying to blow the abrasive particles and debris with compressed air because the debris is often simply blown further into the oil drilling.

All old gasket material **must** be removed from the parts gasket surfaces. However, it is **not** necessary to clean and polish the gasket surface until the machining marks are erased. Excessive sanding or buffing can damage the gasket surface. Many newer gaskets are of the edge molded type (a steel carrier with a sealing member bonded to the steel). What little sealing material that can adhere is best removed with a blunt-edged scraper or putty knife. Cleaning gasket surfaces where an edge-molded gasket is used with abrasive pads or paper is usually a waste of time.

▲ WARNING ▲

Excessive sanding or grinding the carbon ring from the top of the cylinder liners can damage the liner beyond reuse. The surface finish will be damaged and abrasive particles can be forced into the liner material which can cause early cylinder wear-out or piston ring failures.

Tape off or plug all openings to any component interior before using abrasive pads or wire brushes. If really necessary because of time to use a power tool with abrasive pads, tape the oil drillings closed or use plug and clean as much of the surface as possible with the tool but clean around the oil hole/opening by hand so as to prevent contamination of the drilling. Then remove the tape or plug and clean the remaining area carefully and without the tool. **DO NOT** use compressed air to blow the debris out of oil drilling on an assembled engine! More likely than not, the debris can be blown further into the drilling. Using compressed air is fine if both ends of the drilling are open but that is rarely the case when dealing with an assembled engine.

Gasket Surfaces

The object of cleaning gasket surfaces is to remove any gasket material, not refinish the gasket surface of the part.

Cummins Inc. does **not** recommend any specific brand of liquid gasket remover. If a liquid gasket remover is used, check the directions to make sure the material being cleaned will **not** be harmed.

Air powered gasket scrapers can save time but care must be taken to **not** damage the surface. The angled part of the scraper must be against the gasket surface to prevent the blade from digging into the surface. Using air powered gasket scrapers on parts made of soft materials takes skill and care to prevent damage.

Do **not** scrape or brush across the gasket surface if at all possible.

Solvent and Acid Cleaning

Several solvent and acid-type cleaners can be used to clean the disassembled engine parts (other than pistons. See Below). Experience has shown that the best results can be obtained using a cleaner that can be heated to 90° to 95° Celsius (180° to 200° Fahrenheit). Kerosene emulsion based cleaners have different temperature specifications, see below. A cleaning tank that provides a constant mixing and filtering of the cleaning solution will give the best results. Cummins Inc. does **not** recommend any specific cleaners. Always follow the cleaner manufacturer's instructions. Remove all the gasket material, o-rings, and the deposits of sludge, carbon, etc., with a wire brush or scraper before putting the parts in a cleaning tank. Be careful not to damage any gasket surfaces. When possible, steam clean the parts before putting them in the cleaning tank.

▲ WARNING ▲

When using solvents, acids, or alkaline materials for cleaning, follow the manufacturers recommendations for use. Wear goggles and protective clothing to reduce the possibility of personal injury.

Experience has shown that kerosene emulsion based cleaners perform the best to clean pistons. These cleaners should **not** be heated to temperature in excess of 77°C (170°F). The solution begins to break down at temperatures in excess of 82°C (180°F) and will be less effective.

Do **not** use solutions composed mainly of chlorinated hydrocarbons with cresols, phenols and/or cresylic components. They often do **not** do a good job of removing deposits from the ring groove and are costly to dispose of properly.

Solutions with a pH above approximately 9.5 will cause aluminum to turn black; therefore do **not** use high alkaline solutions.

Chemicals with a pH above 7.0 are considered alkaline and those below 7.0 are acidic. As you move further away from the neutral 7.0, the chemicals become highly alkaline or highly acidic.

Remove all the gasket material, o-rings, and the deposits of sludge, carbon, etc., with a wire brush or scraper before putting the parts in a cleaning tank. Be careful to **not** damage any gasket surfaces. When possible use hot high

pressure water or steam clean the parts before putting them in the cleaning tank. Removing the heaviest dirt before placing in the tank will allow the cleaner to work more effectively and the cleaning agent will last longer.

Rinse all the parts in hot water after cleaning. Dry completely with compressed air. Blow the rinse water from all the capscrew holes and the oil drillings.

If the parts are not to be used immediately after cleaning, dip them in a suitable rust proofing compound. The rust proofing compound **must** be removed from the parts before assembly or installation on the engine.

Steam Cleaning

Steam cleaning can be used to remove all types of dirt that can contaminate the cleaning tank. It is a good method for cleaning the oil drillings and coolant passages

▲WARNING▲

When using a steam cleaner, wear safety glasses or a face shield, as well as protective clothing. Hot steam can cause serious personal injury.

Do not steam clean the following components:

- Electrical Components
- Wiring Harnesses
- Injectors
- Fuel Pump
- Belts and Hoses
- Bearings (ball or taper roller)
- Electronic Control Module (ECM)
- ECM Connectors
- Dosing Control Unit

Plastic Bead Cleaning

Cummins Inc. does **not** recommend the use of glass bead blast or walnut shell media on any engine part. Cummins Inc. recommends using **only** plastic bead media, Part Number 3822735 or equivalent on any engine part. **Never** use sand as a blast media to clean engine parts. Glass and walnut shell media when **not** used to the media manufacturer's recommendations can cause excess dust and can embed in engine parts that can result in premature failure of components through abrasive wear.

Plastic bead cleaning can be used on many engine components to remove carbon deposits. The cleaning process is controlled by the use of plastic beads, the operating pressure and cleaning time.

▲CAUTION▲

Do not use bead blasting cleaning methods on aluminum pistons skirts or the pin bores in any piston, piston skirt or piston crown. Small particles of the media will embed in the aluminum or other soft metal and result in premature wear of the cylinder liner, piston rings, pins and pin bores. Valves, turbocharger shafts, etc., can also be damaged. Follow the cleaning directions listed in the procedures.

▲CAUTION▲

Do not contaminate wash tanks and tank type solvent cleaners with the foreign material and plastic beads. Remove the foreign material and plastic beads with compressed air, hot high pressure water or steam before placing them in tanks or cleaners. The foreign material and plastic beads can contaminate the tank and any other engine parts cleaned in the tank. Contaminated parts may cause failures from abrasive wear.

Plastic bead blasting media, Part Number 3822735, can be used to clean all piston ring grooves. Do not use any bead blasting media on piston pin bores or aluminum skirts.

Follow the equipment manufacturer's cleaning instructions. Make sure to adjust the air pressure in the blasting machine to the bead manufacturer's recommendations. Turning up the pressure can move material on the part and cause the plastic bead media to wear out more quickly. The following guidelines can be used to adapt to manufacturer's instructions:

1. Bead size: U.S. size Number 16 — 20 for piston cleaning with plastic bead media, Part Number 3822735
2. Operating Pressure — 270 kPa (40 psd) for piston cleaning. Pressure should not cause beads to break.
3. Steam clean or wash the parts with solvent to remove all of the foreign material and plastic beads after cleaning. Rinse with hot water. Dry with compressed air.

▲CAUTION▲

The bead blasting operation must not disturb the metal surface. If the metal surface is disturbed the engine can be damaged due to increased parts clearance or inadequate surface finish on parts that move against other parts.

When cleaning pistons, it is **not** necessary to remove all the dark stain from the piston. All that is necessary is to remove the carbon on the rim and in the ring grooves. This is best done by directing the blast across the part as opposed to straight at the part. If the machining marks are disturbed by the blasting process, then the pressure is too high or the blast is being held on one spot too long. The blast operation **must not** disturb the metal surface.

Walnut shell bead blast material is sometimes used to clean ferrous metals (iron and steel). Walnut shell blasting produces a great amount of dust particularly when the pressure of the air pressure on the blasting machine is increased above media manufacturer's recommendation. Cummins Inc. recommends **not** using walnut shell media to clean engine parts due to the risk media embedment and subsequent contamination of the engine.

Cummins Inc. now recommends glass bead media **NOT** used to clean any engine parts. Glass media is too easily embedded into the material particularly in soft materials and when air pressures greater than media manufacturer's recommend are used. The glass is an abrasive so when it is in a moving part, that part is abrading all the parts in contact with it. When higher pressures are used the media is broken and forms a dust of a very small size that floats easily in the air. This dust is very hard to control in the shop, particularly if **only** compressed air (and not hot water) is used to blow the media after it is removed from the blasting cabinet (blowing the part off inside the cabinet may remove large accumulations but never removes all the media).

Bead blasting is best used on stubborn dirt/carbon build-up that has **not** been removed by first steam/higher pressure washing then washing in a heated wash tank. This is particularly true of pistons. Steam and soak the pistons first then use the plastic bead method to safely remove the carbon remaining in the grooves (instead of running the risk of damaging the surface finish of the groove with a wire wheel or end of a broken piston ring. Make sure the parts are dry and oil free before bead blasting to prevent clogging the return on the blasting machine.

Always direct the bead blaster nozzle "across" rather than directly at the part. This allows the bead to get under the unwanted material. Keep the nozzle moving rather than hold on one place. Keeping the nozzle directed at one place too long causes the metal to heat up and be moved around. Remember that the spray is **not** just hitting the dirt or carbon. If the machining marks on the piston groove or rim have been disturbed then there has **not** been enough movement of the nozzle and/or the air pressure is too high.

Never bead blast valve stems. Tape or use a sleeve to protect the stems during bead blasting. Direct the nozzle across the seat surface and radius rather than straight at them. The object is to remove any carbon build up and continuing to blast to remove the stain is a waste of time.

Acronyms and Abbreviations

General Information

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

API	American Petroleum Institute
ASTM	American Society of Testing and Materials
°C	Celsius
CARB	California Air Resources Board
C.I.D.	Cubic Inch Displacement
CNG	Compressed Natural Gas
CPL	Control Parts List
cSt	Centistokes
ECM	Electronic Control Module
EGR	Exhaust Gas Recirculation
EPA	Environmental Protection Agency
°F	Fahrenheit
FMI	Failure Mode Identifier
GVW	Gross Vehicle Weight
LPG	Liquefied Petroleum Gas
Hg	Mercury
hp	Horsepower
H₂O	Water
ICM	Ignition Control Module
km/l	Kilometers per Liter
kPa	Kilopascal
LNG	Liquid Natural Gas
LTA	Low Temperature Aftercooling
MPa	Megapascal
mph	Miles Per Hour
mpq	Miles Per Quart
N•m	Newton-meter
NG	Natural Gas
OEM	Original Equipment Manufacturer
PID	Parameter Identification Descriptions
ppm	Parts Per Million
psi	Pounds Per Square Inch
PTO	Power Takeoff
rpm	Revolutions Per Minute
SAE	Society of Automotive Engineers
SCA	Supplemental Coolant Additive
STC	Step Timing Control
SID	Subsystem Identification Descriptions
VS	Variable Speed
VSS	Vehicle Speed Sensor

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Section E - Engine Identification

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Engine Dataplate	E-1


Section E - Engine Identification
1. Engine Model Number
2. Engine Serial Number
3. Engine Manufacturer
4. Engine Displacement
5. Engine Horsepower
6. Engine Speed
7. Engine Type
8. Engine Application
9. Engine Identification Number
10. Engine Identification Date

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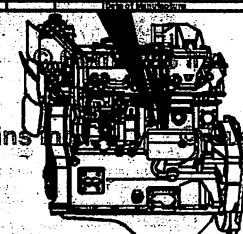
Engine Identification Engine Dataplate

The engine dataplates show specific information about your engine. The engine serial number (1) and Control Parts List (CPL) (2) provide information for ordering parts and service needs.

NOTE: The engine dataplate must not be changed unless approved by Cummins Inc.


 Cummins Engine Company, Inc. Columbus, Indiana 47203-0001 www.cummins.com	Identical to the following: Model: QSB3.3 Power: 1000 HP Low Speed: 1500 RPM Fuel System: Direct Injection Emissions: EPA Tier 4 Final
<small>This engine conforms to ISO 9001:2008 and ISO 14001:2004 requirements for design and development, production and installation. For more information, contact your distributor.</small>	

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00900248

 Cummins Engine Company, Inc. Columbus, Indiana 47202-3005 www.cummins.com		Important Engine Information	
Warning: Injury may result and warranty is voided if fuel rate, rpm, or altitudes exceed published maximum values for this model and application.		Model: B3.3 Gross rated HP/kw: _____ rpm	ESN: _____
This engine conforms to 1999 U.S. EPA and California regulations for large non-road compression ignition engines as applicable. This engine is certified to operate on diesel fuel.		Low Idle: RPM _____ RPM _____	Fuel Rating: _____
Timing: BTDC _____ degrees		Displacement: _____ in ³ / _____ L	CPL: _____
Valve Lead (cold engine):	Exhaust: _____ in. / _____ mm	EPA Cert.: _____	
Fuel rate at rated HP/kw: _____ mm ³ /st		European Approval Number: _____	
Made in Japan: _____	Date of Manufacture: _____		

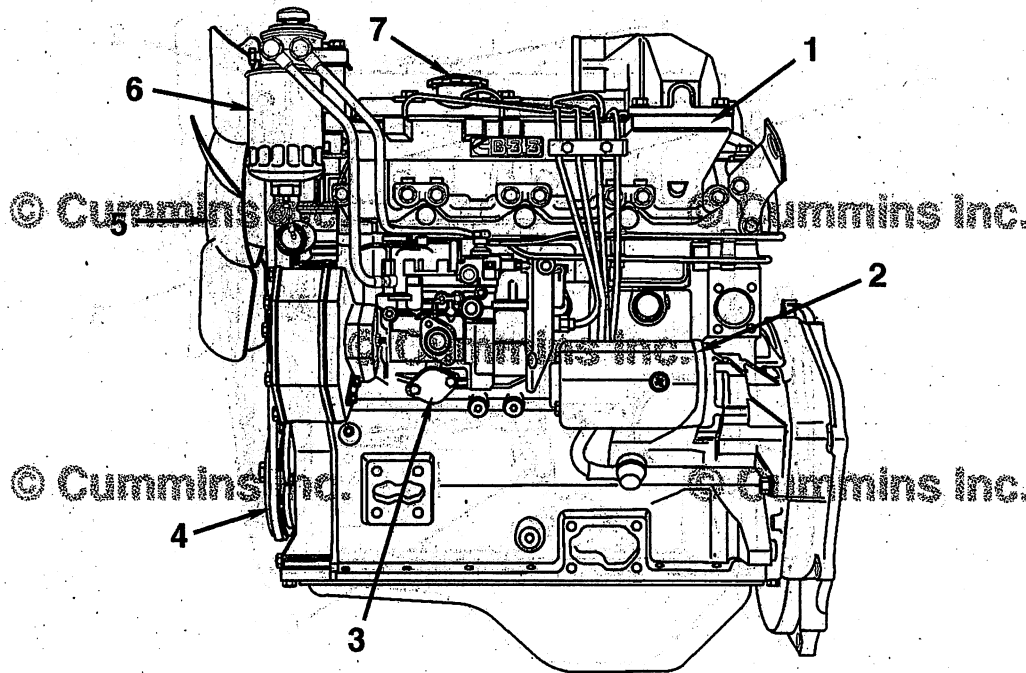
2
1

1. Control parts list (CPL)
2. Engine serial number

00900249

Engine Diagrams

Engine Views with Mechanically Actuated Injector



B3.3 Engine Intake Side (Naturally Aspirated)

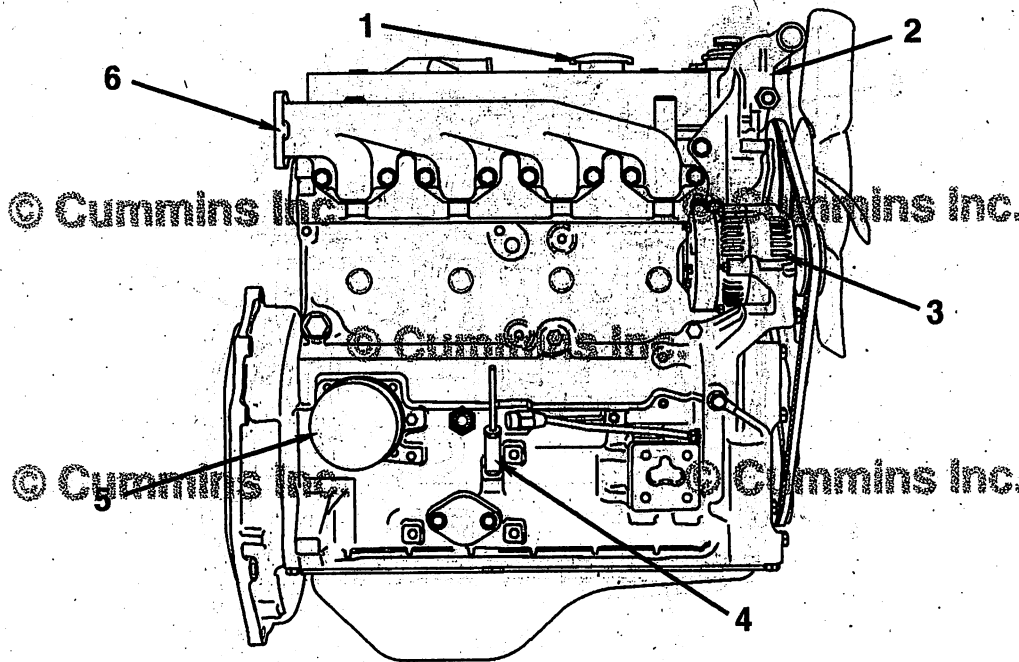
00900138

- 1. Intake manifold
- 2. Starting motor
- 3. Fuel injection pump
- 4. Crankshaft pulley

- 5. Cooling fan
- 6. Fuel filter
- 7. Oil fill cap.

Engine Diagrams

Engine Views with Mechanically Actuated Injector



00900139

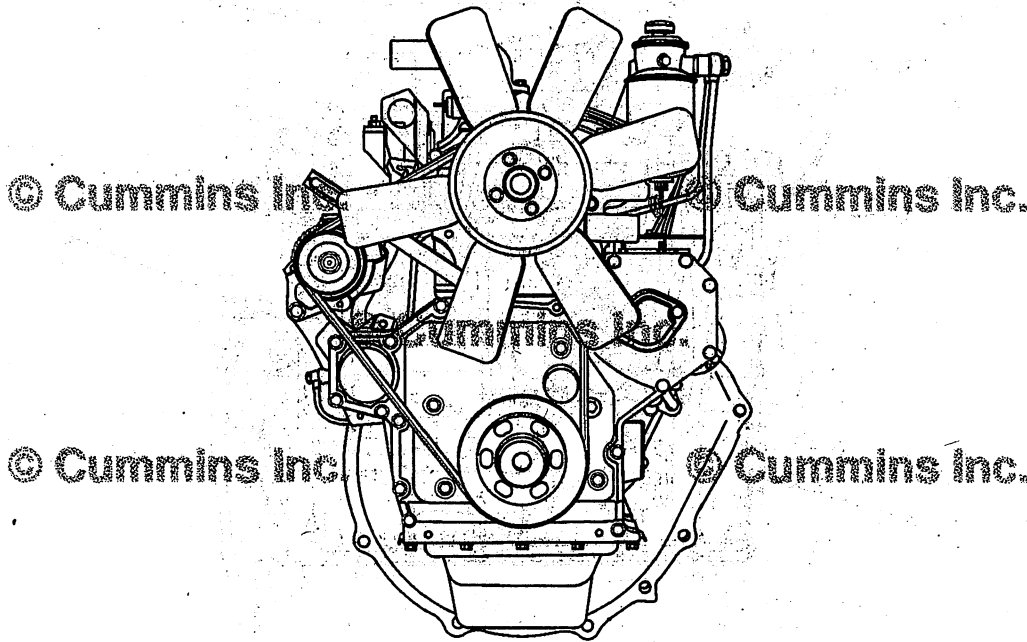
B3.3 Engine Exhaust Side (Naturally Aspirated)

- 1. Oil fill cap
- 2. Thermostat housing
- 3. Alternator

- 4. Dipstick
- 5. Oil filter
- 6. Exhaust manifold.

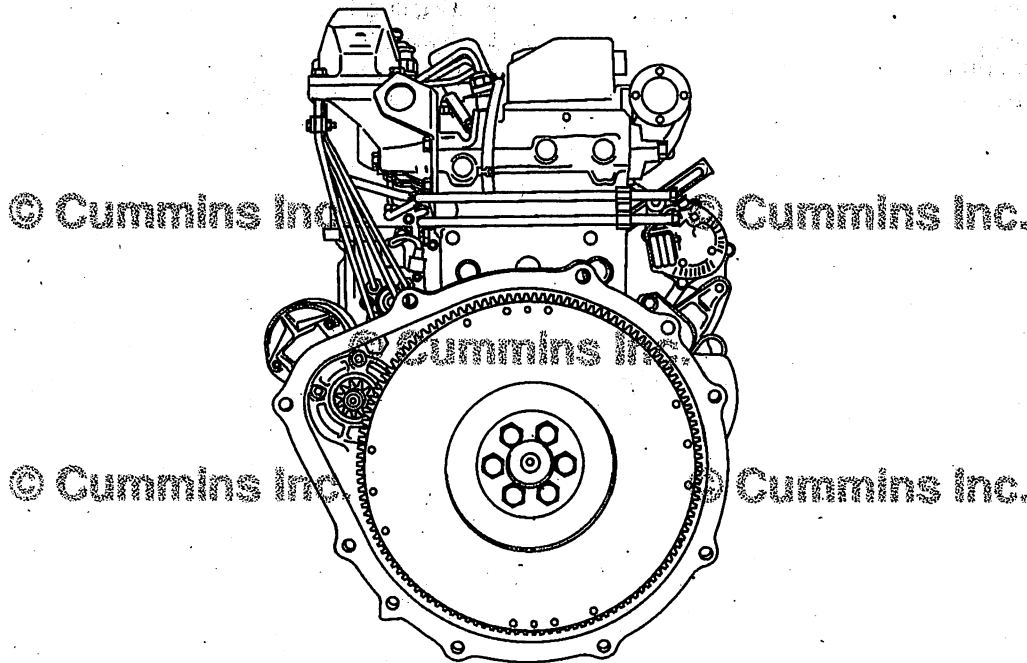
Engine Diagrams

Engine Views with Mechanically Actuated Injector



B3.3 Engine Front View (Naturally Aspirated)

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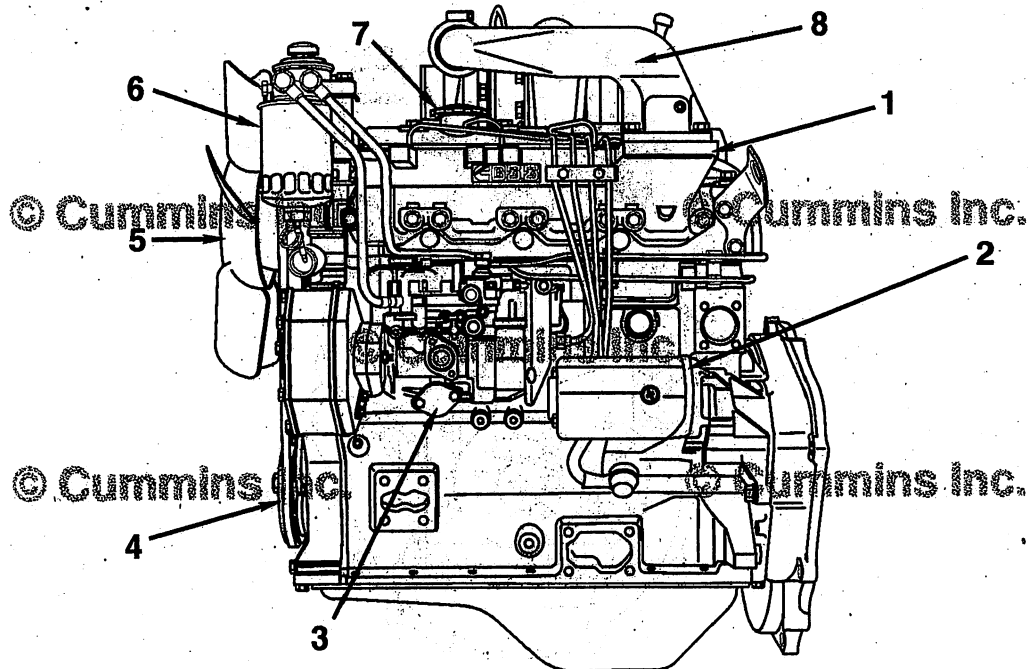


B3.3 Engine Rear View (Naturally Aspirated)

00900141

Engine Diagrams

Engine Views with Mechanically Actuated Injector



B3.3 Engine Intake Side (Turbocharged)

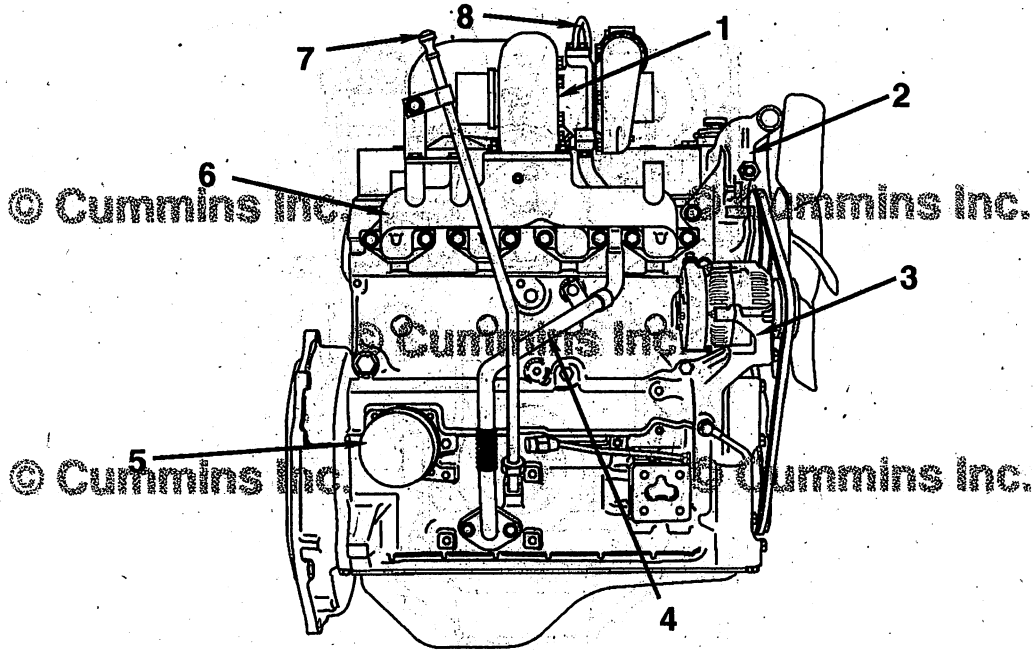
- 1. Intake manifold
- 2. Starting motor
- 3. Fuel injection pump
- 4. Crankshaft pulley

- 5. Cooling fan
- 6. Fuel filter
- 7. Oil fill cap
- 8. Air crossover tube.

00900142

Engine Diagrams

Engine Views with Mechanically Actuated Injector



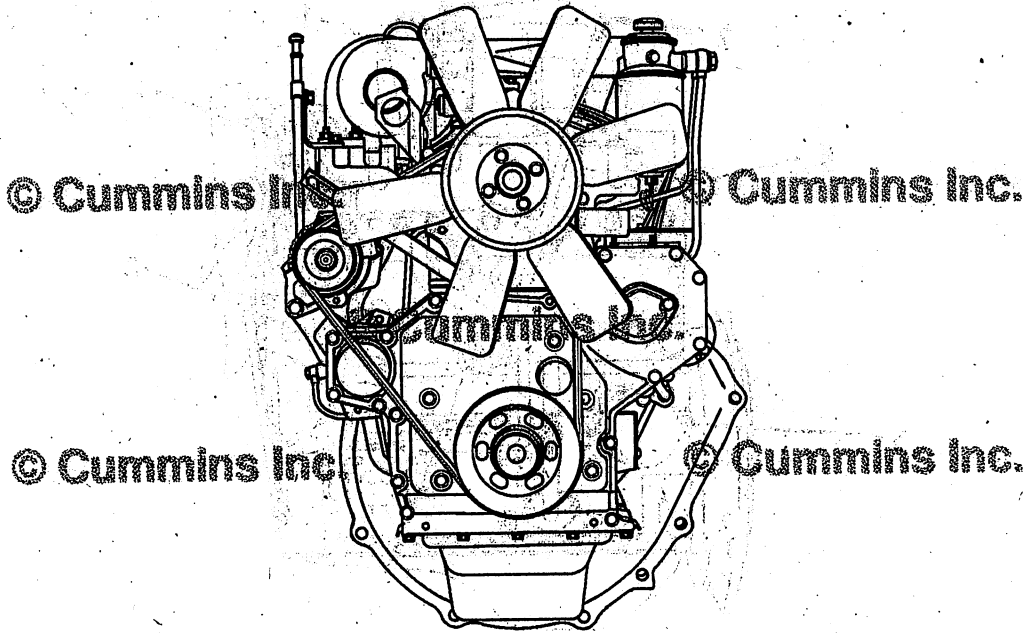
B3.3 Engine Exhaust Side (Turbocharged)

00900143

- | | |
|--------------------------------|----------------------------------|
| 1. Turbocharger | 5. Oil filter |
| 2. Thermostat housing | 6. Exhaust manifold |
| 3. Alternator | 7. Dipstick |
| 4. Turbocharger oil drain tube | 8. Turbocharger oil supply tube. |

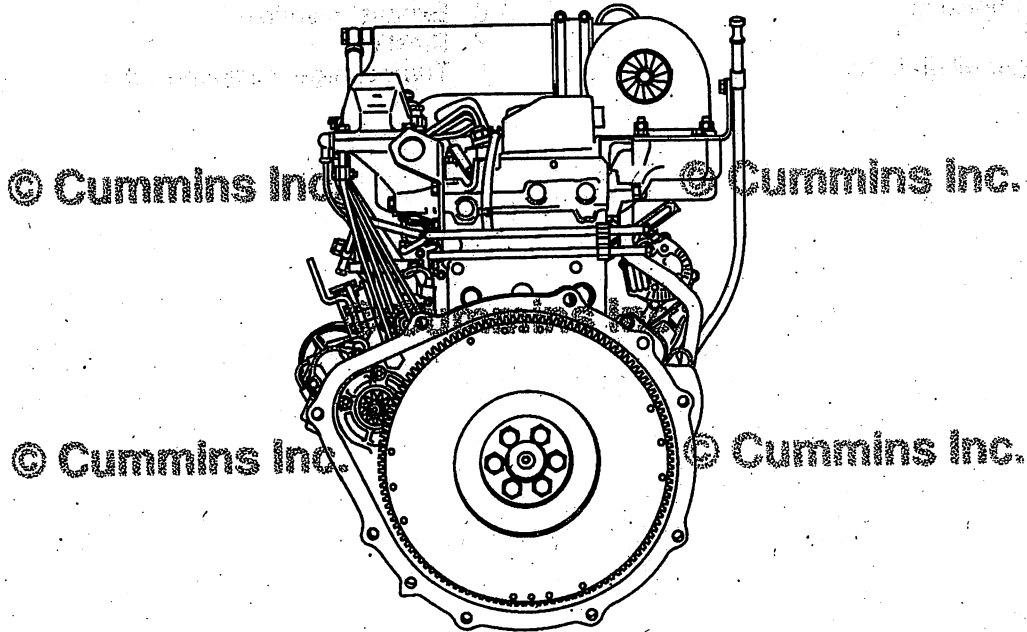
Engine Diagrams

Engine Views with Mechanically Actuated Injector



B3.3 Engine Front View (Turbocharged)

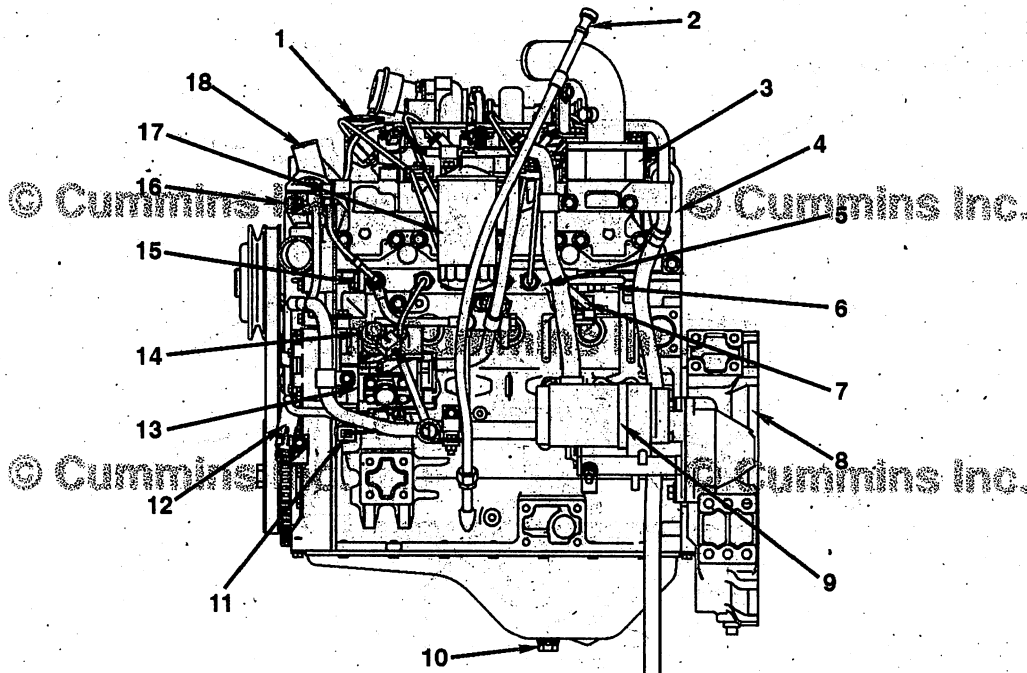
00900144



B3.3 Engine Rear View (Turbocharged)

00900145

with Electronically Actuated Injector

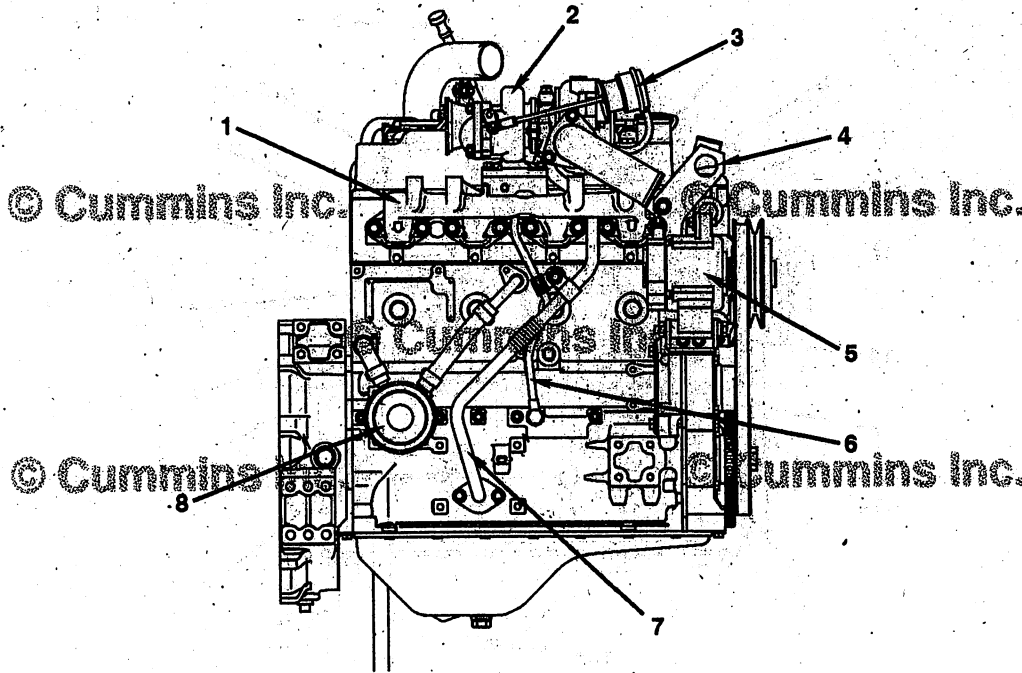


QSB3.3 Engine Intake Side (Turbocharged)

00900457

- | | |
|-----------------------------------|-------------------------------------|
| 1. Lubricating oil fill cap | 10. Lubricating oil pan drain plug |
| 2. Lubricating oil dipstick | 11. Lubricating oil pressure switch |
| 3. Intake air heater | 12. Crankshaft position sensor |
| 4. Engine lifting bracket | 13. Bosch® fuel pump |
| 5. Fuel rail | 14. Fuel pump actuator |
| 6. Fuel rail pressure sensor | 15. Fuel rail pressure relief valve |
| 7. Barometric air pressure sensor | 16. Coolant temperature sensor |
| 8. Flywheel housing | 17. Fuel filter |
| 9. Starter motor | 18. Coolant outlet. |

with Electronically Actuated Injector

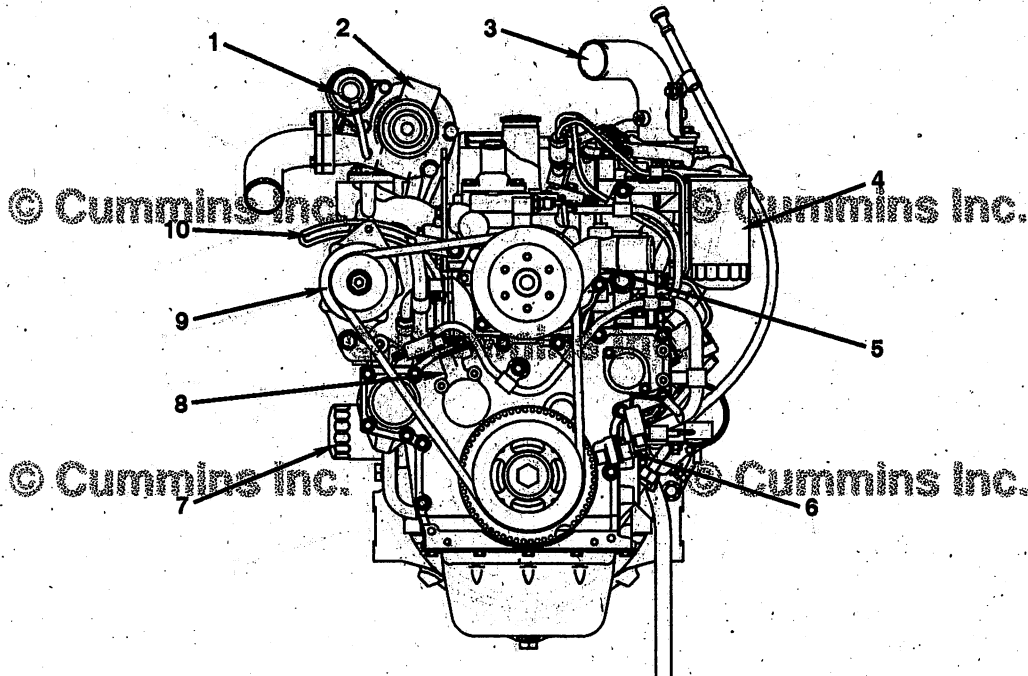


00900460

QSB3.3 Engine Exhaust Side (Turbocharged)

- | | |
|------------------------------------|---|
| 1. Exhaust manifold | 5. Alternator |
| 2. Turbocharger | 6. Turbocharger lubricating oil supply line |
| 3. Turbocharger wastegate actuator | 7. Turbocharger lubricating oil drain line |
| 4. Engine lifting bracket | 8. Lubricating oil cooler. |

with Electronically Actuated Injector

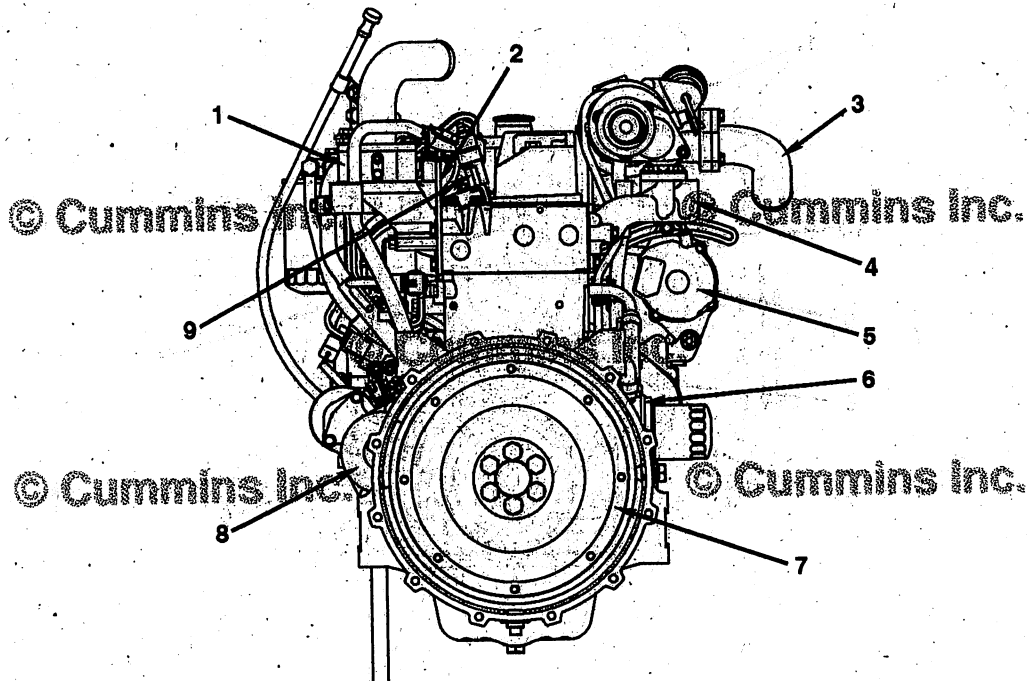


QSB3.3 Engine Front View (Turbocharged)

00900458

- | | |
|------------------------------------|--------------------------------------|
| 1. Turbocharger wastegate actuator | 6. Crankshaft position sensor |
| 2. Turbocharger compressor inlet | 7. Lubricating oil filter |
| 3. Air intake inlet | 8. Camshaft position sensor |
| 4. Fuel filter | 9. Alternator |
| 5. Water pump | 10. Alternator belt adjustment link. |

with Electronically Actuated Injector

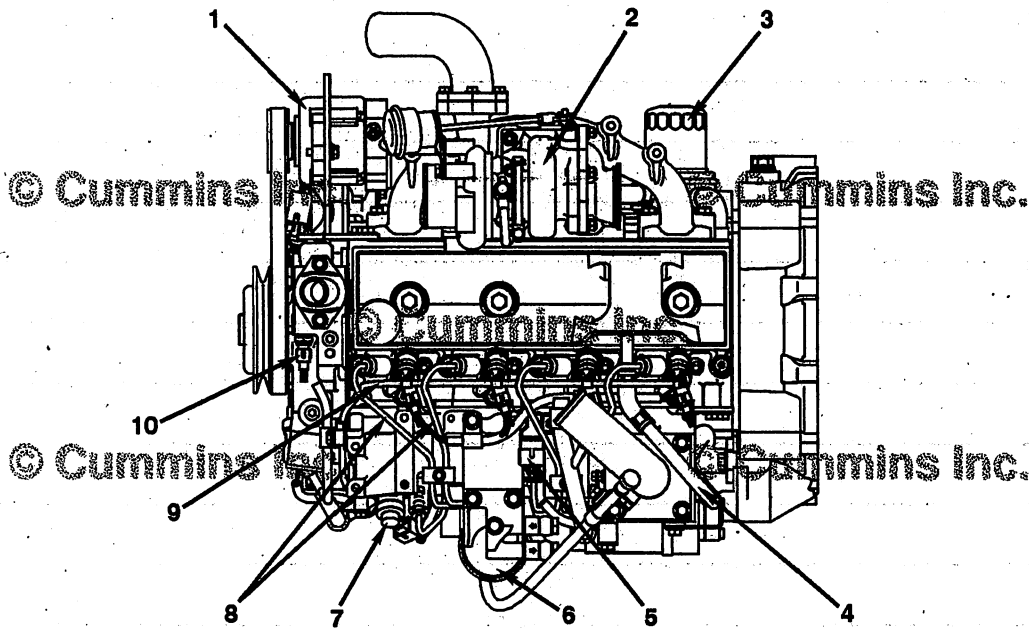


QSB3.3 Engine Rear View (Turbocharged)

- | | |
|-----------------------------------|----------------------------|
| 1. Intake air heater | 6. Lubricating oil cooler |
| 2. Engine lifting bracket | 7. Flywheel |
| 3. Turbocharger compressor outlet | 8. Starter motor |
| 4. Exhaust manifold | 9. High-pressure injector. |
| 5. Alternator | |

00900459

with Electronically Actuated Injector



00900461

QSB3.3 Engine Top View (Turbocharged)

- | | |
|--|---------------------------------|
| 1. Alternator | 6. Fuel filter head |
| 2. Turbocharger | 7. Fuel pump actuator |
| 3. Lubricating oil filter | 8. High-pressure injector lines |
| 4. Crankcase breather tube | 9. Injector drain lines |
| 5. Intake manifold pressure/temperature sensor | 10. Coolant temperature sensor. |

Section 1 - Operating Instructions

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Operating Instructions - Overview

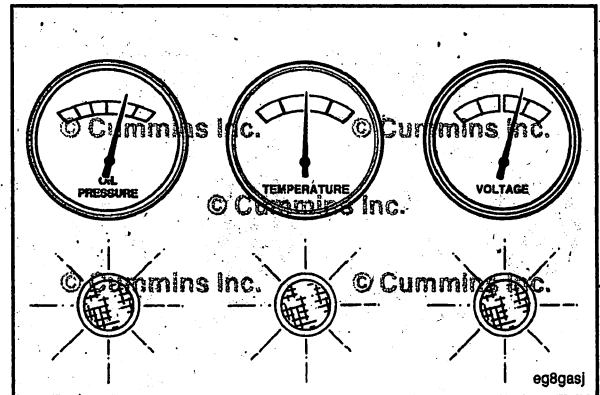
General Information

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.

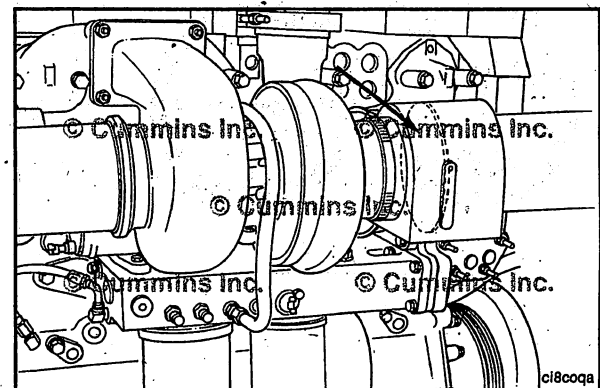
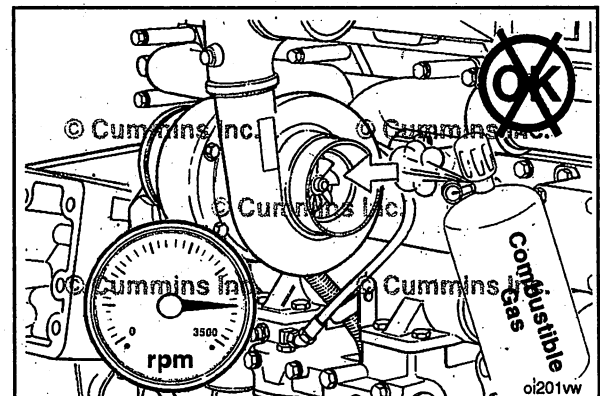
Check the oil pressure indicators, temperature indicators, warning lights, and other gauges daily to make sure they are operational.



▲ WARNING ▲

DO NOT OPERATE A DIESEL ENGINE WHERE THERE ARE OR CAN BE COMBUSTIBLE VAPORS. The vapors can be sucked through the air intake system and cause engine acceleration and overspeeding 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 overspeeding where an engine, due to its application, due to a fuel spill or gas leak. Remember, Cummins 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 YOUR CUMMINS AUTHORIZED REPAIR LOCATION FOR FURTHER INFORMATION.**

Cummins recommends the installation of an air intake shutoff device or a similar safety device to minimize the risk of overspeeding where an engine, due to the vehicle, vessel or equipment being operated in a combustible environment, such as due to a fuel spill or gas leak.



⚠ CAUTION ⚠

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

Normal Starting Procedure

General Information

⚠ WARNING ⚠

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

⚠ CAUTION ⚠

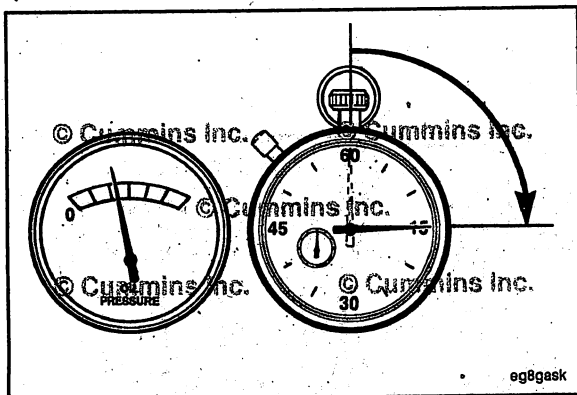
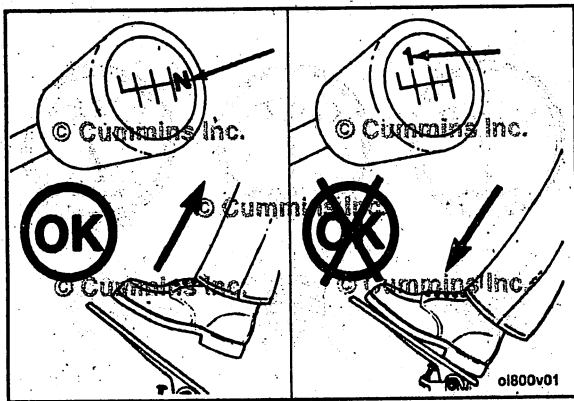
To prevent damage to the starting motor, do not engage the starting motor for more than 30 seconds. Wait 2 minutes between each attempt to start (electrical starting motors only).

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

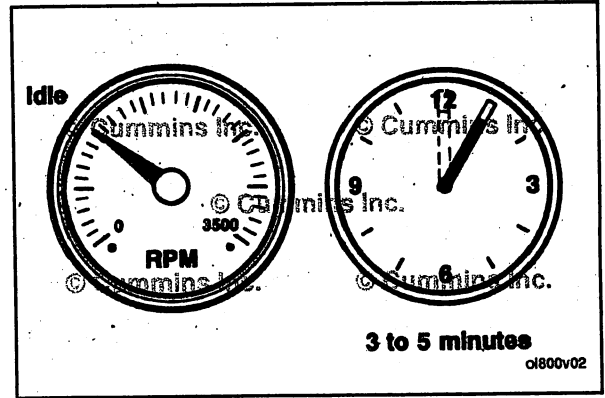
- Disengage the driven unit, or if equipped, put the transmission in neutral.
- With the accelerator pedal or lever in the idle position, turn the key switch to the ON position, and wait for the WAIT-TO-START lamp to go out; then, turn the key to the START position.
- If the engine does not start after three attempts, check the fuel supply system. Absence of blue or white exhaust smoke during cranking indicates no fuel is being delivered.

⚠ CAUTION ⚠

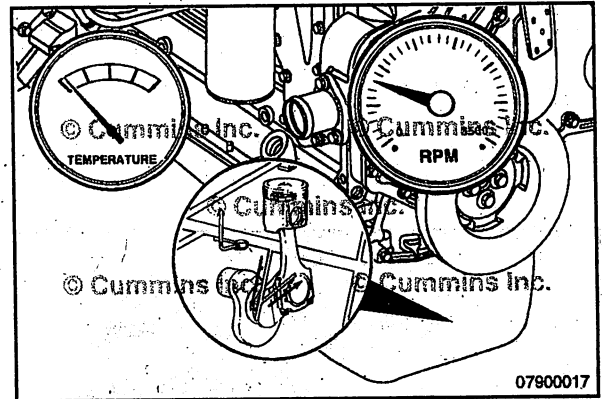
The engine must have adequate oil pressure within 15 seconds after starting. If the WARNING lamp indicating low oil pressure has not gone out or there is no oil pressure indicated on a gauge within 15 seconds, shut off the engine immediately to avoid engine damage. The low oil pressure troubleshooting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



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



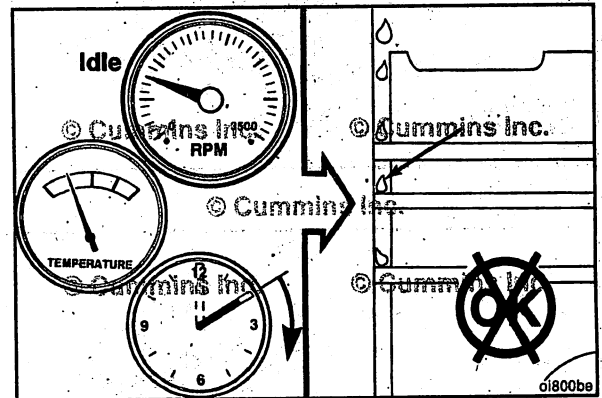
After starting a cold engine, increase the engine speed (rpm) slowly to provide adequate lubrication to the bearings and to allow the oil pressure to stabilize.



⚠CAUTION⚠

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

- Fuel Dilution of the lubricating oil
- Carbon build up in the cylinder
- Cylinder head valve sticking
- Reduced performance



Jump Starting

⚠ WARNING ⚠

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

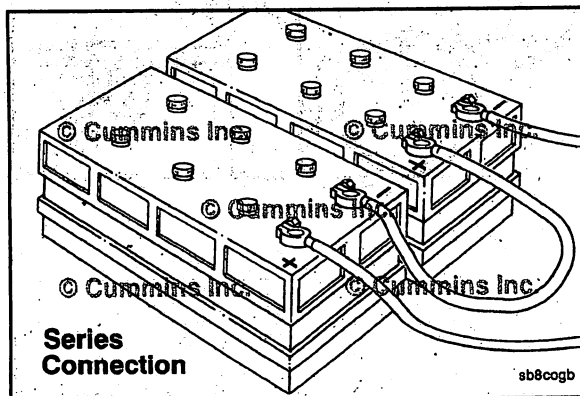
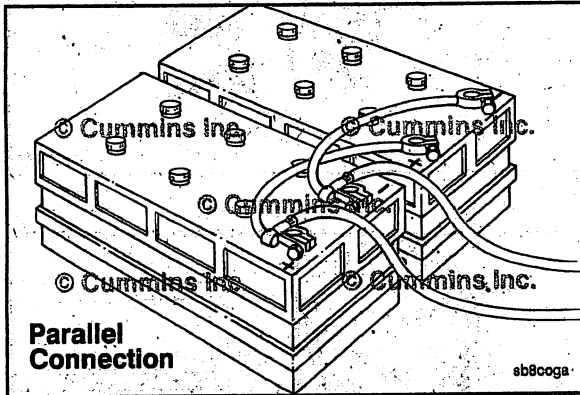
⚠ CAUTION ⚠

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 avoid damage to engine parts, do not connect jumper starting or battery charging cable to any fuel system or electronic component.

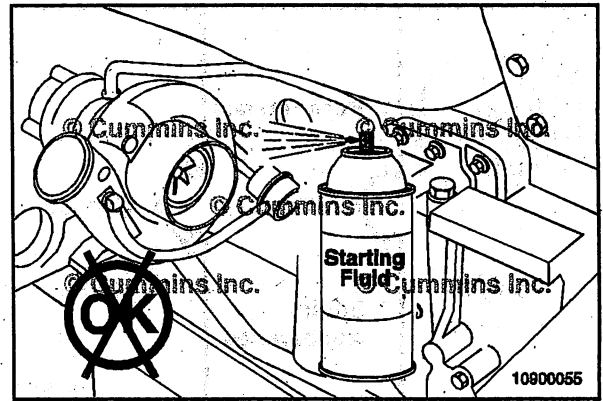
The accompanying illustration shows a typical parallel battery connection. This arrangement doubles the cranking amperage.



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

Using Starting Aids

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



Starting Procedure After Extended Shutdown or Oil Change

General Information

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

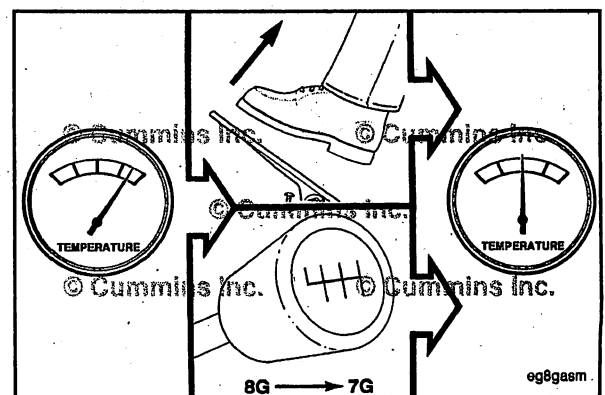
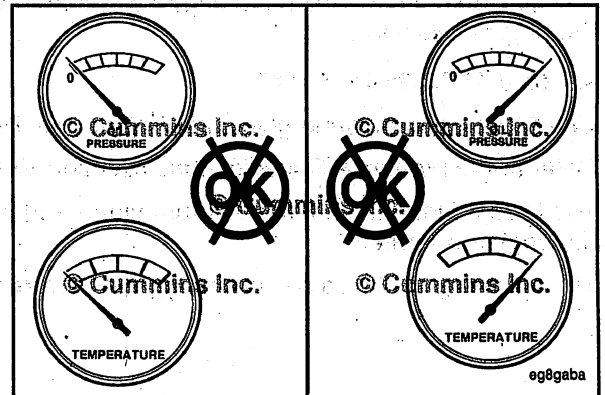
Operating the Engine

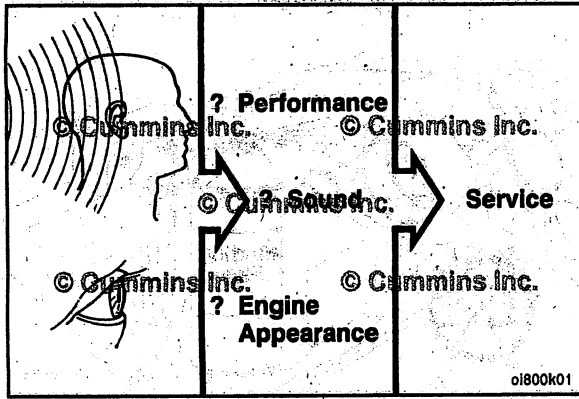
Normal

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

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

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





Most failures give an early warning. Look and listen for changes in performance, sound, or engine appearance that can indicate service or engine repair is needed. Some changes to look for are:

- Engine misfires
- Vibration
- Unusual engine noises
- Sudden changes in engine operating temperatures or pressures
- Excessive smoke
- Loss of power
- An increase in oil consumption
- An increase in fuel consumption
- Fuel, oil, or coolant leaks.

Cold Weather

It is possible to operate engines in extremely cold environments if they are properly prepared and maintained. Satisfactory performance of an engine in low ambient temperature conditions requires modification of the engine, surrounding equipment, operating practices and maintenance procedures.

The correct engine coolant lubricating oil and fuels **must** be used for the cold weather range in which the engine is being operated. Below are the recommendations for these critical engine fluids:

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.

Refer to Maintenance Specifications (Section V) Lubricating Oil recommendations for the correct specifications.

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.

Refer to Maintenance Specifications (Section V) Lubricating Oil recommendations for the correct specifications.

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 following cold weather operating aids are required for cold weather situations:

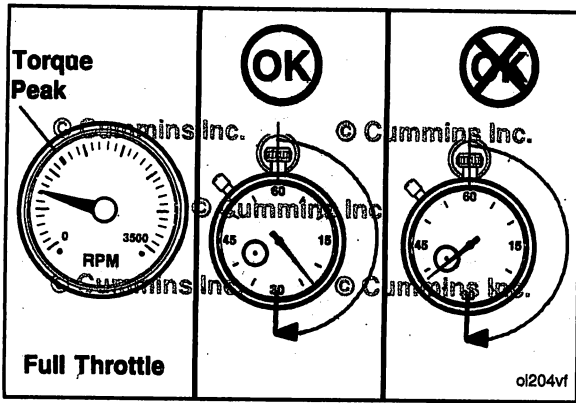
Cold Weather Operating Aids										
Temperature	Starting Aid	Coolant Heater	Oil Heater	Under-hood Air	Fuel Heater	Battery Heater	Radiator Shutters	Engine Enclosure	Winter Front	Thermatic Fan
50 to 32° F. 10 to 0° C	© Cummins Inc.						© Cummins Inc.			
32 to -10° F. 0 to -23° C	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
-10 to -25° F. -23 to -32° C	Required	Required	Required	Required	Required	Required	Required	Required	Required	Required
-25 to -65° F. -32 to -54° C	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

* Required dependent upon viscosity/pour point.

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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).



Engine Operating Range General Information

⚠CAUTION⚠

Do not operate the engine at full throttle operation 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⚠

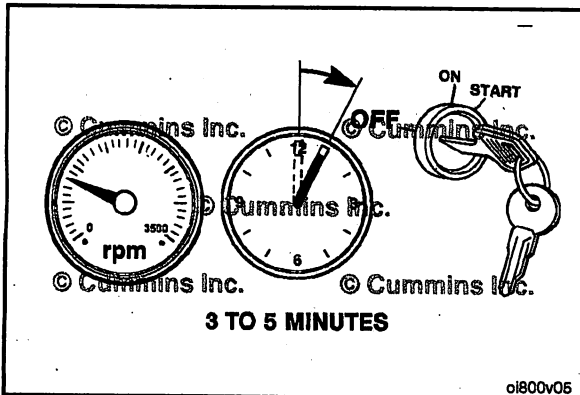
Do not operate the engine beyond the maximum engine speed. Operating the engine beyond the maximum engine speed can cause severe engine damage. Use proper operating techniques for the vehicle, vessel, or equipment to prevent engine overspeed. The maximum engine speed specification is listed in Maintenance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

Engine Shutdown

General Information

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

Turn the ignition switch to the OFF position. If the engine does not shut down, refer to Troubleshooting Symptom (Section TS).



Electronic Controlled Fuel System

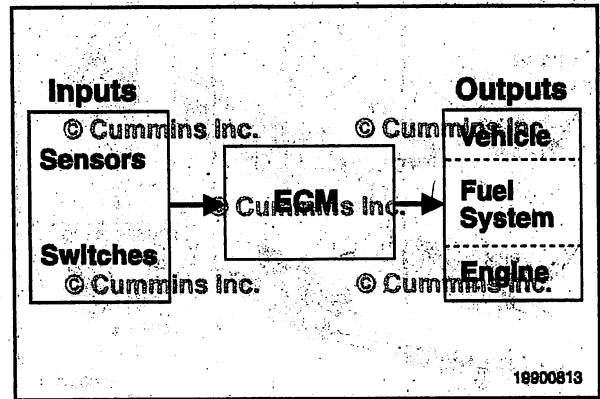
General Information

The engine control system is an electronically operated fuel control system that also provides many operator and vehicle or equipment features.

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

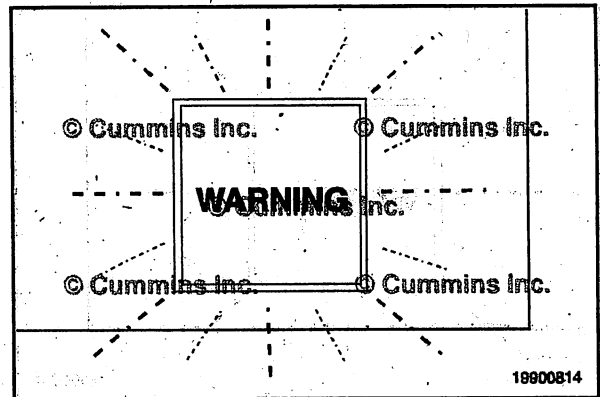
The control system uses inputs from the operator and its sensors to determine the fueling and timing required to operate at the desired engine speed.

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



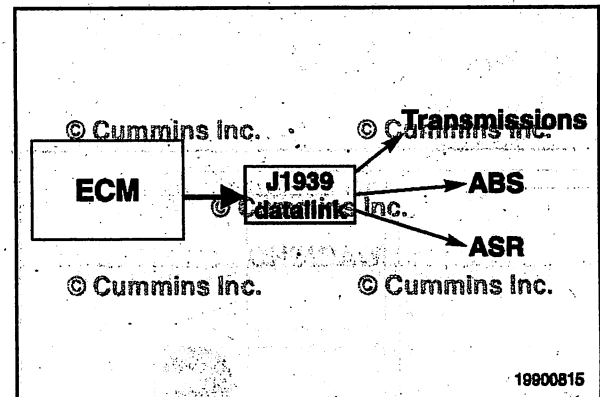
The ECM performs diagnostic tests on most of its circuits and will activate a fault code if a problem is detected in one of these circuits. Along with the fault code identifying the problem, a snapshot of the engine's operating parameters at the time of fault activation is also stored in memory.

Some fault codes will cause a diagnostic lamp to activate to signal the driver.



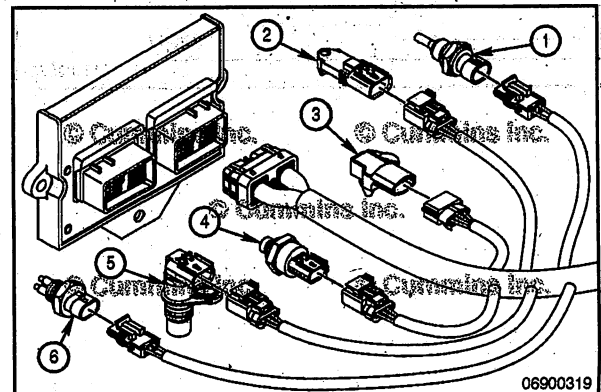
The ECM communicates with service tools and some other vehicle controllers such as transmissions, antilock brake systems, and antislip reduction through an SAE J1939 datalink.

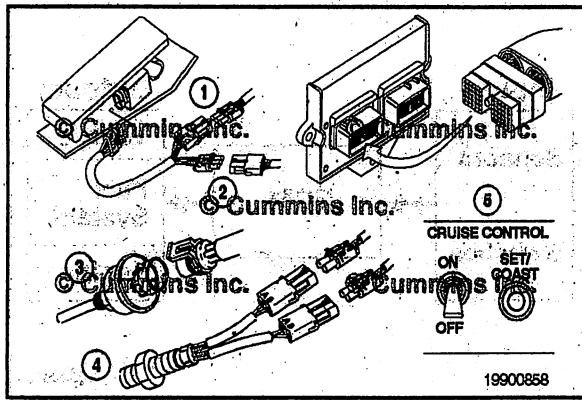
Some vehicles and equipment will have J1939 networks on them that link many of the smart controllers together. Vehicle control devices can temporarily command engine speed or torque to perform one of the devices' functions, such as transmission shifting or antilock braking.



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

1. Coolant temperature sensor
2. Barometric pressure sensor
3. Intake manifold pressure/temperature sensor
4. Oil pressure switch
5. Engine speed/position sensor
6. Water-in-fuel sensor.

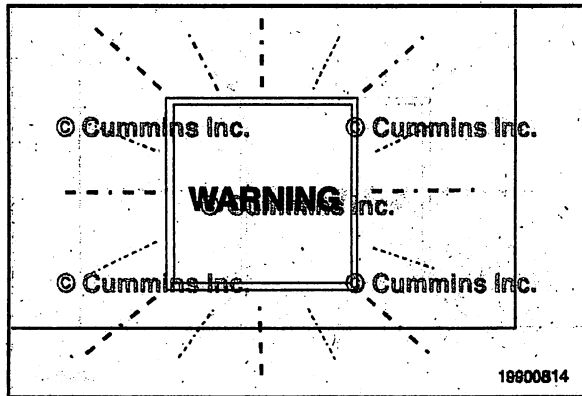




The following inputs are provided by OEM-selected devices:

1. Accelerator pedal position sensor
2. Idle validation switch
3. Coolant level sensor
4. Vehicle speed sensors
5. Feature control switches (i.e., cruise control switches).

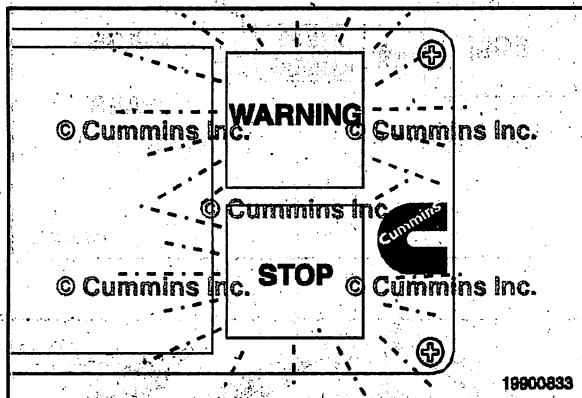
NOTE: These inputs are application-dependent. Some applications will not use all of these inputs.



Engine Protection System

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

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



Engine Protection Shutdown

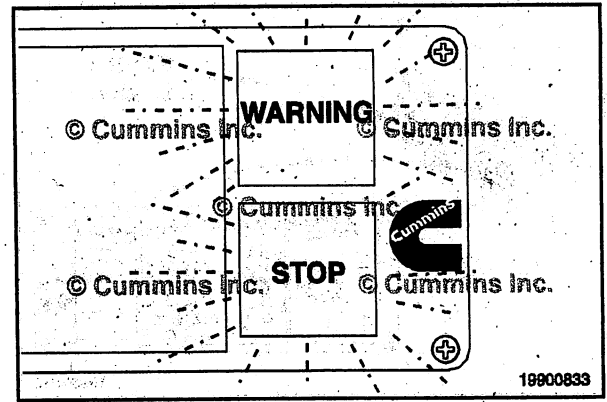
This feature automatically shuts off the engine when the temperature, pressure, and coolant level sensors indicate the engine is operating over or under normal operating conditions.

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

Engine Protection Shutdown Manual Override

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

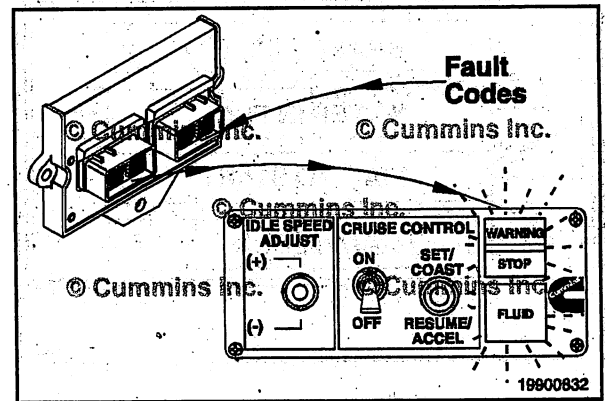
If the vehicle is **not** equipped with a clutch switch, then the OEM will provide a dash-mounted switch marked as the ENGINE PROTECTION SHUTDOWN OVERRIDE switch. When the operator triggers this switch while the red lamp is flashing, a timer within the ECM will reset and allow the engine to run for an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



Diagnostic Fault Codes

The control system can show and record operation anomalies that present themselves as fault codes. These codes will make troubleshooting easier. The fault codes are recorded in the ECM. They can be read using the fault lamps in the dash, or with the INSITE™ electronic service tool.

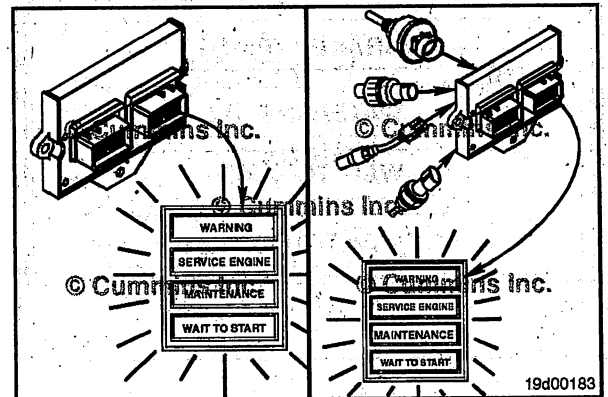
NOTE: Not all engine or control system anomalies are shown as fault codes.



There are three types of system codes:

- Engine electronic control system fault codes
- Engine protection system fault codes
- Engine maintenance indicator codes.

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



Most of the electronic fault codes will light a lamp when they are active. There are three possible lamps that can be lit when a fault is active:

1. The **WARNING** or **CHECK ENGINE** lamp is yellow and indicates the need to repair the fault at the first available opportunity.
2. The **STOP** or **STOP ENGINE** lamp is red and indicates the need to stop the engine as soon as it can be safely done. The engine should remain shut down until the fault can be repaired.
3. The **MAINTENANCE** or **FLUID** lamp will illuminate when an engine maintenance function needs to be performed.

NOTE: The names and colors of these lamps can vary by equipment manufacturer.

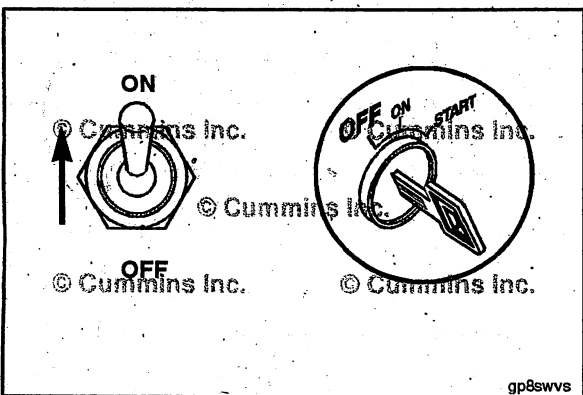
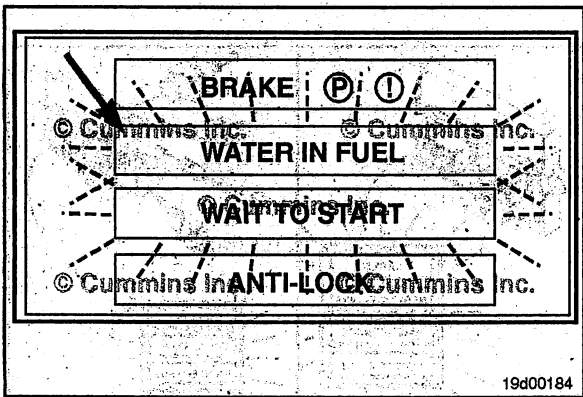
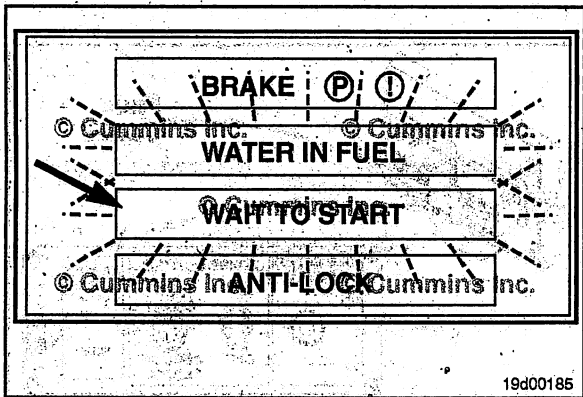
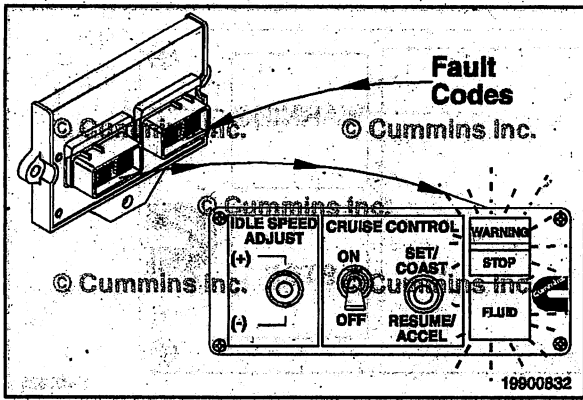
Some vehicles will also have a **WAIT-TO-START** lamp and a **WATER-IN-FUEL** lamp. The **WAIT-TO-START** lamp is illuminated during the preheating time that takes place at key-on during cold-weather starting. To minimize cranking time during cold-weather starting, the engine should not be cranked until the **WAIT-TO-START** lamp has been extinguished.

The **WATER-IN-FUEL** lamp indicates that the engine's water-in-fuel separator needs to have the water drained out of it. This task should be performed as soon as possible whenever this lamp is illuminated. Some vehicle manufacturers will combine the functions of the **MAINTENANCE** and **WATER-IN-FUEL** lamps. In these cases, the **MAINTENANCE** lamp would indicate a **WATER-IN-FUEL** warning, in addition to other maintenance indicators.

Vehicle, Equipment, or Vessel Diagnostic Switch

There are two ways to check for active engine electronic fuel system fault codes and maintenance indicator codes, depending on whether the engine is equipped with a diagnostic switch.

Turn the keyswitch to the **OFF** position. Move the diagnostic switch to the **ON** position, or connect the shorting plug into the diagnostic connector. Turn the vehicle keyswitch to the **ON** position.

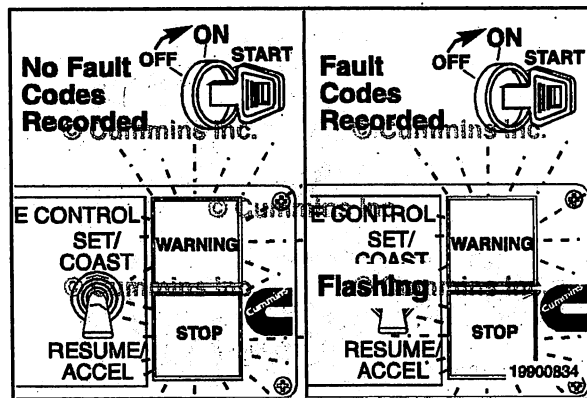


Throttle Activated Diagnostic Switch

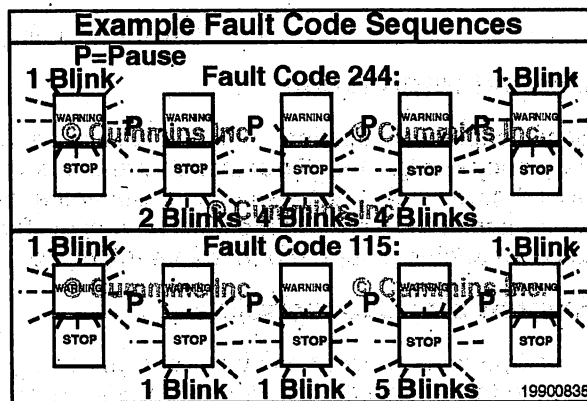
Turn the vehicle keyswitch to the ON position. With the keyswitch on and the engine not running, cycle the accelerator pedal to full throttle and back to the idle position three times.

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

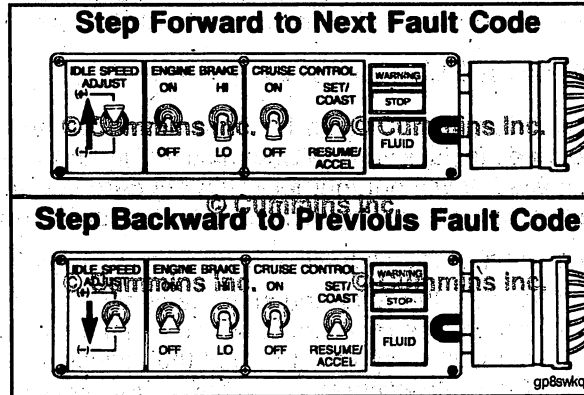
If active fault codes are recorded, both lights will come on momentarily, then begin to flash the code of the recorded fault(s).



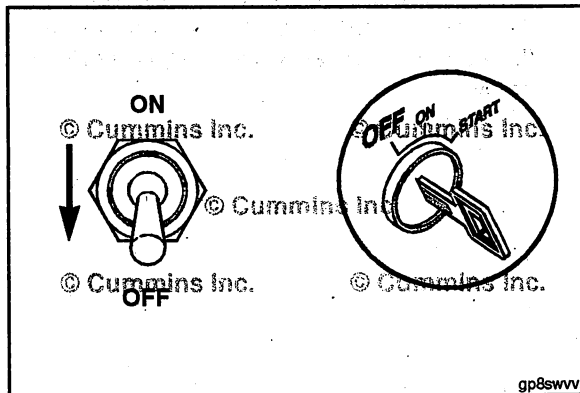
The fault code will flash in the following sequence: First, a WARNING (yellow) lamp will flash. Then there will be a short 1- or 2-second pause, after which the number of the recorded fault code will flash in the STOP (red) lamp. There will be a 1- or 2-second pause between each number. When the number has finished flashing in red, a yellow lamp will appear again. The three-digit code will repeat in the same sequence.

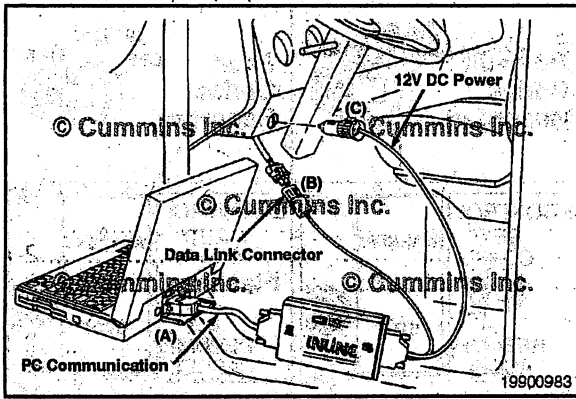


The lights flash each fault code out two times before advancing to the next code. To skip to the next fault code sooner, move the idle speed adjust switch (if equipped) momentarily to the "(+)" position. You can go back to the previous fault code by momentarily moving the idle speed adjust switch (if equipped) to the "(-)" position. If only one active fault is recorded, the control system will continuously display the same fault code, even when either "(+)" or "(-)" switch is depressed.



When not using the diagnostic system, turn off the diagnostic switch, or remove the shorting plug. If the diagnostic switch is left on or the shorting plug in, the electronic control module will not log some faults.





Fault Code Snapshot Data

This data makes up additional fault code information that can be obtained by using the INSITE™ electronic service tool. The snapshot data records the value or state of the control system sensors and switches at the time a fault occurred. This data is stored for the first occurrence of the fault, since it was last cleared, and for the most recent occurrence. This data can be very valuable when trying to create or determine engine operating conditions at the time of a fault.

Electromagnetic Interference (EMI)

General Information

Some engine applications utilize accessories (CB radios, mobile transmitters, etc.) that generate and use radio frequency energy that, if not installed and used properly, can cause electromagnetic interference (EMI) conditions to exist between the accessory and Cummins electronic controlled fuel system. Cummins is **not** liable for any performance problems with either the fuel system or the accessory due to EMI. EMI is **not** considered by Cummins to be an engine 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 engine 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 fuel system EMI susceptibility level will protect your engine from most, if **not** all, electromagnetic energy-emitting devices that meet the Federal Communications Commission 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 engine is properly installed, it 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 receiving antenna as far away from the engine and as high as possible.
2. Locate the receiving 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:
 - Calibrate accurately 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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Section 2 - Maintenance Guidelines

Section 2 - Maintenance Guidelines

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- 3.0 Inspection Procedures
- 4.0 Repair Procedures
- 5.0 Replacement Procedures
- 6.0 Testing Procedures
- 7.0 Record Keeping
- 8.0 Training
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- 10.0 Appendix

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Maintenance Guidelines - Overview

General Information

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

If the engine 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 engine is operated in a dusty environment or if frequent stops are made. 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 engine is equipped with a component or accessory not manufactured by Cummins Inc., refer to the component manufacturer's maintenance recommendations.

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

Tool Requirements

General Information

The maintenance operations described in the manual can be performed with common hand tools, metric and Society of Automotive Engineering (S.A.E.) wrenches, sockets, and screwdrivers.

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

Service Tools	
Tool Part Number	Tool Description
ST 647	Standard Puller
ST-1111-3	Manometer
3163381	Fuel Pump Gear Puller
3164488	Digital Multimeter
3164706	Injector Remover
3375273	Pressure Kit
3376050	Dial Indicator Assembly
3377399	Magnetic Base Indicator Holder
3400157	Filter Wrench
3824591	Barring Tool
3822985	Combustion Leak Test Kit

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

Maintenance Schedule

General Information

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

If the engine is operating in ambient temperatures consistently below -18°C [0°F] or above 38°C [100°F], perform maintenance at shorter intervals. Shorter maintenance intervals are also required if the engine is operated in a dusty environment or if frequent stops are made. Contact a Cummins Authorized Repair Location for recommended intervals.

Use the chart provided to record maintenance. Refer to Procedure 102-001 (Maintenance Record Form) in this section.

If the engine is equipped with a component or an accessory **not** manufactured by Cummins Inc., refer to the OEM service manual and maintenance recommendations.

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

For your convenience, listed below are the section numbers which contain specific instructions for performing the maintenance checks listed in the maintenance schedule.

Maintenance Procedures at Daily Interval.....Section 3

- Fuel-Water Separator - Drain
- Engine Lubricating Oil Level - Check/Correct
- Engine Coolant Level - Check/Correct
- Drive Belts - Inspect/Correct
- Cooling Fan - Inspect/Correct
- Crankcase Breather Tube - Check

Maintenance Procedures at 250 Hours or 3 Months.....Section 4

- Lubricating Oil and Filters - Change ⁽¹⁾
- Valve Lash Clearance - Adjust ⁽²⁾
- Air Intake System - Inspect
- Air Cleaner Restriction - Check/Correct

Maintenance Procedures at 500 Hours or 6 Months.....Section 5

- Fuel Filter - Replace
- Fuel Supply Lines - Vent
- Injection Pump - Vent
- Cooling System - Check⁽³⁾

Maintenance Procedures at 1000 Hours or 1 Year.....Section 6

- Drive Belt Tension - Measure

Maintenance Procedures at 2000 Hours or 2 Years.....Section 7

- Cooling System - Drain, Flush, and Fill
- Valve Lash Clearance - Adjust ⁽²⁾

⁽¹⁾Oil change interval for naturally aspirated engines is every 500 hours or 6 months.

⁽²⁾Initial valve lash clearance adjustment; subsequent adjustments **must** be performed at 2000-hour or 2-year intervals, whichever comes first.

⁽³⁾ **Must** use a heavy-duty year-around antifreeze that meets the chemical composition of GM6038M. The change interval is 2000 hours or 2 years, whichever comes first.

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Section 3 - Maintenance Procedures at Daily Interval

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Daily Maintenance Procedures - Overview

General Information

Preventative maintenance begins with day-to-day awareness of the engine and its system. Before starting the engine, check the oil and coolant levels. Look for:

- Leaks
- Loose or damaged parts
- Worn or damaged belts
- Any change in engine appearance.
- Odor of fuel

Engine Operation Report

The engine **must** be maintained in top mechanical condition if the operator is to get optimum satisfaction from its use. The maintenance department needs daily running reports from the operator to make necessary adjustments in the time allocated. The daily running report also helps to make provisions for more extensive maintenance work as the reports indicate the necessity.

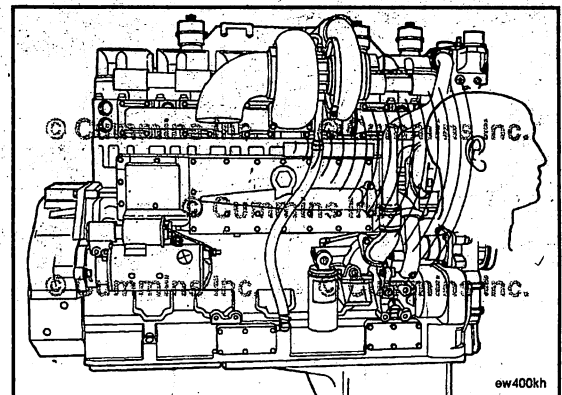
Comparison and intelligent interpretation of the daily report, along with a practical follow-up action, will eliminate most failures and emergency repairs.

Report to the maintenance department any of the following conditions:

- Low lubricating oil pressure
- Low power
- Power increases or engine surge
- Erratic or no accelerator control or response
- Any warning lights flashing or staying on
- Abnormal water or oil temperature
- Unusual engine noise
- Excessive smoke
- Excessive use of coolant, fuel, or lubricating oil
- Any fuel, coolant, or lubricating oil leaks
- Loose or damaged parts
- Worn or damaged belts

Unusual Engine Noise

During daily maintenance checks, listen for any unusual engine noise that can indicate that service is required.

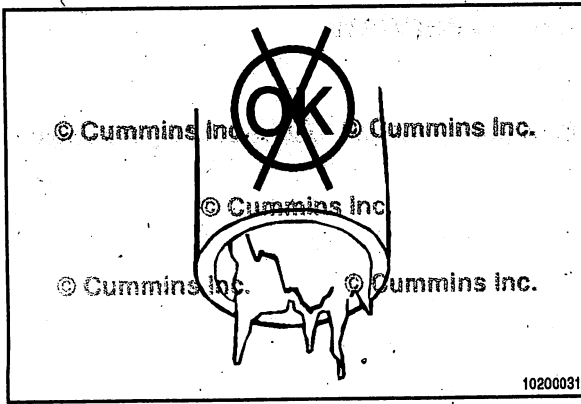




Crankcase Breather Tube Maintenance Check

Inspect the breather tube for sludge, debris, or ice in the tube.

Inspect the tube more frequently in icy conditions.



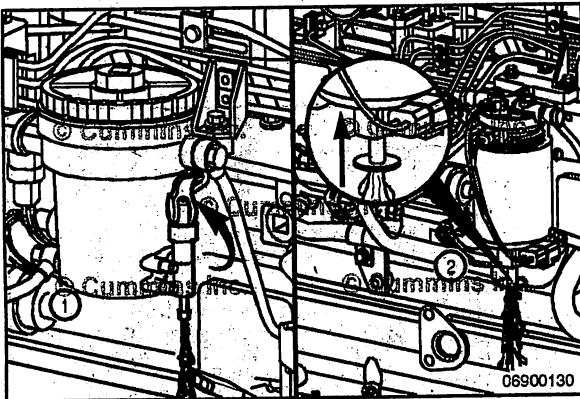
Fuel-Water Separator Drain



Drain the water-fuel separator into a container and dispose of in accordance with local environmental regulations.

Cummins Inc. requires a fuel-water separator or fuel filter be installed in the fuel supply system.

Drain the water and sediment from the separator daily.

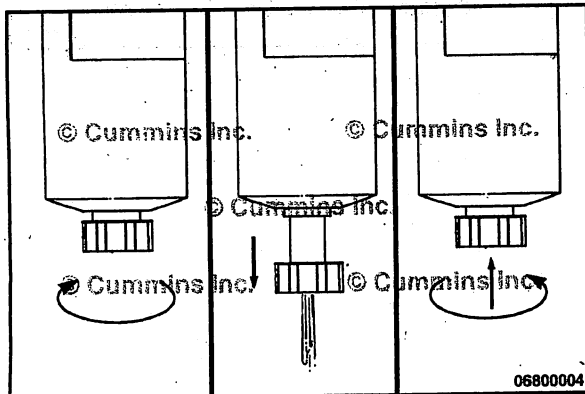


Canister Type

Shut off the engine.

Pull up on the drain valve lever until fluid drains out of the drain tube. Drain the filter sump until clear fuel is visible.

Push up on the drain valve until fluid drains out of the drain tube.



Spin-on Type

Shut off the engine.

Use your hand to open the drain valve. Turn the valve **counterclockwise** approximately $3\frac{1}{2}$ turns until the valve drops down 25.4mm [1 in] and draining occurs.

Drain the filter sump until clear fuel is visible.



When closing the drain valve, do not overtighten the valve. Overtightening can damage the threads.

To close the valve, lift the valve and turn **clockwise** until it is hand-tight.

Lubricating Oil Level Maintenance Check

▲ CAUTION ▲

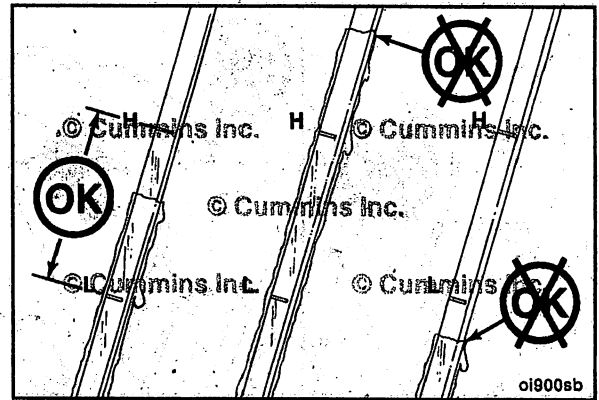
Never operate the engine with oil level below the L (low) mark or above the H (high) mark. Poor engine performance or engine damage can occur.

The engine must be level when checking the oil level to make sure the measurement is correct.

Shut off the engine for an accurate reading.

Wait at least 15 minutes after shutting off the engine to check the oil level. This allows time for the oil to drain into the oil pan.

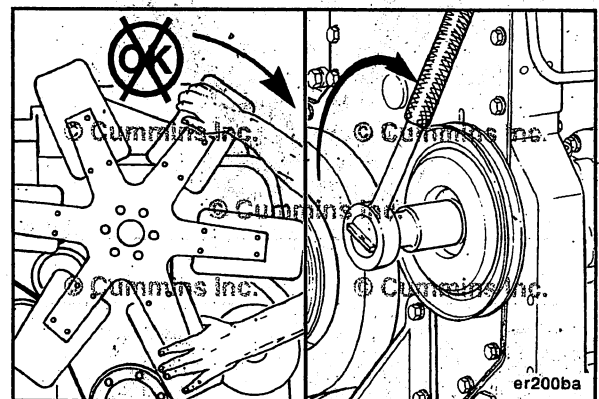
For additional lubricating oil recommendations and oil pan capacity information, refer to Maintenance Specifications (Section V).



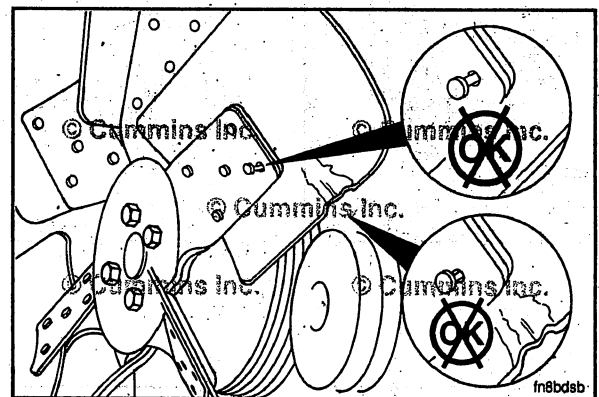
Fan, Cooling Inspect for Reuse

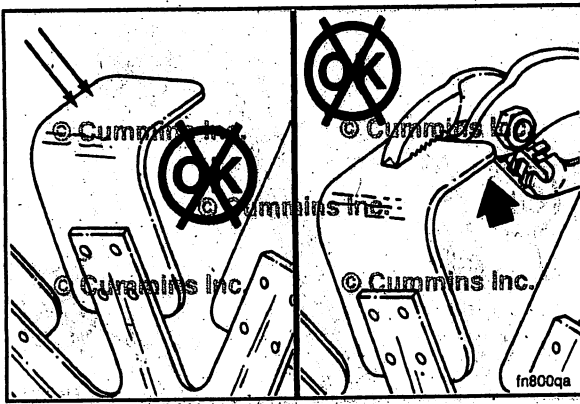
▲ WARNING ▲

Do not rotate the engine by pulling or prying on the fan. The fan blade(s) can be damaged and cause the fan to fail and cause personal injury or property damage. Use the accessory drive shaft or the crankshaft barring tool to rotate the crankshaft.

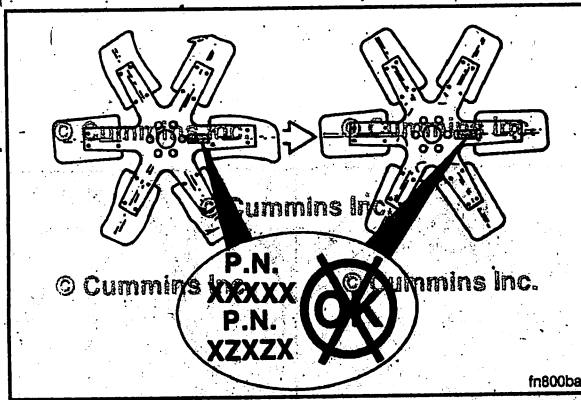


A visual inspection of the cooling fan is required daily. Check for cracks, loose rivets, and bent or loose blades. Check the fan to make sure it is securely mounted. Tighten the capscrews, if necessary.



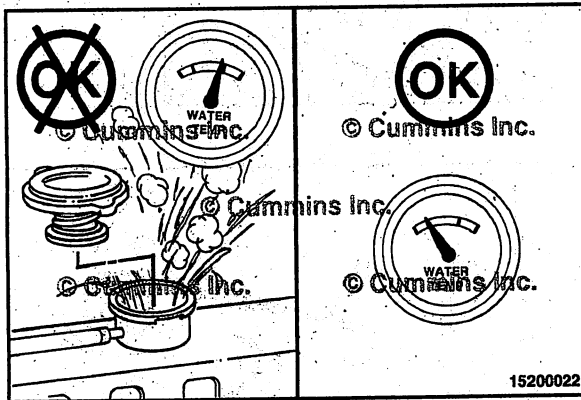


▲ WARNING ▲
Do not straighten a bent fan blade or continue to use a damaged fan. A bent or damaged fan blade can fail during operation and cause personal injury or property damage.



Replace original equipment fan that is damaged with a fan of the identical part number. Cummins Inc. must approve any other fan changes to be covered under warranty.

Refer to the vehicle or equipment manufacturer's specifications for capscrew torque.

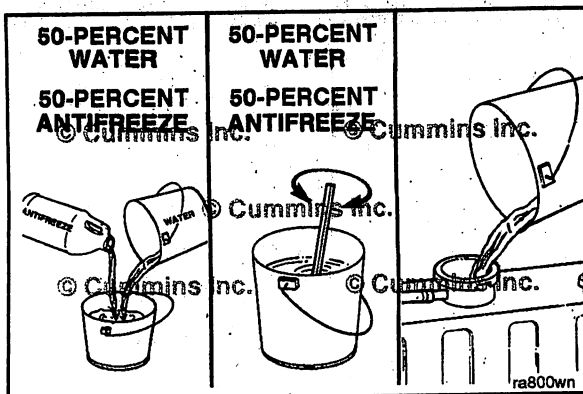


Coolant Level Maintenance Check

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

▲ CAUTION ▲
Never use a sealing additive to stop leaks in the cooling system. This can result in cooling system plugging and inadequate coolant flow, causing the engine to overheat.

The coolant level must be checked daily.



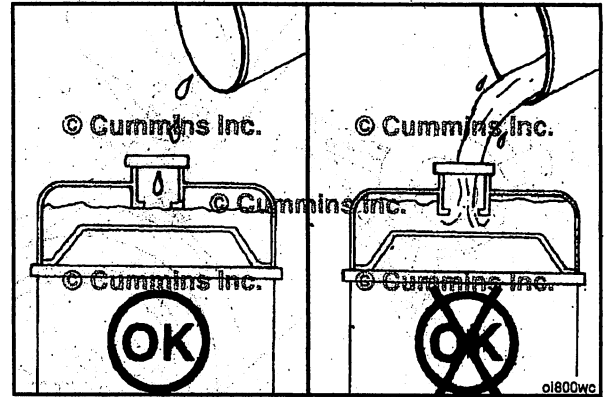
▲ CAUTION ▲
Do not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool to below 50°C [120°F] before adding coolant.

Make up coolant added to the engine must be mixed with the correct proportions of antifreeze, supplemental coolant additive, and water to avoid engine damage.

Coolant recommendations and specification details on correct mixing of coolant can be found in Maintenance Specifications (Section V).

Fill the cooling system with coolant to the bottom of the fill neck in the radiator fill or expansion tank.

NOTE: Some radiators have two fill necks, both of which must be filled when the cooling system is drained.



Drive Belts

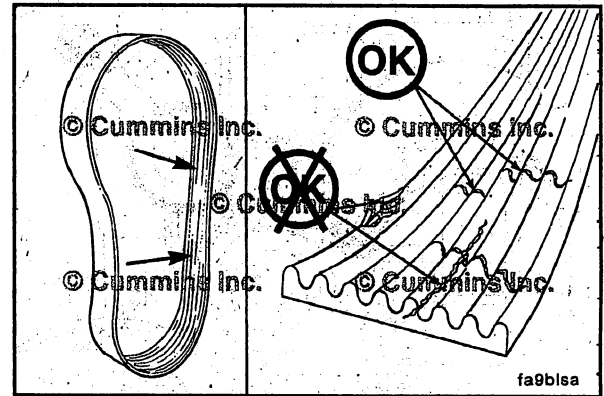
Maintenance Check

Poly-Vee Belt

Inspect the belts daily. Check the belt for intersecting cracks. Traverse (across the belt width) cracks are acceptable. Longitudinal (direction of belt length) cracks that intersect with transverse cracks are **not** acceptable. Replace the belt if it is frayed or has pieces of material missing. Refer to Section A for belt adjustment and replacement procedures.

Belt damage can be caused by:

- Incorrect tension
- Incorrect size or length
- Pulley misalignment
- Incorrect installation
- Severe operating environment
- Oil or grease on the side of belts.



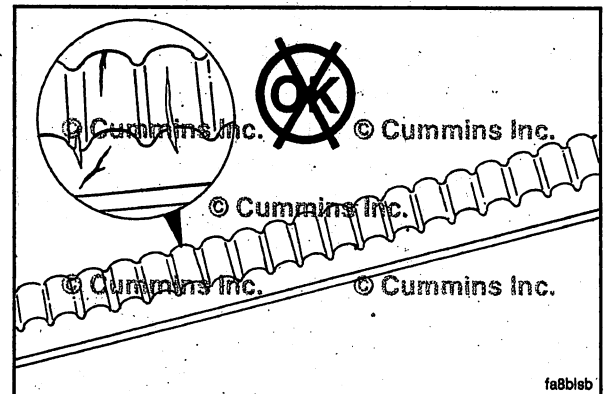
Cogged Belt

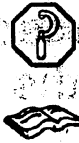
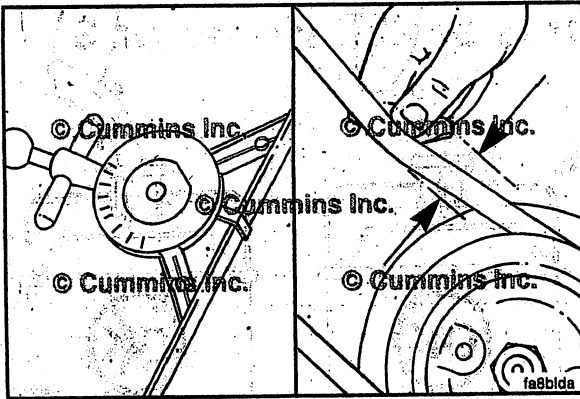
Inspect the belts daily. Replace the belts if they are cracked, frayed, or have chunks of material missing. Small cracks are acceptable.

Adjust the belts that have a glazed or shiny surface, which indicates belt slippage. Correctly installed and tensioned belts will show even pulley and belt wear. Refer to Section A for belt adjustment and replacement procedures.

Belt damage can be caused by:

- Incorrect tension
- Incorrect size or length
- Pulley misalignment
- Incorrect installation
- Severe operating environment
- Oil or grease on the belts

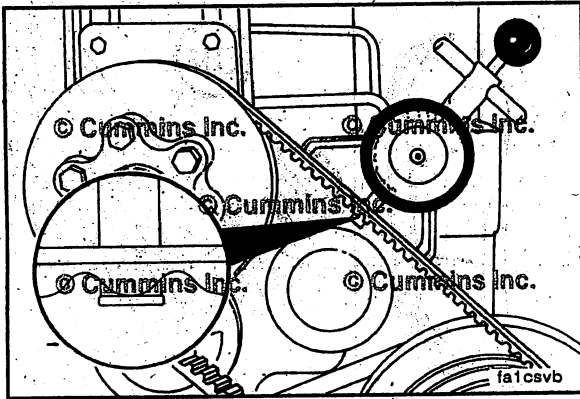




Measure the belt tension in the center span of the pulleys. Refer to the Belt Tension Chart in Section V for the correct gauge and tension value for the belt width used.

An alternate method (deflection method) can be used to check belt tension by applying 110 N [25 lbf] force between the pulleys on v-belts. If the deflection is more than one belt thickness per foot of pulley center distance, the belt tension must be adjusted.

Refer to Section A for adjustment procedures.



For cogged belts, make sure that the belt tension gauge is positioned so that the center tensioning leg is placed directly over the high point (hump) of a cog. Other positioning will result in incorrect measurement.

Section 4 - Maintenance Procedures at 250 Hours or 3 Months

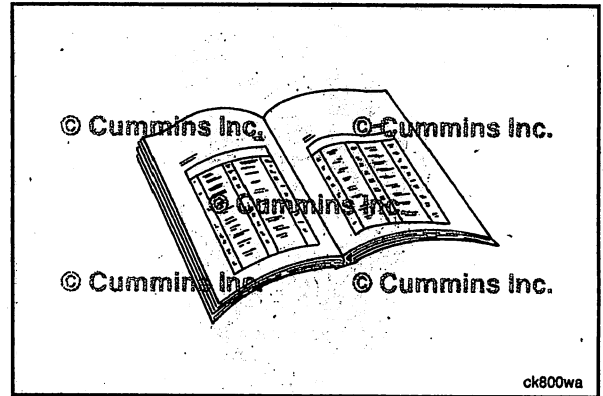
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Preparatory Steps.....	4-1

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Overhead Set Preparatory Steps

- Remove the rocker lever cover. Refer to Procedure 003-011 (Rocker Lever Cover) in Section A.



Adjust

Rotate the crankshaft in the normal direction (clockwise).

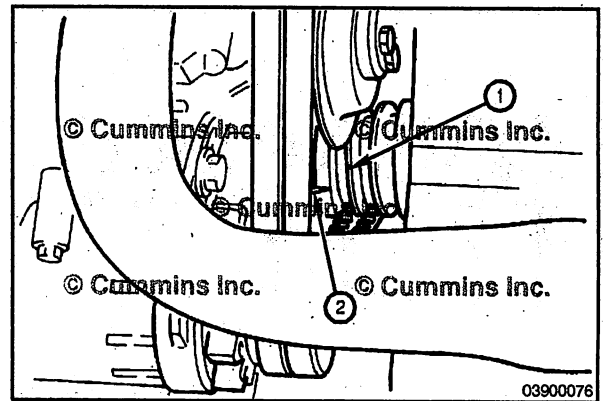
Check the movement of the intake valve number 4 cylinder.

The number 4 cylinder intake valve will start to open when the number 1 cylinder comes near the compression top dead center (TDC).

Rotate the number 1 cylinder into compression top dead center (TDC) position.

Align the "TOP" engraved mark on the crankshaft pulley (1) with the pointer (2).

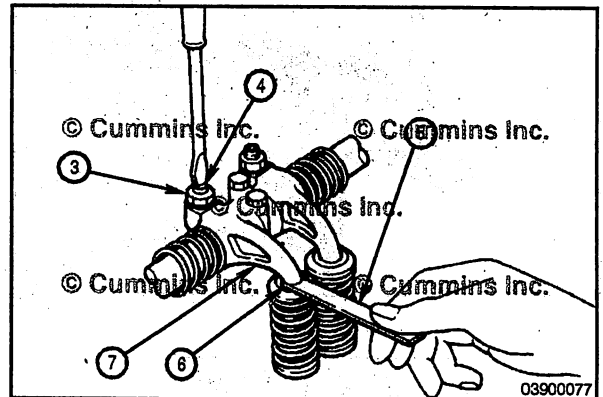
The engraved mark on the crankshaft pulley will read "1.4 TOP".



Loosen the locknut (3) on the adjustment screw (4).

Insert the feeler gauge (5) between the valve stem (6) and the rocker arm (7).

Adjust the clearance with the adjustment screw until slight drag is felt on the feeler gauge.

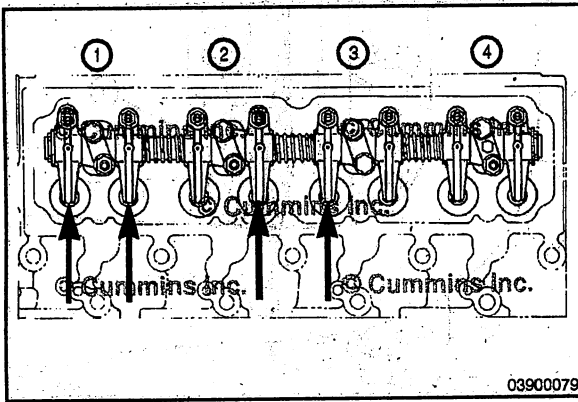
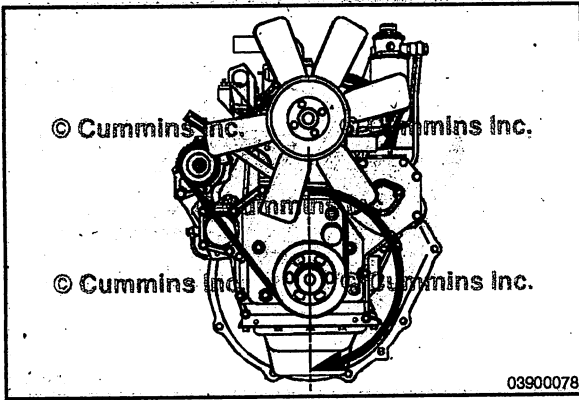


Valve Clearance (Engine Hot or Cold)	
Intake Valve	Exhaust Valve
0.35 mm [0.014 in]	0.50 mm [0.020 in]

Section 4 - Maintenance Procedures at 250 Hours or 3 Months

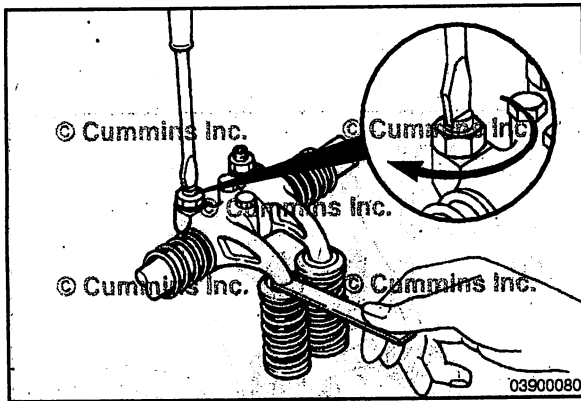
Adjust intake and exhaust clearances in the following firing order by rotating the crankshaft 180 degrees clockwise (1-2-4-3 firing order) or use the following procedure to adjust in two locations:

1. Number 1 cylinder at top dead center (TDC)
2. Rotate 360 degrees.



Adjust the valve clearance for the intake valves number 1 and number 3.

Adjust the valve clearance for the exhaust valves number 1 and number 2.



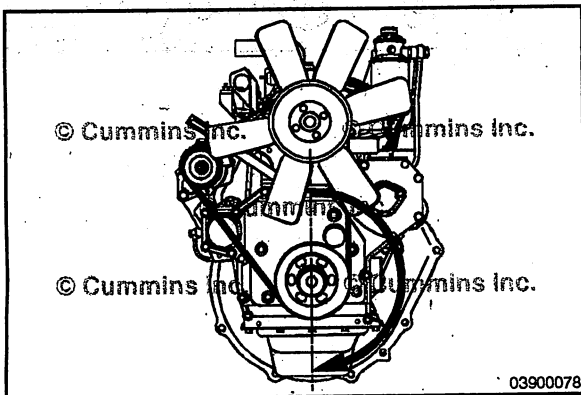
Tighten the locknut to secure the adjustment screw.

Locknut Torque Value		
N•m		ft-lb
39	MIN	29
49	MAX	36

Rotate the crankshaft in the normal direction one revolution.

Adjust the valve clearance for the intake valves number 2 and number 4.

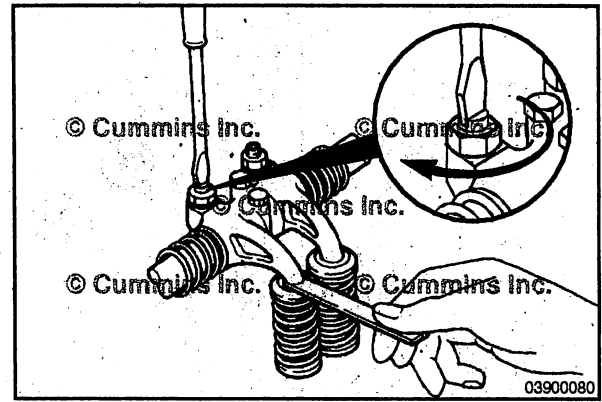
Adjust the valve clearance for the exhaust valves number 3 and number 4.



Tighten the locknut to secure the adjustment screw.

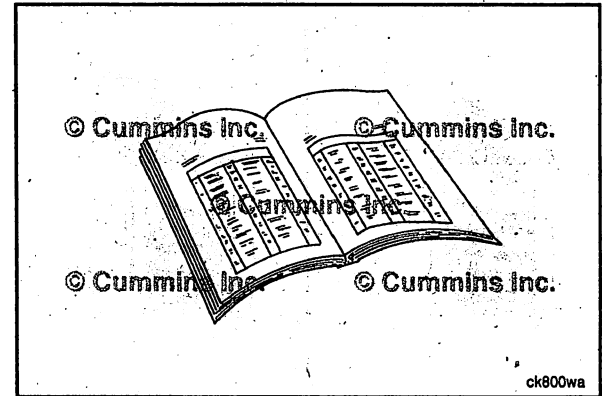


Locknut Torque Value		
N·m		ft-lb
39	MIN	29
49	MAX	36



Finishing Steps

- Install the rocker lever cover. Refer to Procedure 003-011 (Rocker Lever Cover) in Section A.



Lubricating Oil and Filters Drain



WARNING

To reduce the possibility of personal injury, avoid direct contact of hot oil with your skin.



WARNING

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

NOTE: Use a container that will hold at least 7.5 liters [1.98 gal] when draining the lubricating oil.

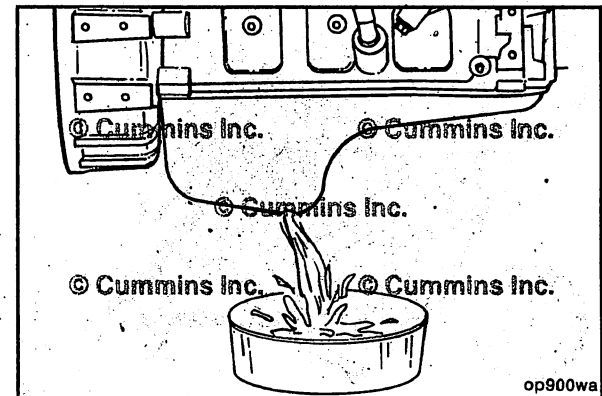
Operate the engine until the coolant temperature reaches 60°C [140°F].

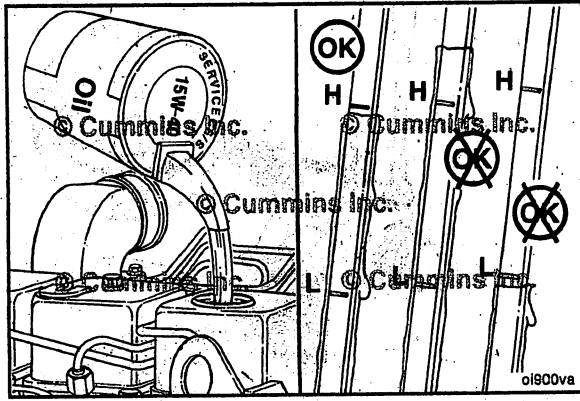
Shut off the engine.

Drain the oil immediately to make sure all the oil and suspended contaminants are removed from the engine.

Remove the oil pan drain plug.

Drain the lubricating oil from the engine.

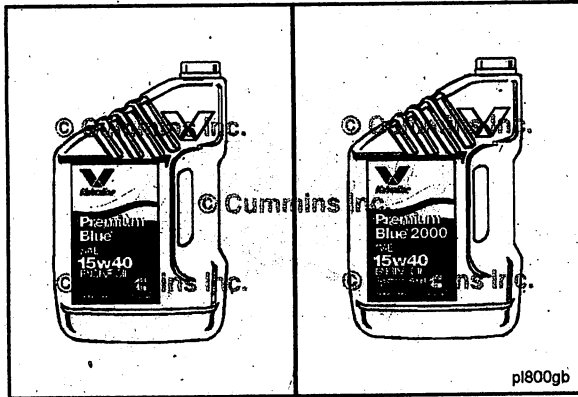




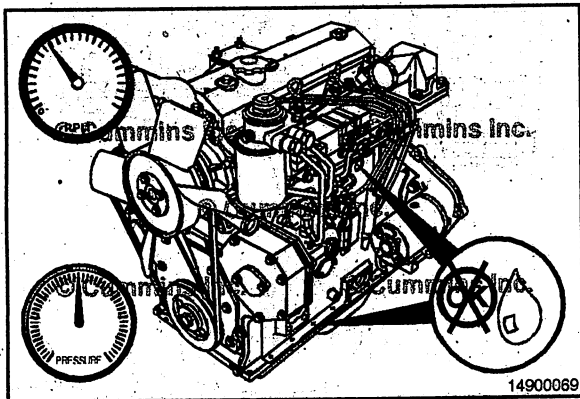
Fill

Fill the engine with clean lubricating engine oil to the proper level on the oil dipstick. Refer to Procedure 018-017 (Lubricating Oil System Specifications) in Section V for engine oil capacity.

Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3 for proper oil level.



Use high-quality 15W-40 multicosity oil, such as Cummins Premium Blue®, or equivalent, in Cummins® engines. Choose the correct oil for your operating climate as outlined in the Cummins Engine Oil Recommendations, Bulletin 3810340. Refer to Procedure 205-001 (Service Literature) in Section L for ordering information.

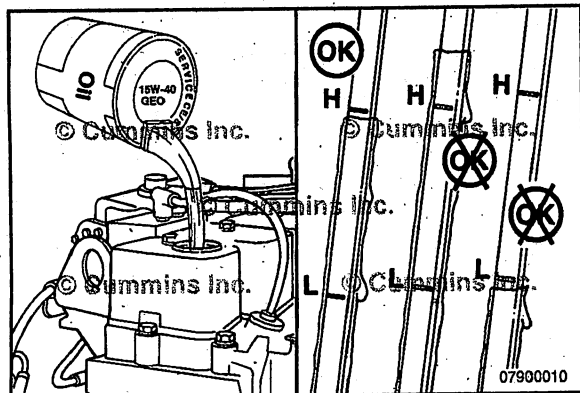


CAUTION

Engine oil pressure must be indicated on the gauge within 15 seconds after starting. If oil pressure is not registered within 15 seconds, shut off the engine immediately to reduce the possibility of engine damage.

Confirm the correct oil level in the oil pan.

Idle the engine to inspect for leaks at the drain plug.



Shut off the engine. Wait approximately 5 minutes to let the oil drain from the upper parts of the engine.

Check the oil level again.

Add lubricating oil, as necessary, to bring the oil level to the "H" (high) mark on the oil dipstick.

Lubricating Oil Filter (Spin-On)

Preparatory Steps

▲WARNING▲

When using a steam cleaner, wear safety glasses or a face shield, as well as protective clothing. Hot steam can cause serious personal injury.

▲WARNING▲

To reduce the possibility of personal injury, avoid direct contact of hot oil with your skin.

▲WARNING▲

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

- Steam clean the area around the filter head.
- Drain the lubricating oil from engine. Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 4.

Remove

Remove the lubricating oil filter from the lubricating oil filter head with a filter wrench, Part Number 3400157, or equivalent.

Clean the gasket surface on the lubricating oil filter head.

Install

▲CAUTION▲

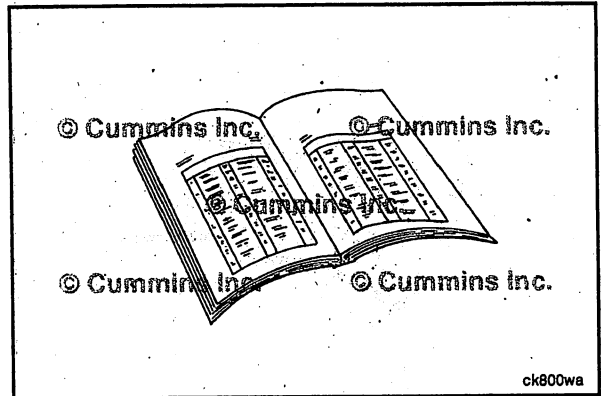
Mechanical overtightening of the lubricating oil filter can distort the threads or damage the lubricating oil filter seal.

Use clean engine lubricating oil to coat the gasket surface of the lubricating oil filter.

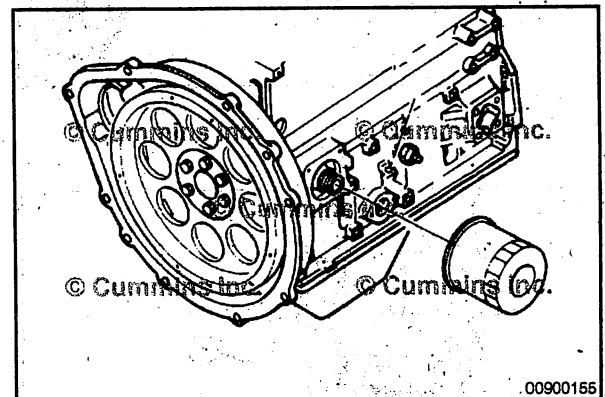
Fill the lubricating oil filter with clean engine lubricating oil.

Install the lubricating oil filter head onto the lubricating oil filter head. Tighten the lubricating oil filter until the gasket contacts the filter head surface.

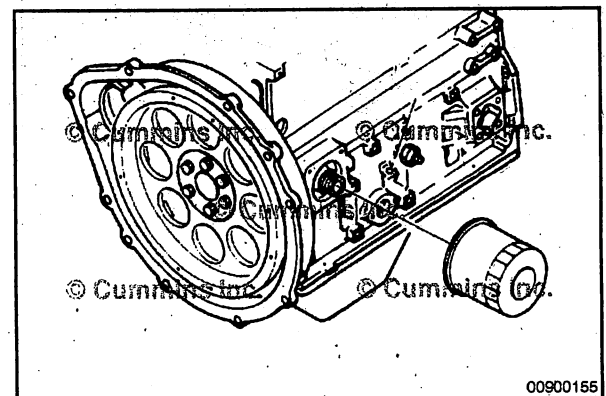
Use the filter wrench, Part Number 3400157, or equivalent, to tighten the lubricating oil filter. Refer to the manufacturer's tightening instructions.



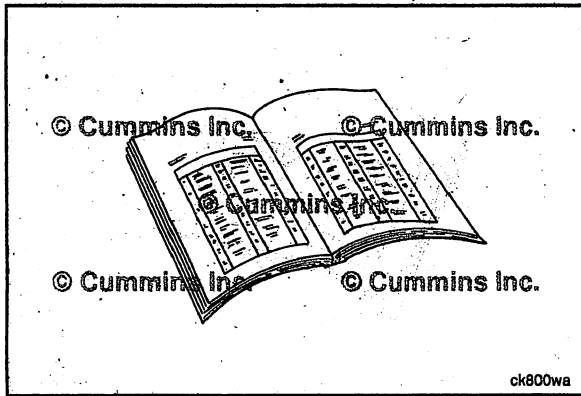
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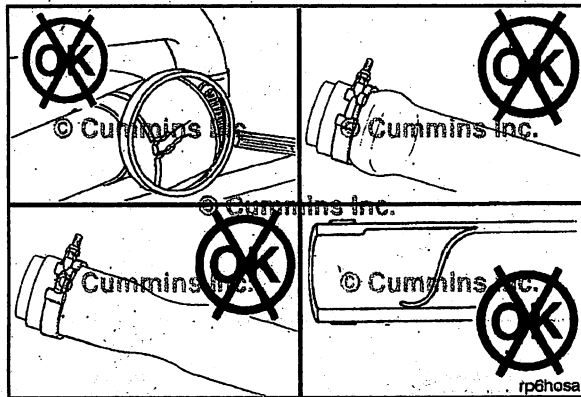
Finishing Steps



If oil pressure is not registered within 15 seconds with engine running, shut off the engine immediately to reduce the possibility of engine damage.



- Fill the engine with lubricating oil. Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 4.
- Operate the engine and check for oil leaks. Confirm the correct oil level in the lubricating oil pan.



Air Intake Piping Maintenance Check

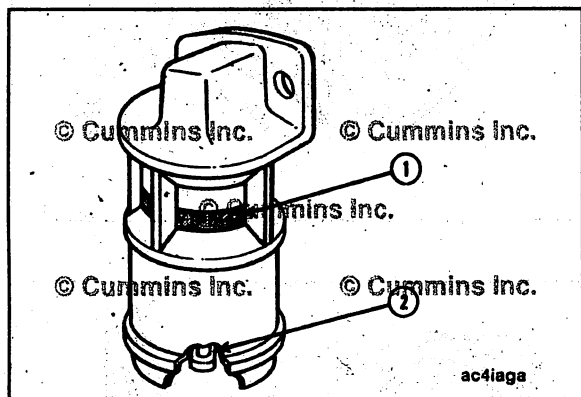


Visually inspect the intake piping daily for wear points and damage to piping, loose clamps, or punctures that can damage the engine.

Replace damaged pipes, and tighten loose clamps, as necessary, to prevent the air system from leaking.

Torque Value: 8 N•m [72 in-lb]

Check for corrosion under the clamps and hoses of the intake system piping. Corrosion can allow corrosive products and dirt to enter the intake system. Disassemble and clean, as required.



Air Cleaner Restriction Maintenance Check

Mechanical Indicator

NOTE: Do not remove the felt washer from the indicator. The felt washer absorbs moisture.

A mechanical restriction indicator is available to indicate excessive air restriction through a dry-type air cleaner. This instrument can be mounted in the air cleaner outlet or on the instrument panel. The red flag (1) in the window gradually rises as the cartridge loads with dirt. After changing or replacing the cartridge, reset the indicator by pushing the reset button (2).

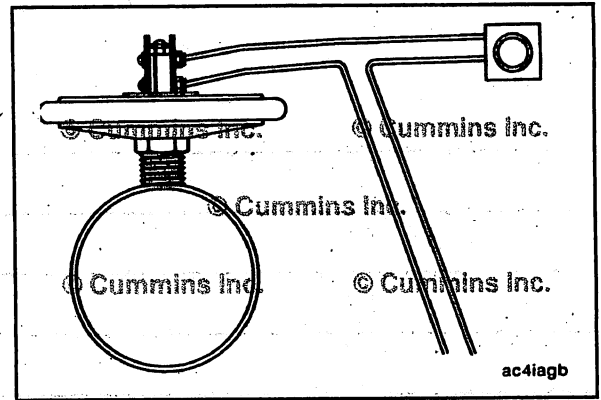
Restriction or vacuum indicators need to be installed as close as possible to the turbocharger air inlet in order to obtain a true indication of restrictions.



Never operate the engine without an air cleaner. Intake air must be filtered to prevent dirt and debris from entering the engine and causing premature wear.

Vacuum Indicator

Vacuum switches actuate a warning light on the instrument panel when the air restriction becomes excessive.



Section 5 - Maintenance Procedures at 500 Hours or 6 Months

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Section 5 - Maintenance Procedures at 500 Hours or 6 Months

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- 5-100 Fuel System

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Fuel Injection Pumps, In-Line

Prime

The low-pressure fuel supply lines are vented by pumping the hand lever on the fuel lift pump.

⚠ WARNING ⚠

Do not vent the fuel system on a hot engine; this can cause fuel to spill onto a hot exhaust manifold, which can cause a fire.

⚠ WARNING ⚠

Fuel is flammable. Keep all cigarettes, flames, pilot lights, arcing equipment, and switches out of the work area and areas sharing ventilation to reduce the possibility of severe personal injury or death when working on the fuel system.

Vent the high-pressure fuel lines. Loosen the fitting at the number 1 injector.

Place the fuel control in the run position.

Crank the engine so air can vent from the fuel lines.

Tighten the fitting.

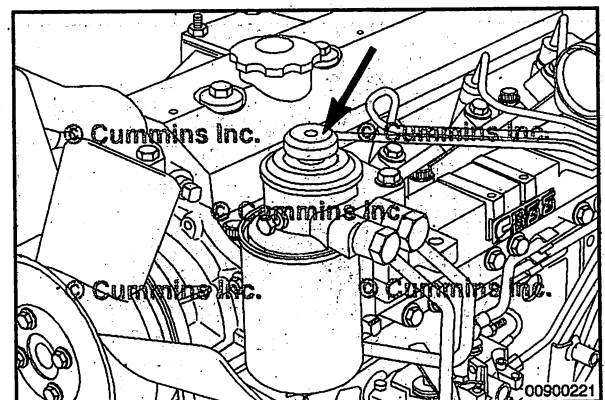
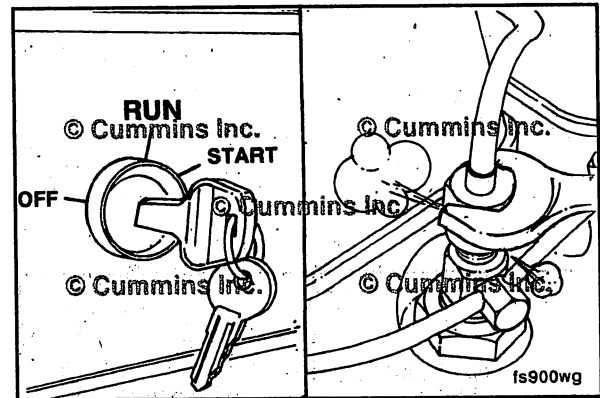
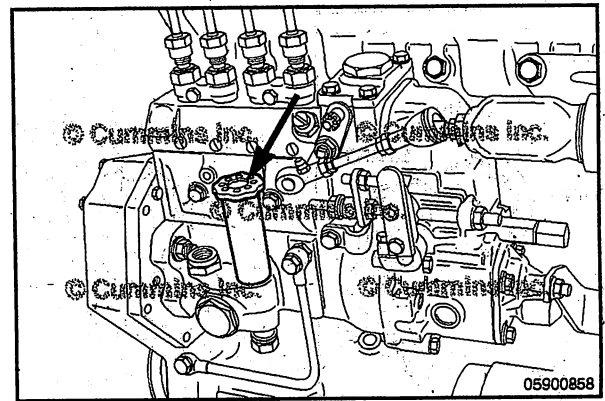
Torque Value: 30 N•m [22 ft-lb]

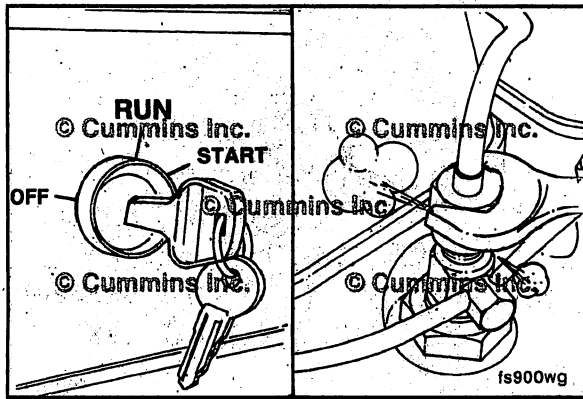
Continue this process through the remaining three injectors until the engine runs smoothly.

Fuel Injection Pump, Rotary

Prime

If the fuel lines are opened, the low-pressure lines can be vented by pumping the hand lever on the fuel filter head.





▲ WARNING ▲

Do not vent the fuel system on a hot engine; this can cause fuel to spill onto a hot exhaust manifold, which can cause a fire.

▲ WARNING ▲

Fuel is flammable. Keep all cigarettes, flames, pilot lights, arcing equipment, and switches out of the work area and areas sharing ventilation to reduce the possibility of severe personal injury or death when working on the fuel system.

Vent the high-pressure fuel lines.

Loosen the fitting at the number 1 injector.

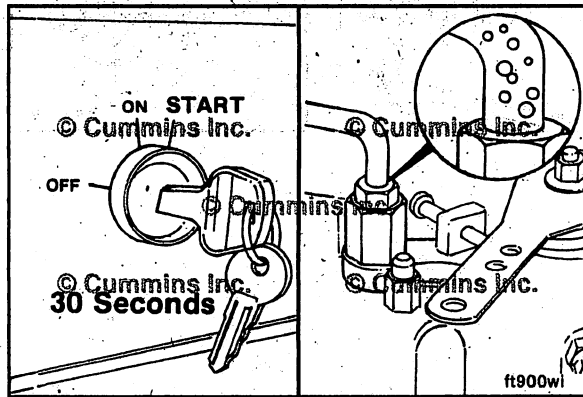
Place the fuel control in the run position.

Crank the engine so air can vent from the fuel lines.

Tighten the fitting.

Torque Value: 30 N•m [22 ft-lb]

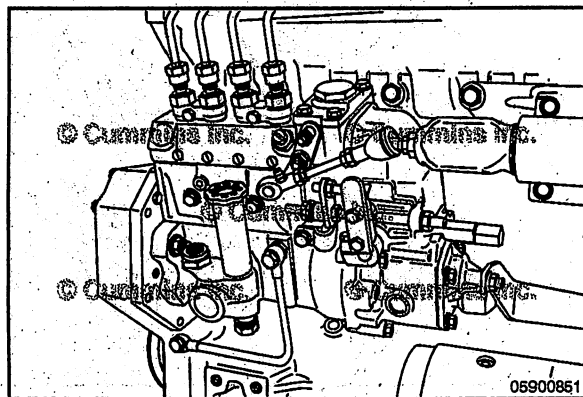
Continue this process through the remaining three injectors until the engine runs smoothly.



Air in Fuel

General Information

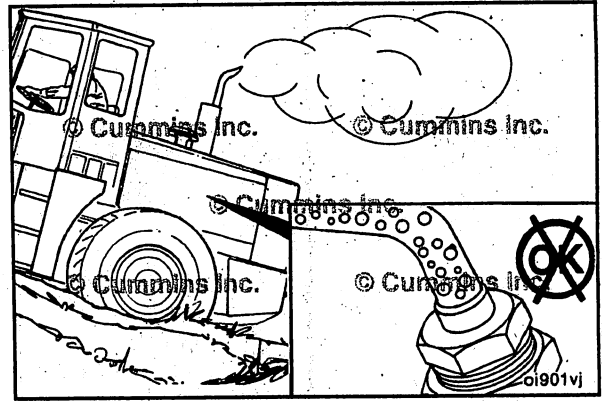
Air will enter the fuel system if the fuel supply lines, fuel filter(s), fuel injection pump, high-pressure fuel lines, or injectors are removed.



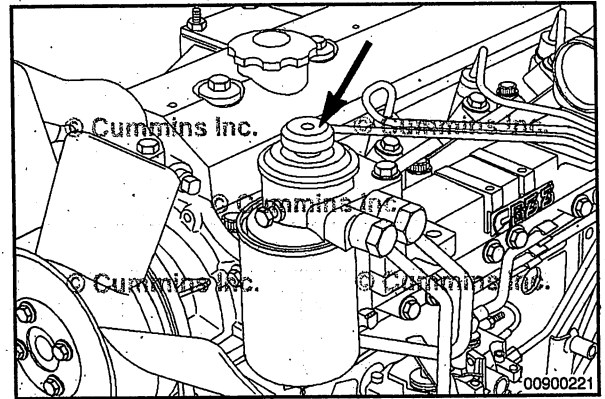
Engines using a fuel transfer pump to provide positive pressure through the fuel filter and fuel supply line to the fuel injection pump, the loose connections or defective seals result in a fuel leak and not as an air leak.

Air in the fuel system will cause the following engine problems:

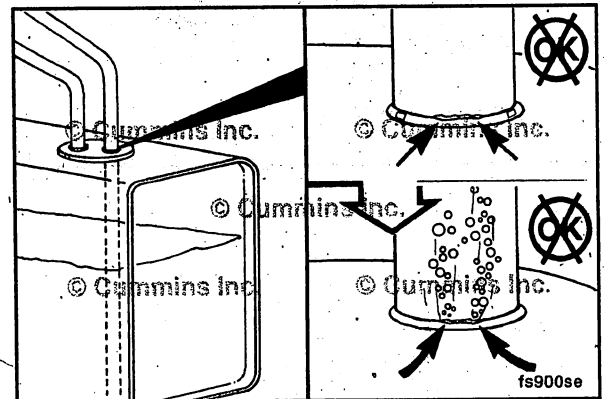
- Hard to start
- Run rough
- Misfire
- Fuel knock.

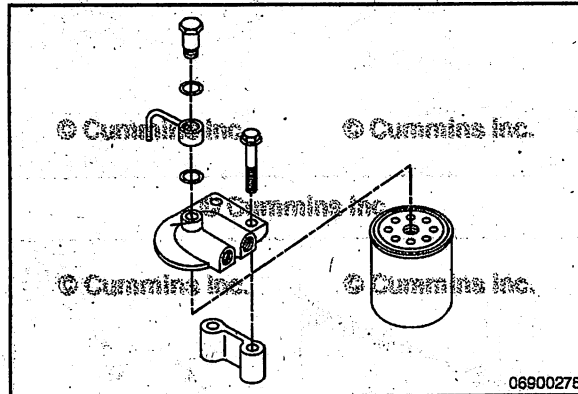
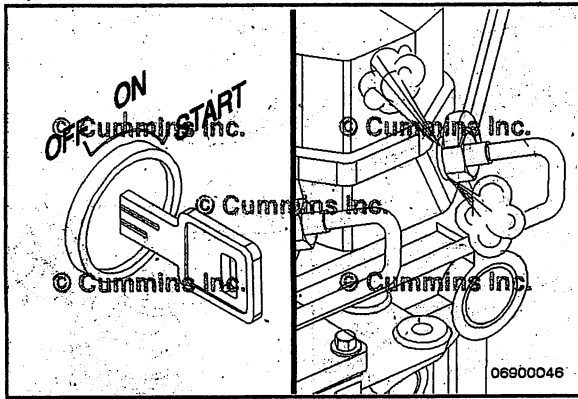


For faster air purge, small amounts of air can be vented from the pump by operation of the hand primer on the fuel filter head, if equipped, or by cranking the engine.



A source that is often overlooked for air to enter the fuel system is between the inlet of the prefilter and the suction tube in the tank. Fuel tanks that have the outlet fitting at the top have a suction tube that extends to the bottom of the tank. Cracks or pin holes in the weld that join the tube to the fitting can let air enter the fuel system.





Vent



Do not vent the fuel system on a hot engine; this can cause fuel to spill onto a hot exhaust manifold, which can cause a fire.



The pressure of the fuel in the line is sufficient to penetrate the skin and cause serious personal injury. Wear gloves and protective clothing.

NOTE: This step applies to mechanical engines only.

Check for air in the high-pressure lines by loosening the fittings at the head of the injector. Crank the engine to allow entrapped air to vent from the line. Tighten the fittings.

Torque Value: 20 N•m [177 in-lb]

Operate the engine, and vent one line at a time until the engine runs smoothly.



Fuel Filter (Spin-On Type)

Remove



In-line Fuel Injection Pumps



Fuel is flammable. Keep all cigarettes, flames, pilot lights, arcing equipment, and switches out of the work area and areas sharing ventilation to reduce the possibility of severe personal injury or death when working on the fuel system.

NOTE: Close any OEM fuel valves (if equipped) to prevent fuel from draining or siphoning.

Clean the area around the fuel filter head.

Remove the fuel filter.

Clean the gasket surface on the fuel filter head.

Rotary Fuel Injection Pumps



Fuel is flammable. Keep all cigarettes, flames, pilot lights, arcing equipment, and switches out of the work area and areas sharing ventilation to reduce the possibility of severe personal injury or death when working on the fuel system.



Drain the fuel-water separator into a container, and dispose of contents in accordance with local environmental regulations.

NOTE: Close any OEM fuel valves (if equipped) to prevent fuel from draining or siphoning.

Clean the area around the fuel filter head.

Drain the fuel-water separator at the bottom of the fuel filter. Refer to Procedure 006-043 (Fuel Filter (Spin-on) in Section 3.

Remove the fuel filter.

Clean the gasket surface on the fuel filter head.

Remove the o-ring.

Install

In-line Fuel Injection Pumps



Fuel is flammable. Keep all cigarettes, flames, pilot lights, arcing equipment, and switches out of the work area and areas sharing ventilation to reduce the possibility of severe personal injury or death when working on the fuel system.

Fill the new fuel filter with clean fuel, and lubricate the gasket with clean lubricating engine oil.



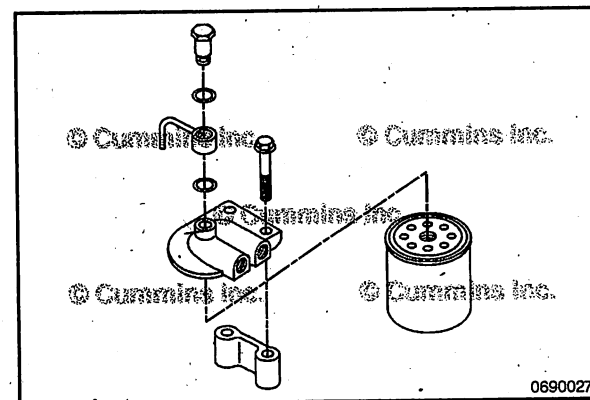
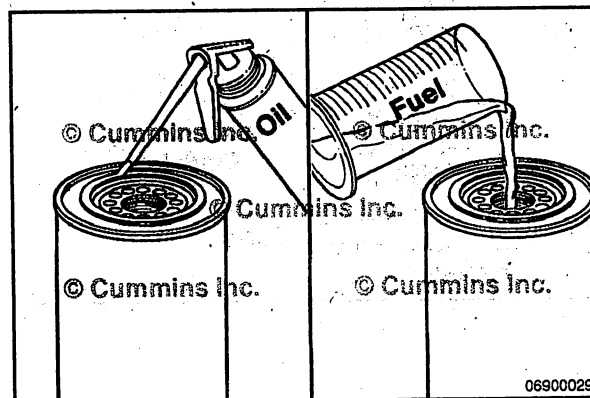
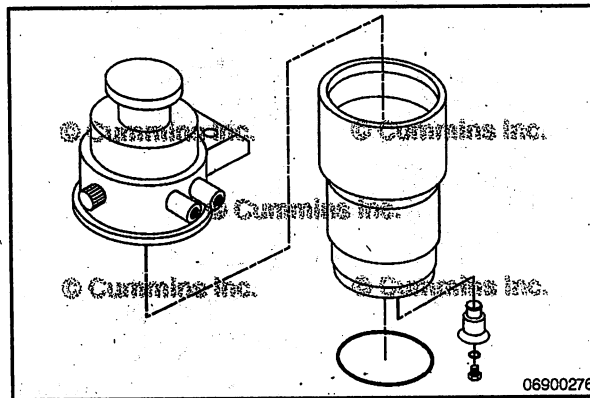
Fuel is flammable. Keep all cigarettes, flames, pilot lights, arcing equipment, and switches out of the work area and areas sharing ventilation to reduce the possibility of severe personal injury or death when working on the fuel system.

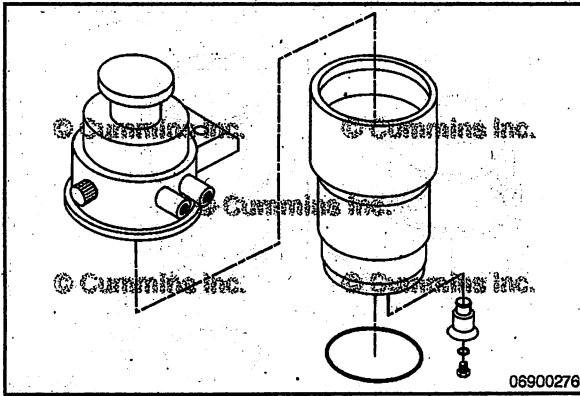


Mechanical overtightening will distort the threads on the filter element seal or filter can.

Install the fuel filter as specified by the filter manufacturer.

Start the engine and check for fuel leaks around the fuel filter.





Rotary Fuel Injection Pumps

⚠ WARNING ⚠

Fuel is flammable. Keep all cigarettes, flames, pilot lights, arcing equipment, and switches out of the work area and areas sharing ventilation to reduce the possibility of severe personal injury or death when working on the fuel system.



⚠ CAUTION ⚠

Mechanical overtightening will distort the threads on the filter element seal or filter can.

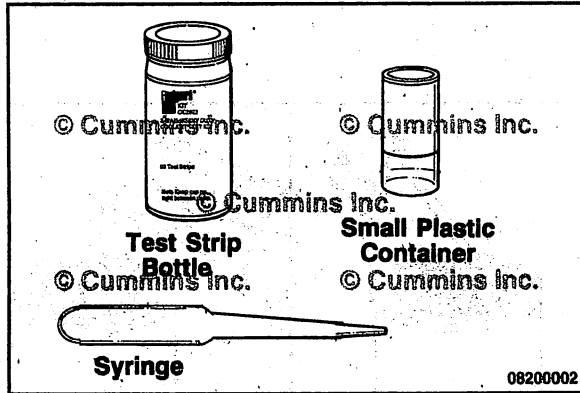
A fuel-water separator is used on the rotary style injection pumps.

Fill the fuel filter with clean fuel.

Install the o-ring.

Install the fuel filter as specified by the filter manufacturer.

Start the engine and check for fuel leaks around the fuel filter.



Supplemental Coolant Additive (SCA) and Antifreeze Concentration



Maintenance Check

Supplemental Coolant Additive (SCA)

Check the SCA concentration level:

- At least twice a year
- At every subsequent oil drain interval if the concentration is above 3 units
- Whenever coolant is added to the cooling system between filter changes.

Use Fleetguard® coolant test kit, Part No. CC2602, to check the SCA concentration level. Instructions are included with the test kit. Refer to Coolant Recommendations and Specifications in Maintenance Specifications (Section V) for the correct SCA and antifreeze level.

Antifreeze

⚠ CAUTION ⚠

Overconcentration of antifreeze or use of high-silicate antifreeze can damage the engine.

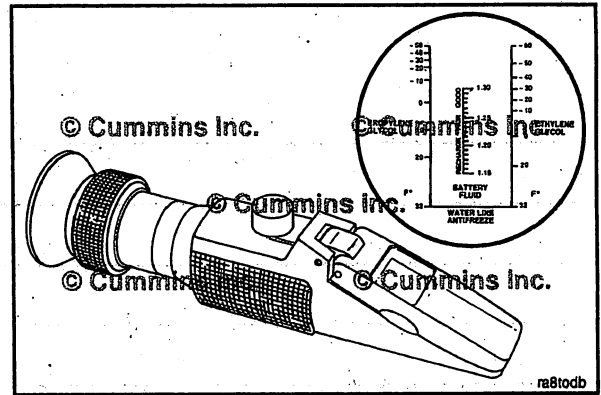
Check the antifreeze concentration. Use a mixture of 50-percent water and 50-percent ethylene glycol or propylene glycol-based antifreeze to protect the engine to -32°C [-26°F] year-around.

The Fleetguard® refractometer, Part Number C2800, provides a reliable, easy-to-read, and accurate measurement of freezing point protection and glycol (antifreeze) concentration.

Antifreeze is essential in every climate.

Antifreeze broadens the operating temperature range by lowering the coolant freezing point and by raising its boiling point.

The corrosion inhibitors also protect the cooling system components from corrosion and prolong component life.



Section 6 - Maintenance Procedures at 1000 Hours or 1 Year

Section Contents

	Page
Drive Belt, Cooling Fan	6-1
Measure.....	6-1



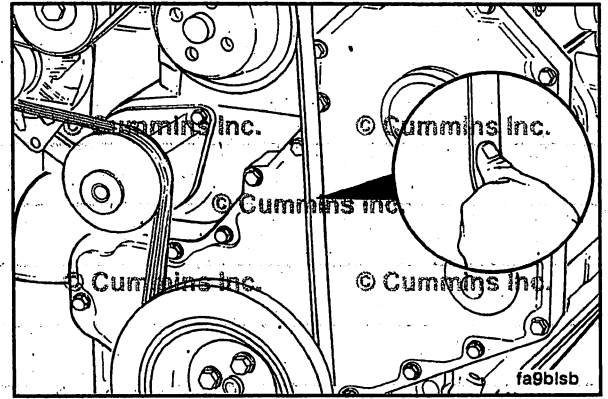
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Drive Belt, Cooling Fan Measure

Measure the belt tension in the center span of the pulleys.

Check the belt tension using a click-type belt tension gauge, Part Number 3822524, or equivalent, or a Burroughs gauge, Part Number ST-1138, or equivalent.

Fan Belt Deflection			
	N		lb
New Belts	324	MIN	73
	378	MAX	85
Used Belts	216	MIN	49
	270	MAX	61



Section 7 - Maintenance Procedures at 2000 Hours or 2 Years

Section Contents

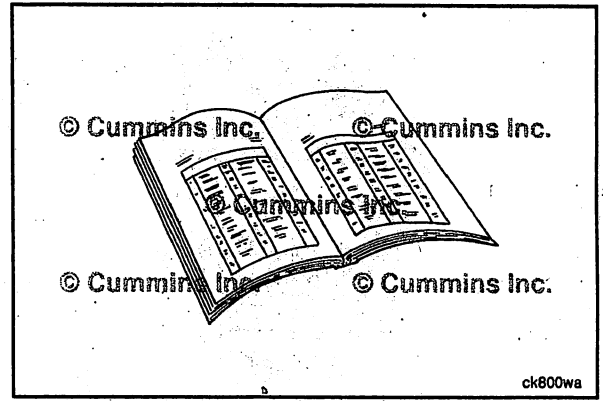
	Page
Cooling System	7-3
Drain	7-3
Fill	7-5
Flush	7-4
Overhead Set	7-1
Adjust	7-1
Finishing Steps	7-3
Preparatory Steps	7-1



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Overhead Set Preparatory Steps

- Remove the rocker lever cover. Refer to Procedure 003-011 (Rocker Lever Cover) in Section A.



Adjust

Rotate the crankshaft in the normal direction (clockwise).

Check the movement of the intake valve number 4 cylinder.

The number 4 cylinder intake valve will start to open when the number 1 cylinder comes near the compression top dead center (TDC).

Rotate the number 1 cylinder into compression top dead center (TDC) position.

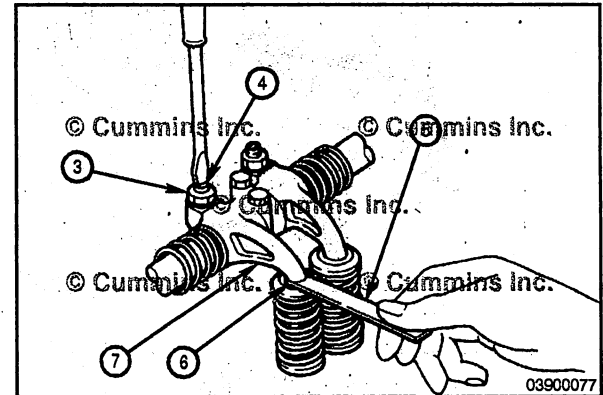
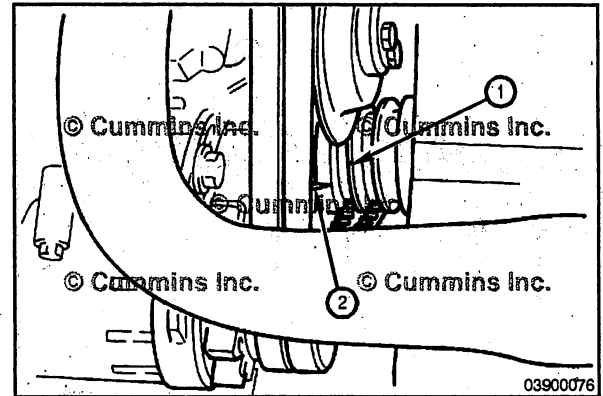
Align the "TOP" engraved mark on the crankshaft pulley (1) with the pointer (2).

The engraved mark on the crankshaft pulley will read "1.4 TOP".

Loosen the locknut (3) on the adjustment screw (4).

Insert the feeler gauge (5) between the valve stem (6) and the rocker arm (7).

Adjust the clearance with the adjustment screw until slight drag is felt on the feeler gauge.

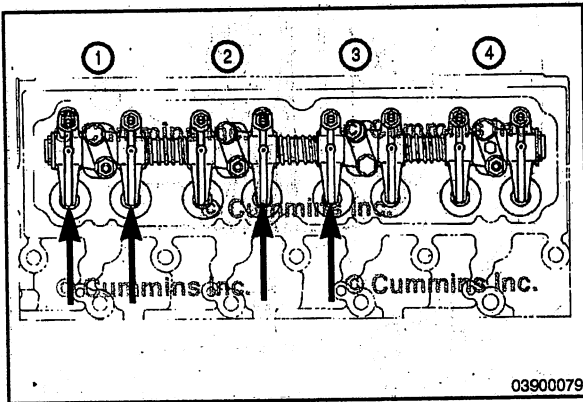
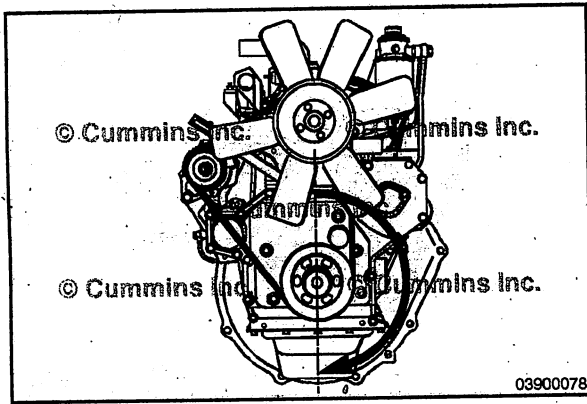


Valve Clearance (Engine Hot or Cold)	
Intake Valve	Exhaust Valve
0.35 mm [0.014 in]	0.50 mm [0.020 in]

Section 7 - Maintenance Procedures at 2000 Hours or 2 Years

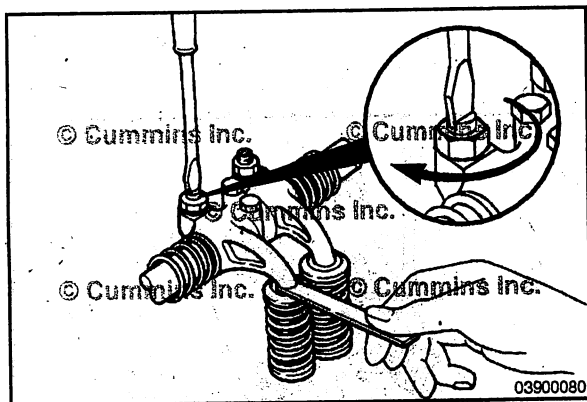
Adjust intake and exhaust clearances in the following firing order by rotating the crankshaft 180 degrees clockwise (1-2-4-3 firing order) or use the following procedure to adjust in two locations:

1. Number 1 cylinder at top dead center (TDC)
2. Rotate 360 degrees.



Adjust the valve clearance for the intake valves number 1 and number 3.

Adjust the valve clearance for the exhaust valves number 1 and number 2.



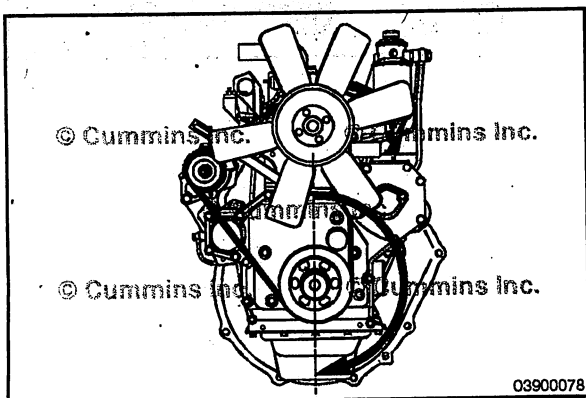
Tighten the locknut to secure the adjustment screw.

N•m	Locknut Torque Value	
	MIN	ft-lb
39	MIN	29
49	MAX	36

Rotate the crankshaft in the normal direction one revolution.

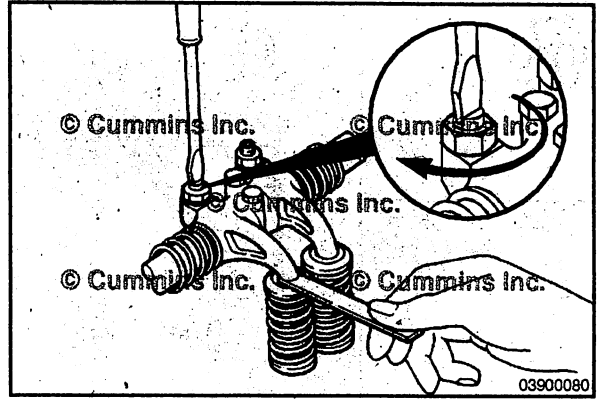
Adjust the valve clearance for the intake valves number 2 and number 4.

Adjust the valve clearance for the exhaust valves number 3 and number 4.



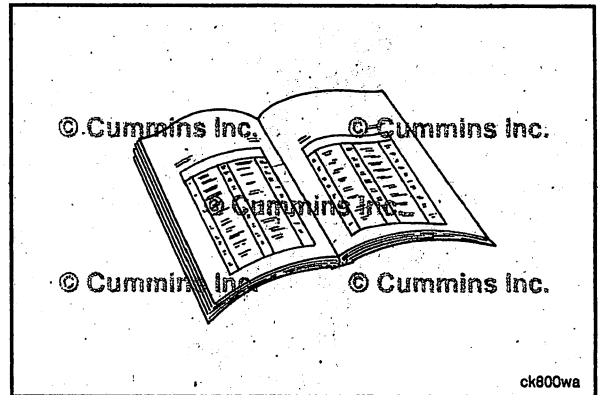
Tighten the locknut to secure the adjustment screw.

Locknut Torque Value		
N·m		ft-lb
39	MIN	29
49	MAX	36



Finishing Steps

- Install the rocker lever cover. Refer to Procedure 003-011 (Rocker Lever Cover) in Section A.



Cooling System

Drain



WARNING

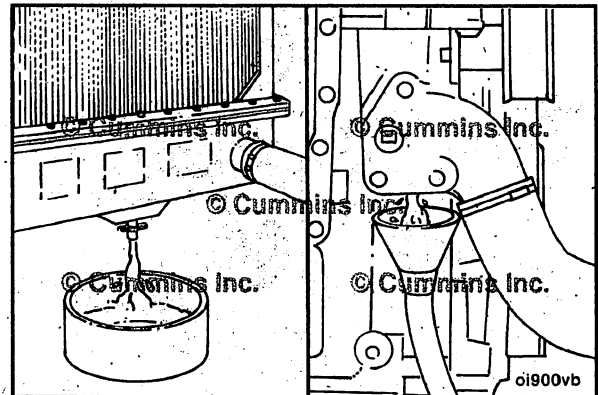
Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [120°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

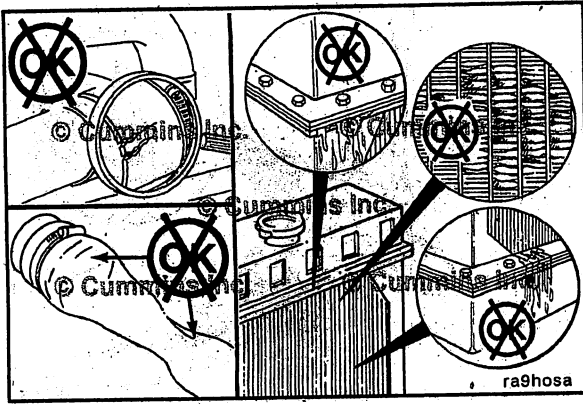


WARNING

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

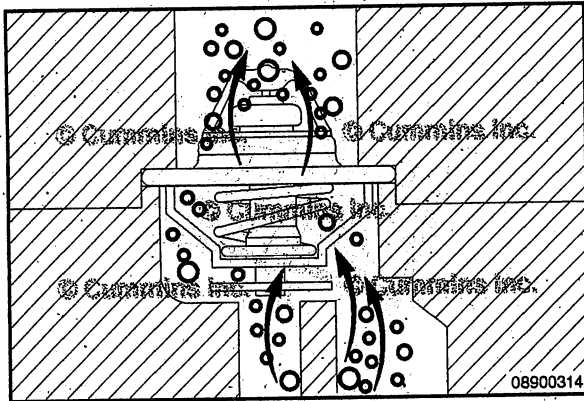
Drain the cooling system by opening the drain valve on the radiator and removing the plug in the bottom of the water inlet. A drain pan with a capacity of 20 liters [5 gal] will be adequate in most applications.





Check for damaged hoses and loose or damaged hose clamps. Replace, as necessary.

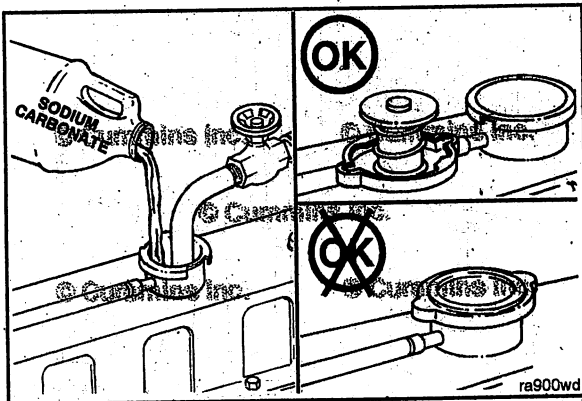
Check the radiator for leaks, damage, and buildup of dirt. Clean and repair, as necessary.



Flush

During filling, air must be vented from the engine coolant passages. The air vents through the "jiggle pin" openings to the top radiator hose and out the fill opening. Additional venting is provided for engine equipped with an aftercooler. Open the petcock during filling.

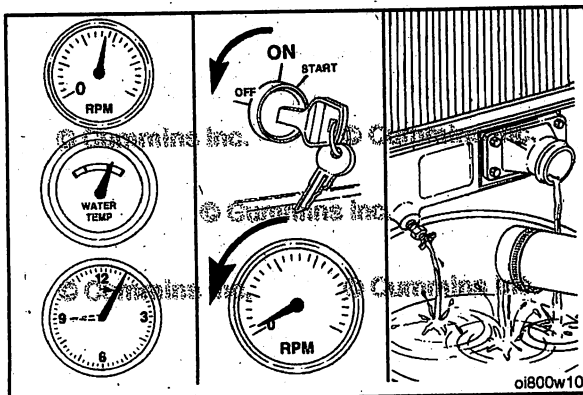
Adequate venting is provided for a fill rate of 10 liters/minute [2.6 gal/minute].



NOTE: Do not install the radiator cap. The engine must be operated without the cap for this process.

Fill the system with a mixture of sodium carbonate and water (or a commercially available equivalent).

Use 0.5 kg [1.0 lb] of sodium carbonate for every 23 liters [6 gal] of water.



▲ WARNING ▲

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

Operate the engine for 5 minutes with a coolant temperature above 82°C [180°F].

Shut the engine off, and drain the cooling system.

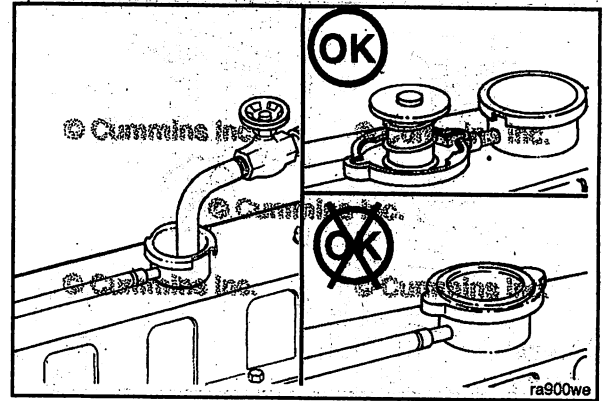
⚠CAUTION⚠

The cooling system must be filled properly to prevent air locks in the cooling passages. Failure to vent the cooling system properly, can cause damage to the cooling system.

Fill the cooling system with clean water.

Make sure to vent the engine and aftercooler (if equipped) for complete filling.

Do not install the radiator cap.



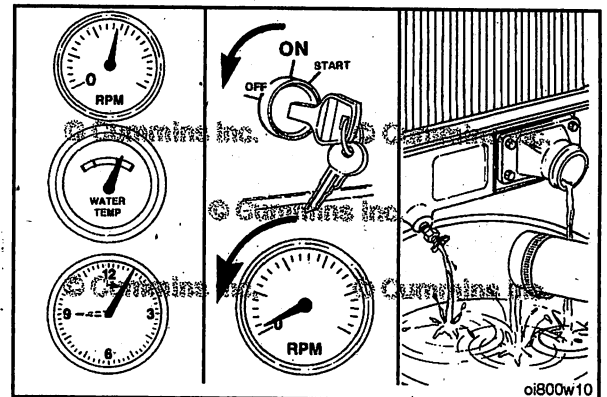
⚠WARNING⚠

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

Operate the engine for 5 minutes with the coolant temperature above 82°C [180°F].

Shut the engine off, and drain the cooling system.

If the water being drained is still dirty, the system must be flushed again until the water is clean.

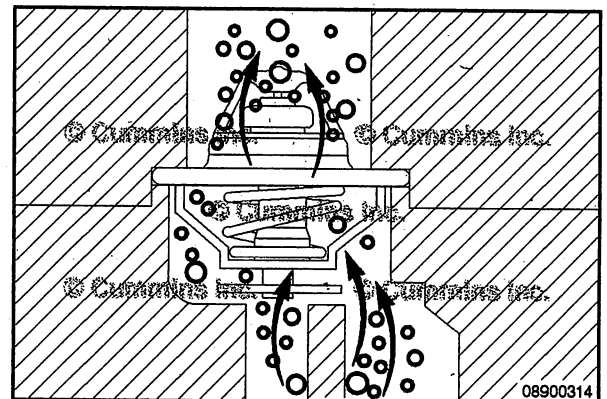


Fill

⚠CAUTION⚠

The cooling system must be filled properly to prevent air locks in the cooling passages. Failure to vent the cooling system properly, can cause damage to the cooling system.

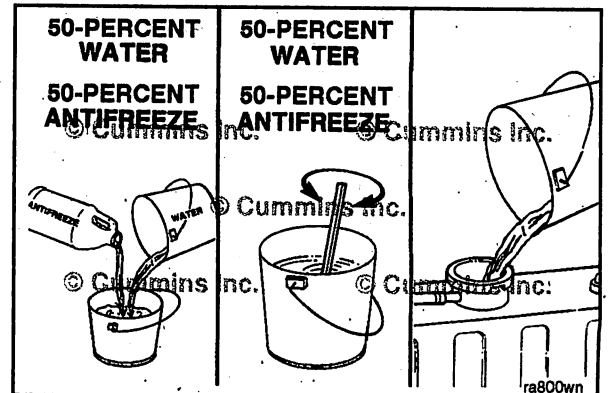
Adequate venting is provided for a fill rate of 10 liters/minute [2.6 gal/minute].

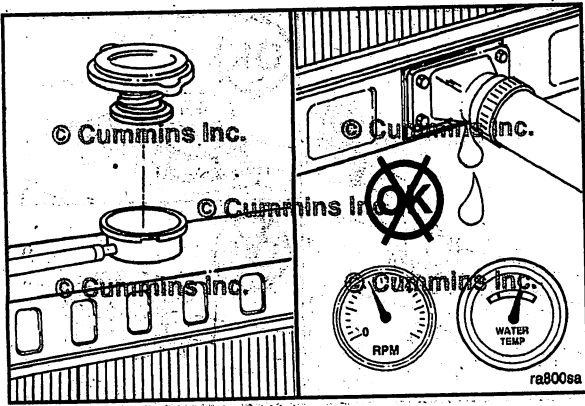


⚠CAUTION⚠

Do not use water alone for coolant. Damage from corrosion can severely damage the engine cooling system.

Use a mixture of 50-percent water and 50-percent ethylene glycol antifreeze to fill the cooling system. Refer to Procedure 018-018 (Coolant System Specification) in Section V for coolant capacity of the engine.





▲ WARNING ▲

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

Install the pressure cap. Operate the engine until it reaches a temperature of 82°C [180°F], and check for coolant leaks.

Check the coolant level again to make sure the system is full of coolant, or that the coolant level has risen to the hot level in the recovery container on the system, if equipped.

Section A - Adjustment, Repair, and Replacement

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Section A - Adjustment, Repair, and Replacement

Section A - Adjustment, Repair, and Replacement

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Engine Storage - Long Term

General Information

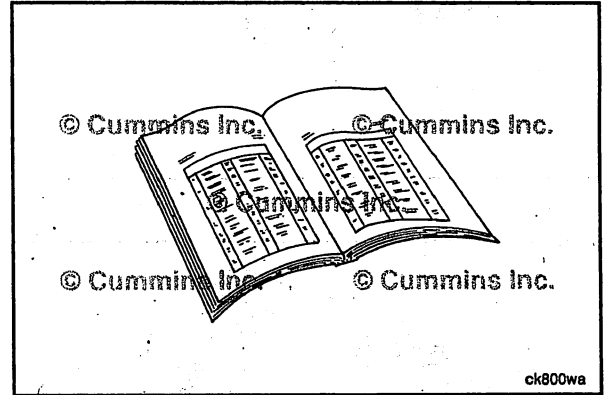
If the engine will be out of service longer than 6 months, take special precautions to prevent rust. Contact the nearest Cummins Authorized Repair Location for information concerning engine storage procedures.

Rocker Lever Cover

Preparatory Steps

Turbocharged Engines

- Remove the crankcase breather tube. Refer to Procedure 003-018 (Crankcase Breather Tube) in Section A.

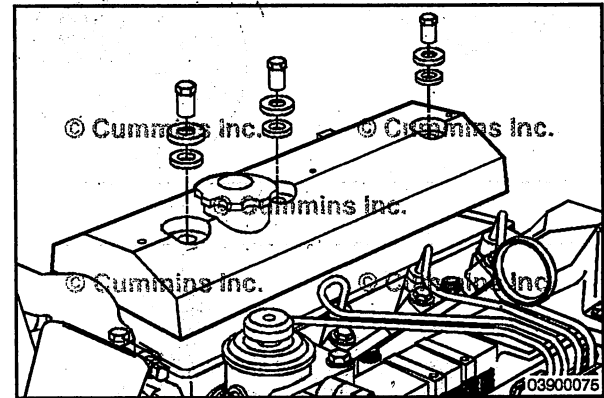


Remove

Naturally Aspirated Engines

Remove the three capscrews, isolator assemblies, o-rings, and rocker lever cover.

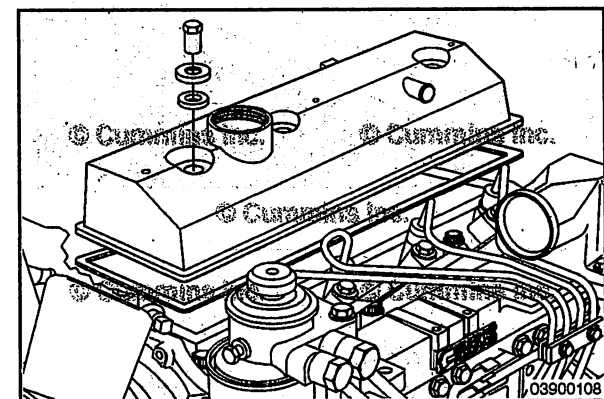
Remove the gasket. Discard the gasket.

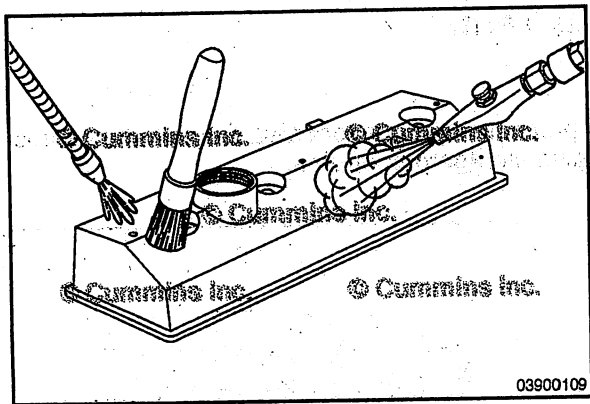


Turbocharged Engines

Remove the three locknuts, , isolator assemblies, o-rings, and rocker lever cover.

Remove the gasket. Discard the gasket.





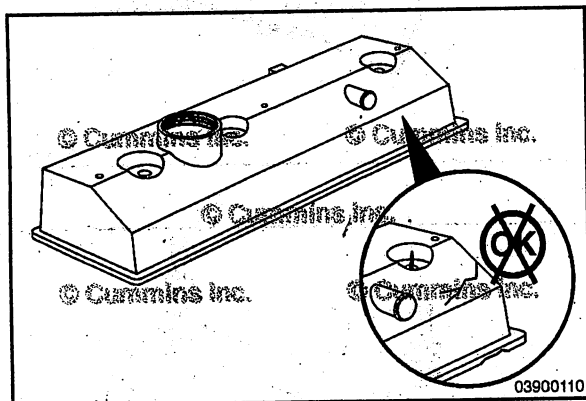
Clean and Inspect for Reuse

▲ WARNING ▲

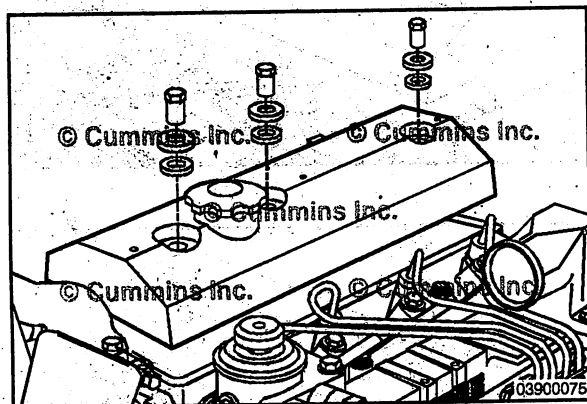
Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

Clean the rocker lever cover with a strong solution of detergent in hot water.

Dry the rocker lever cover with compressed air.



Inspect the rocker lever cover for cracks and other damage.



Install

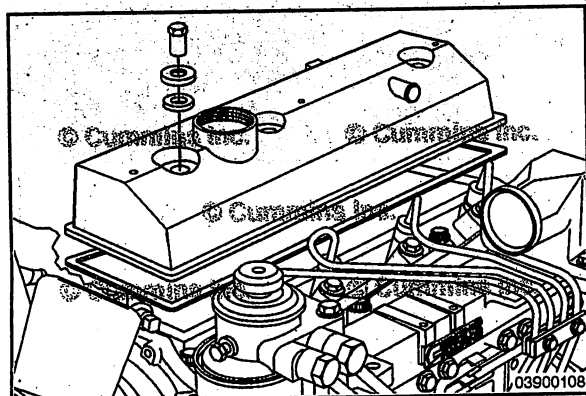
Naturally Aspirated Engines

Install the new gasket.

Install the rocker lever cover, o-rings, isolator assemblies, and three capscrews.

Tighten the capscrews.

Torque Value: 9 N•m [80 in-lb]



Turbocharged Engines

Install the new gasket.

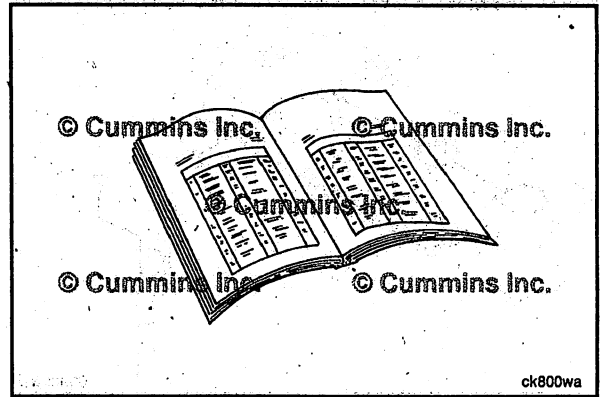
Install the rocker lever cover, o-rings, isolator assemblies, and locknuts.

Torque Value: 9 N•m [80 in-lb]

Finishing Steps

Turbocharged Engines

- Install the crankcase breather tube. Refer to Procedure 003-018 (Crankcase Breather Tube) in Section A.

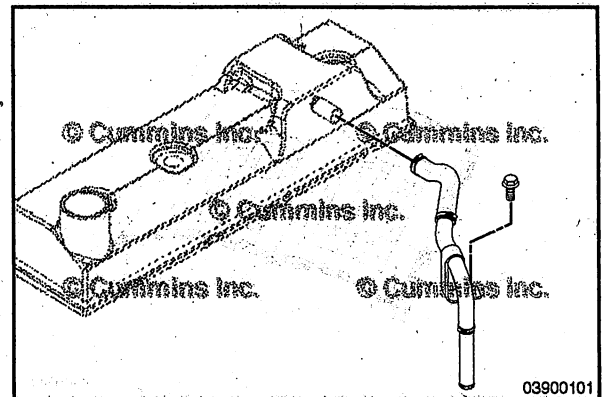


Crankcase Breather Tube

Remove

Turbocharged Engines

Remove the crankcase breather tube from the rocker lever cover.



Clean and Inspect for Reuse

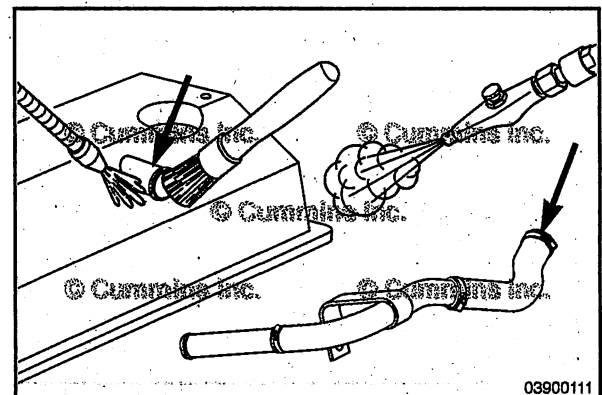
Turbocharged Engines



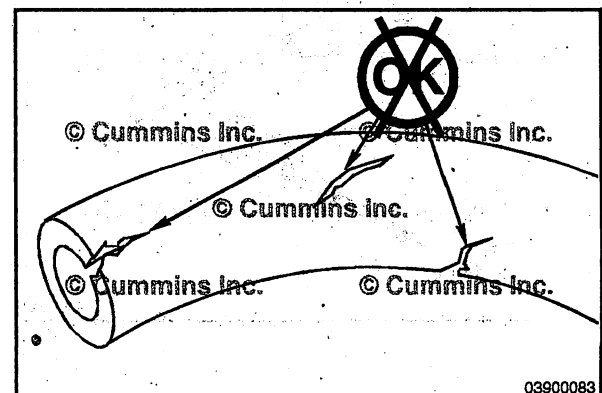
WARNING
Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

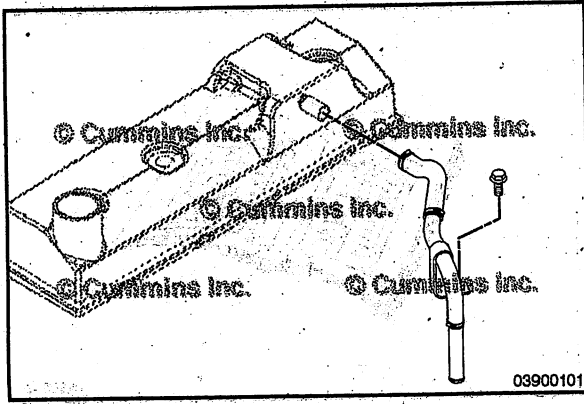
If the crankcase breather tube is blocked with obstructions or sludge buildup, the tube **must** be cleaned with a strong solution of detergent in hot water or replaced to prevent excessive crankcase pressure buildup.

Dry the crankcase breather tube with compressed air.



Inspect the crankcase breather tube for cracks, or other debris, that can obstruct the tube.

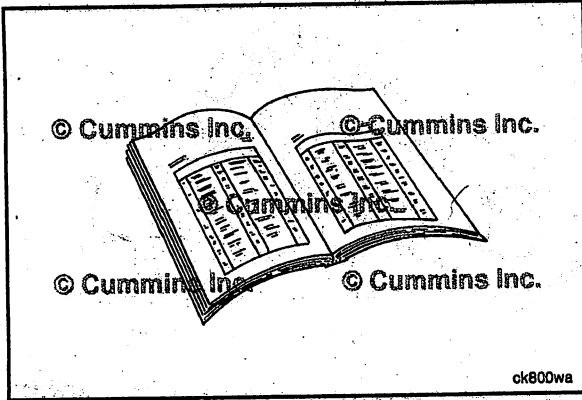




Install Turbocharged Engines

Install the crankcase breather tube onto the rocker lever cover.

Tighten the hose clamp and support bracket. Refer to a Cummins Authorized Repair Location for torque specifications.



Fuel Shutoff Valve Preparatory Steps



In-line Fuel Injection Pumps

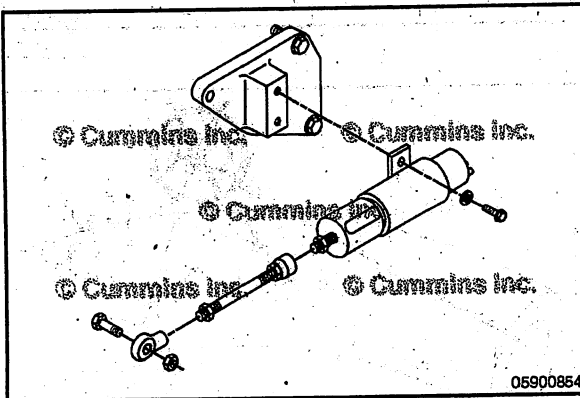
▲ WARNING ▲

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.

▲ WARNING ▲

Acid is extremely dangerous and can damage the machinery and can also cause serious burns. Always provide a tank of strong soda water as a neutralizing agent when servicing the batteries. Wear goggles and protective clothing to reduce the possibility of serious personal injury.

- Disconnect battery cables. Refer to Procedure 013-009 (Battery Cables and Connections) in Section A.
- Clean the area surrounding the fuel shutoff valve.
- Disconnect the electrical wiring from the fuel shutoff valve.



Remove In-line Fuel Injection Pumps

Remove two mounting capscrews and washers from the mounting bracket.

Remove the nut and capscrew from the end of the control rod and fuel injection stop lever.

Remove the fuel shutoff valve.

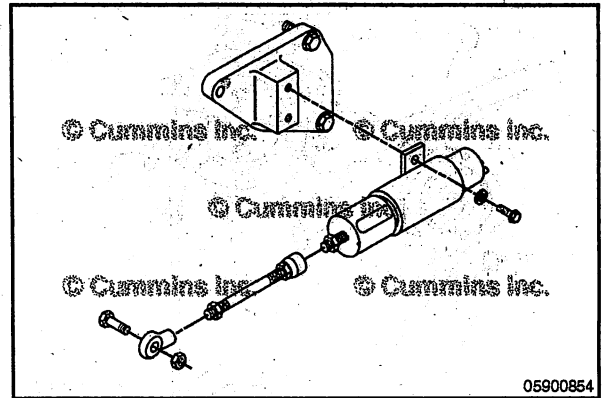
Install

In-line Fuel Injection Pumps

Install the fuel shutoff valve.

Install the nut and capscrew in the end of the control rod and fuel injection stop lever.

Install two mounting capscrews and washers onto the mounting bracket.



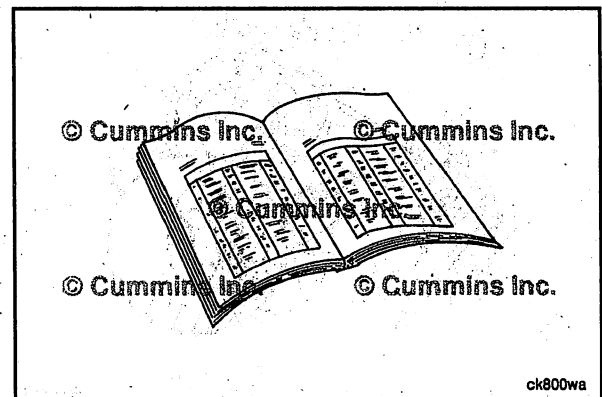
Finishing Steps

In-line Fuel Injection Pumps



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.

- Connect the electrical wiring on the fuel shutoff valve.
- Connect battery cables. Refer to Procedure 013-009 (Battery Cables and Connections) in Section A.



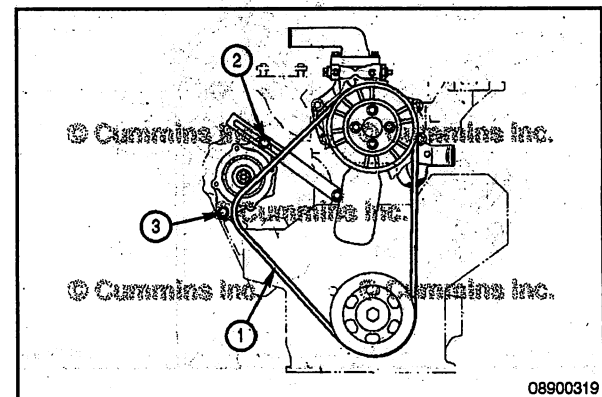
Drive Belt, Cooling Fan

Remove

Loosen the alternator mounting capscrew (3) and the belt tension adjustment capscrew (2).

Move the alternator down the adjustment bar until the drive belt is loose.

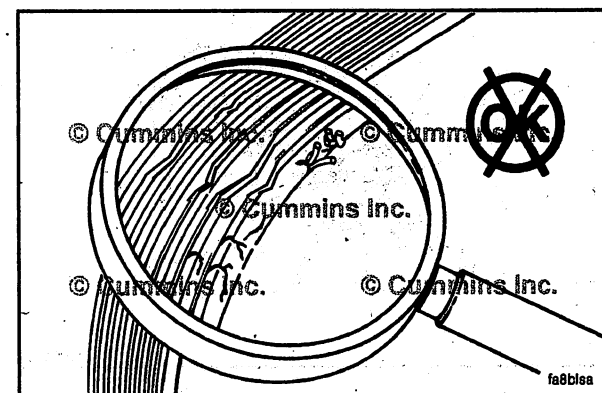
Remove the drive belt (1).

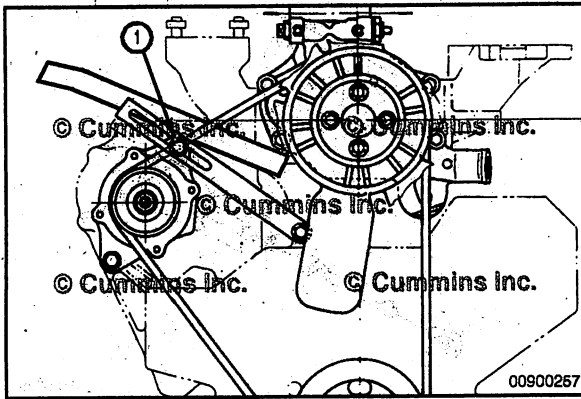


Inspect for Reuse

Inspect the drive belt for the following:

- Cracks
- Glazing
- Tears or cuts
- Excessive wear.

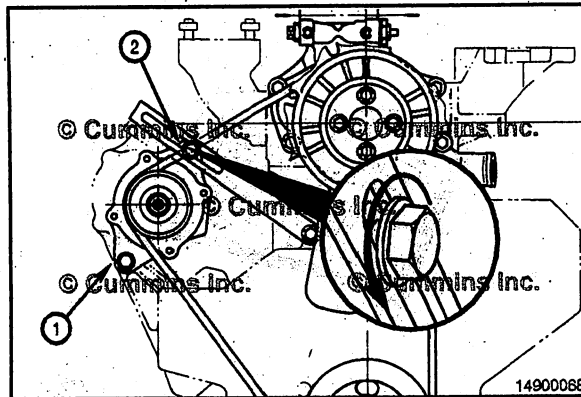




Install

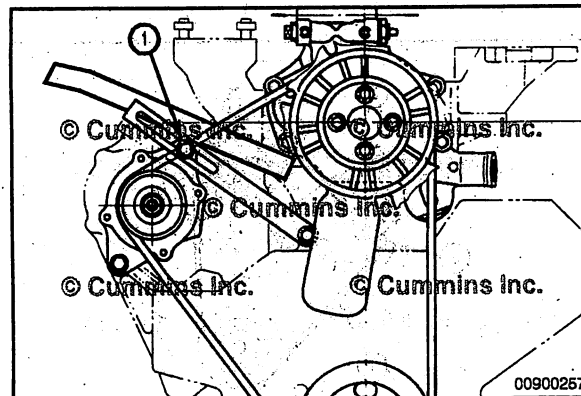
Install the drive belt.

Using a breaker bar, raise the alternator on the adjustment bar (1), and adjust the fan belt tension to specification.



Adjust

Loosen the mounting capscrew of the alternator (1) and belt tension adjustment capscrew (2).

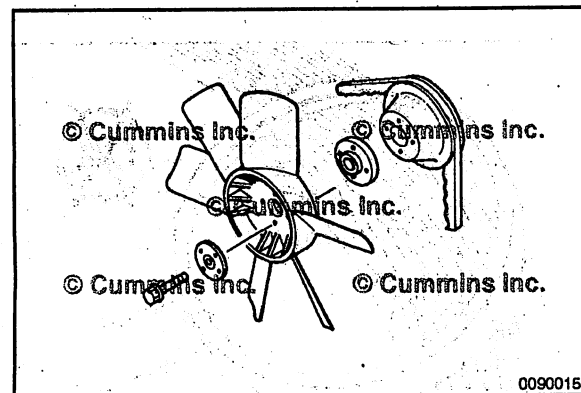


Using a breaker bar, raise the alternator, and adjust the fan belt tension to specification.

Tighten the adjustment capscrew and the mounting capscrew.

Torque Value:

Adjustment Capscrew	31 N•m	[23 ft-lb]
Mounting Capscrew	66 N•m	[49 ft-lb]



Fan, Cooling Remove

▲ WARNING ▲

The cooling fan will engage when the engine is started. To reduce the possibility of personal injury, do not put your hands in the path of the rotating fan.

Remove the four capscrews, retainer plate, fan, and spacer from the fan pulley.

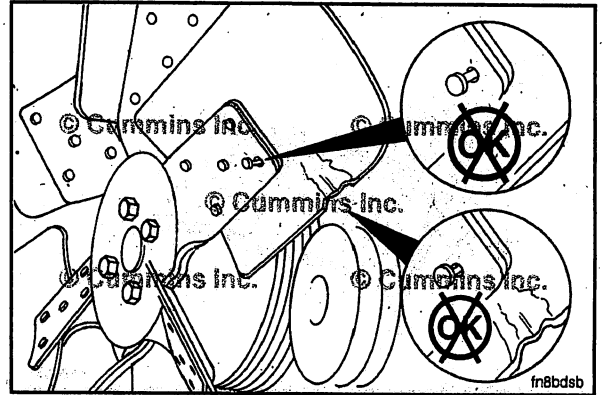
Inspect for Reuse

Inspection of the cooling fan is required daily.

Check for loose cracks, loose rivets, and bent or loose blades.

Check the fan to make sure it is securely mounted. Tighten the capscrews, if necessary.

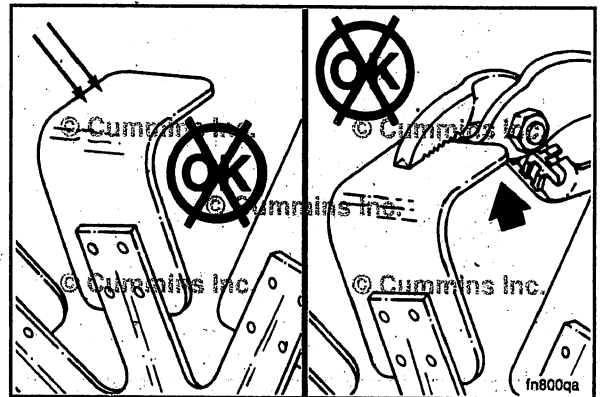
Torque Value: 31 N•m [23 ft-lb]



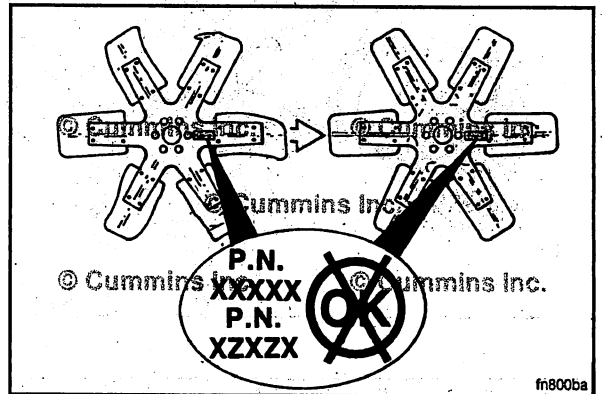
⚠ WARNING ⚠

Do not straighten a bent fan blade or continue to use a damaged fan. A bent or damaged fan blade can fail during operation and cause personal injury or property damage.

Replace the cooling fan, if the fan blades are bent.



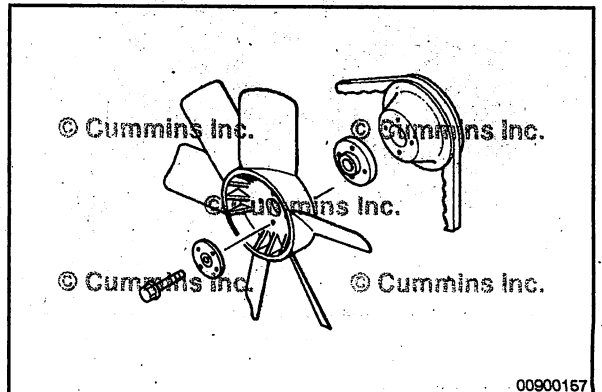
Replace the OEM fan that is damaged with a cooling fan with a identical part number. Cummins Inc. must approve any other cooling fan changes to be covered under warranty.

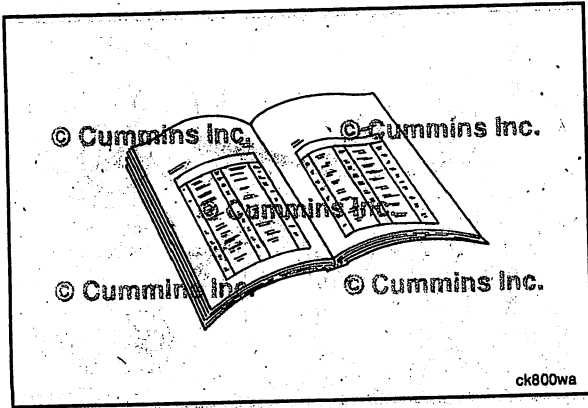


Install

Install the spacer, fan, retainer plate, and four capscrews. Tighten the capscrews.

Torque Value: 31 N•m [23 ft-lb]





Alternator Preparatory Steps

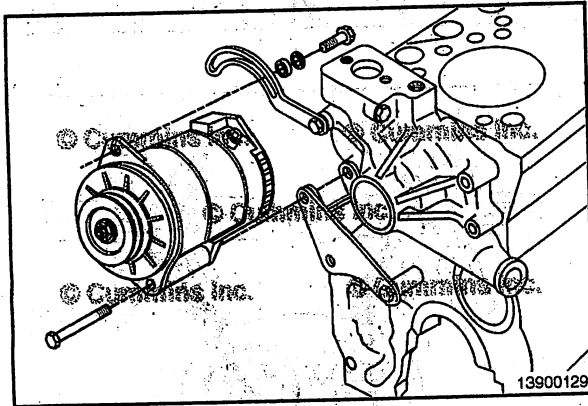
▲ WARNING ▲

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.

▲ WARNING ▲

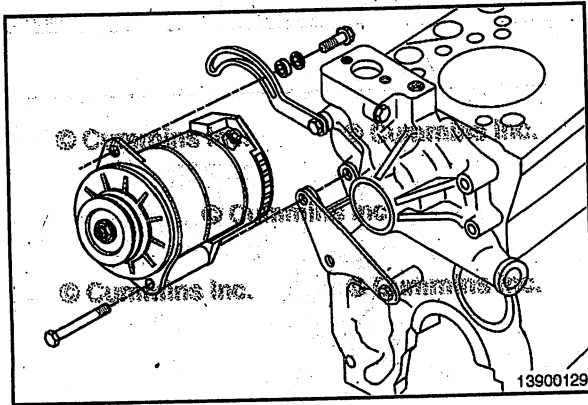
Acid is extremely dangerous and can damage the machinery and can also cause serious burns. Always provide a tank of strong soda water as a neutralizing agent when servicing the batteries. Wear goggles and protective clothing to reduce the possibility of serious personal injury.

- Disconnect battery cables. Refer to Procedure 013-009 (Battery Cables and Connections) in Section A.
- Remove cooling fan drive belt. Refer to Procedure 008-002 (Drive Belt, Cooling Fan) in Section A.
- Remove all wiring from the alternator and tag wires with identification to be used at installation.



Remove

Remove the capscrew from the mounting bracket.
Remove the capscrew from the adjusting bracket.
Remove the alternator.



Install

Install the alternator onto the mounting and adjusting brackets.
Install the capscrew on the mounting bracket.
Install the capscrew on the adjusting bracket.

Finishing Steps

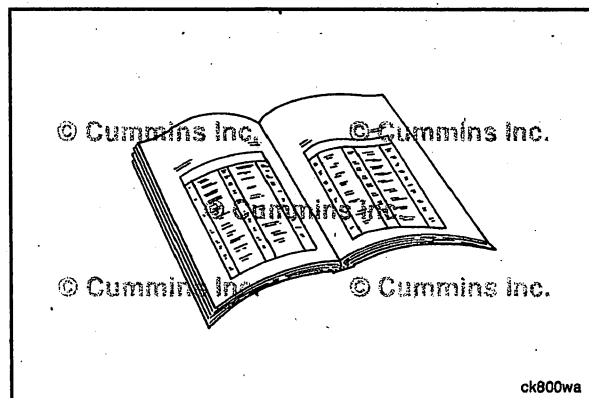
⚠ WARNING ⚠

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.

⚠ WARNING ⚠

Acid is extremely dangerous and can damage the machinery and can also cause serious burns. Always provide a tank of strong soda water as a neutralizing agent when servicing the batteries. Wear goggles and protective clothing to reduce the possibility of serious personal injury.

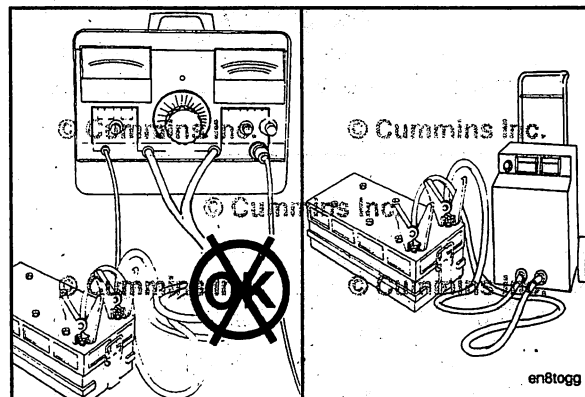
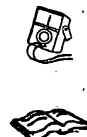
- Connect all wiring on the alternator by using tag identification on the wires.
- Install cooling fan drive belt. Refer to Procedure 008-002 (Drive Belt, Cooling Fan) in Section A.
- Connect battery cables. Refer to Procedure 013-009 (Battery Cables and Connections) in Section A.



Batteries Inspect

Use an inductive charging and cranking system analyzer to load-test the state of charge of maintenance-free batteries. If the state of charge is low, use a battery charger to charge the battery. Refer to the manufacturer's instructions.

Replace the battery if it will not charge to the manufacturer's specifications or the battery will not maintain a charge.



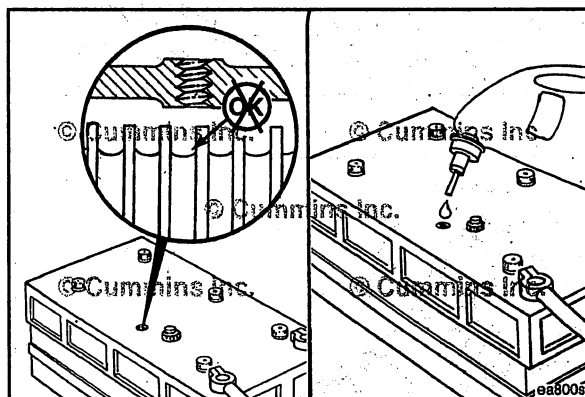
If conventional batteries are used, remove the cell caps or covers and check the electrolyte (water and sulfuric acid solution) level.

⚠ WARNING ⚠

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

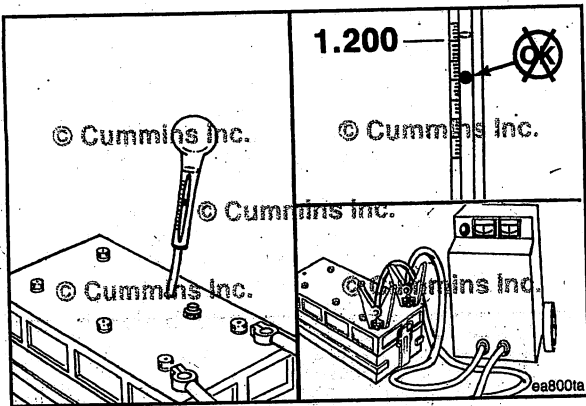
NOTE: Maintenance-free batteries are sealed and do not require the addition of water.

Fill each battery cell with water. Refer to the manufacturer's specifications.



Refer to the accompanying table to determine the battery state of charge based on the specific-gravity readings.

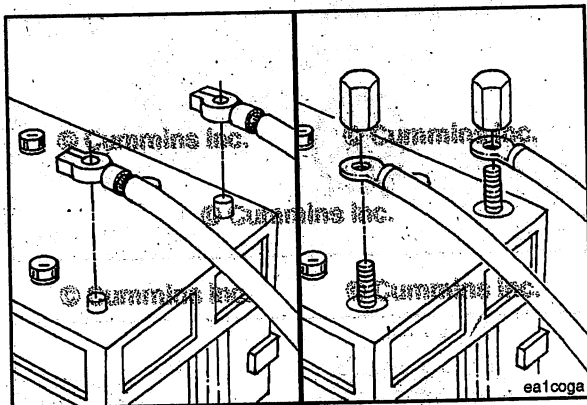
Battery State of Charge	Specific Gravity @ 27°C [80°F]
100%	1.260 to 1.280
75%	1.230 to 1.250
50%	1.200 to 1.220
25%	1.170 to 1.190
Discharged	1.110 to 1.130



Use a hydrometer to measure the specific gravity of each cell.

NOTE: If the specific gravity of any cell is below 1.200, the battery must be charged.

NOTE: Do not attempt to check the specific gravity of a battery immediately after adding water. If it is necessary to add water to allow use of the hydrometer, charge the battery several minutes at a high rate to mix the electrolyte.

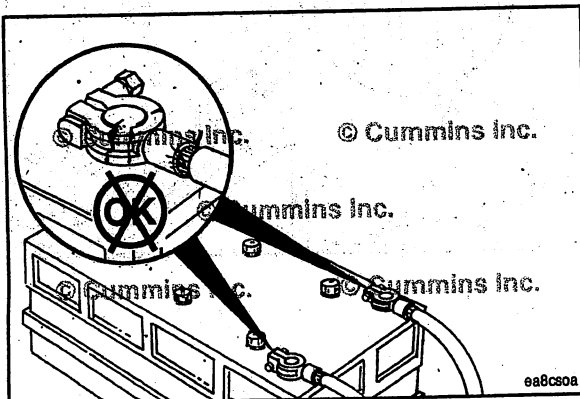


Battery Cables and Connections

Initial Check

There are two possible heavy-duty battery connections:

- Battery terminal and clamp (1)
- Threaded battery terminal and nut (2).



⚠ WARNING ⚠

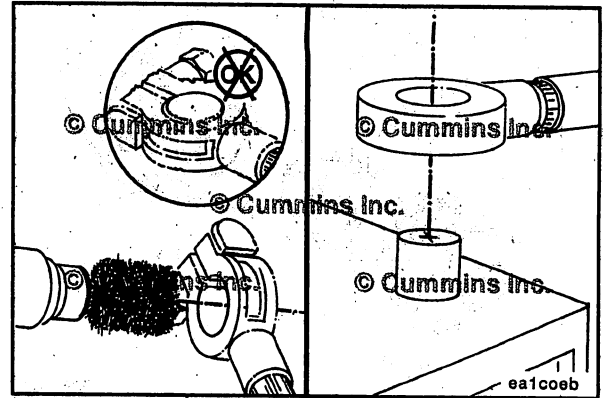
Batteries can emit explosive gases. To reduce the possibility of personal injury, always ventilate the compartment before servicing the batteries. To reduce the possibility of arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

Remove and inspect the battery cables and connections for cracks or corrosion.

Replace broken terminals, connectors, or cables.

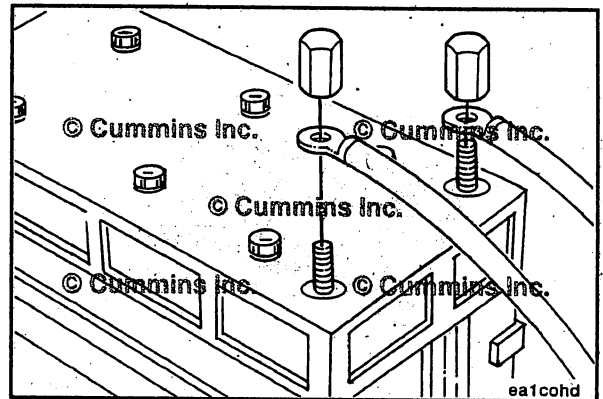
If the connections are corroded, use a battery brush or wire brush to clean the connections until shiny.

Make sure all debris is removed from the connecting surfaces.



▲ 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.



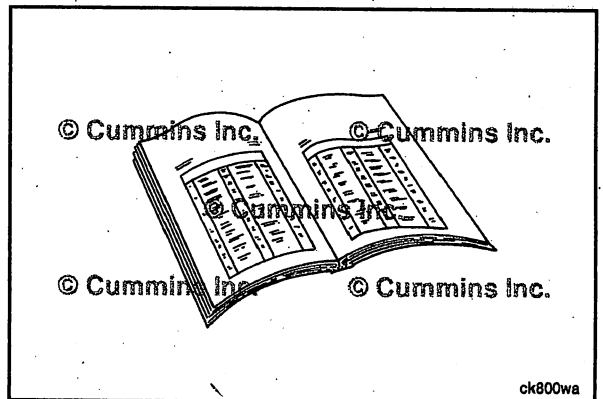
Install the cables and tighten the battery connections.

Coat the terminals with grease to prevent corrosion.

Starting Motor

Preparatory Steps

- Disconnect battery cables. Refer to Procedure 013-009 (Battery Cables and Connections) in Section A.
- Remove all wiring from the starter motor and tag wires with identification for installation and testing.

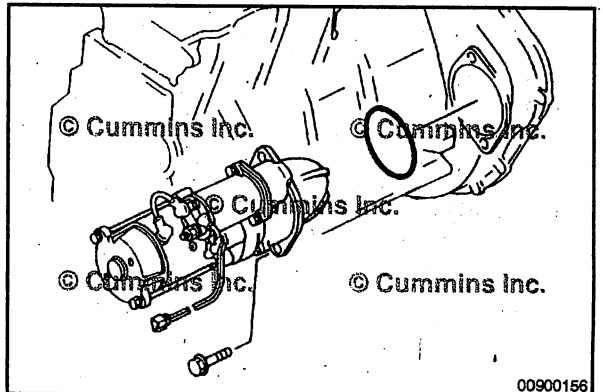


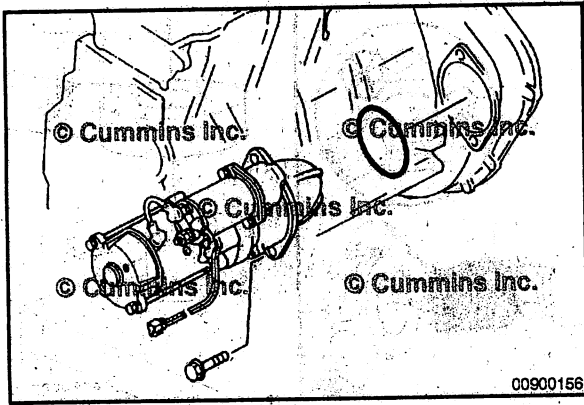
Remove

Remove the two mounting capscrews from the starter motor.

Remove the starter motor.

Remove the sealing o-ring (wet flywheel housing only). Discard the o-ring.





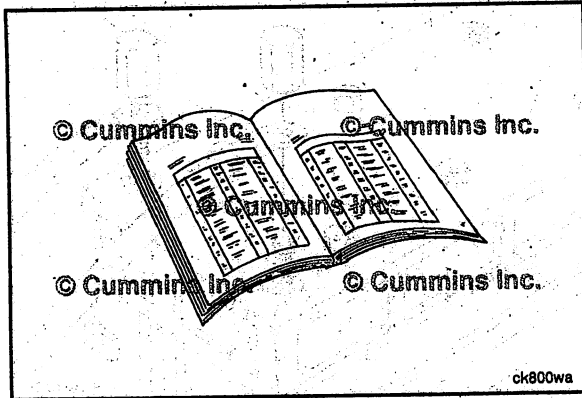
Install

Install the new o-ring on the starter motor (wet flywheel housing only).



Install the starter motor into the flywheel housing cavity. Install the two mounting cap screws. Tighten the cap screws.

Torque Value: 43 N•m [32 ft-lb]



Finishing Steps

- Install all wiring to the starter motor. Use the tag identification on the wires to determine location.
- Connect battery cables. Refer to Procedure 013-009 (Battery Cables and Connections) in Section A.



Section D - System Diagrams

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System Diagrams - Overview

General Information

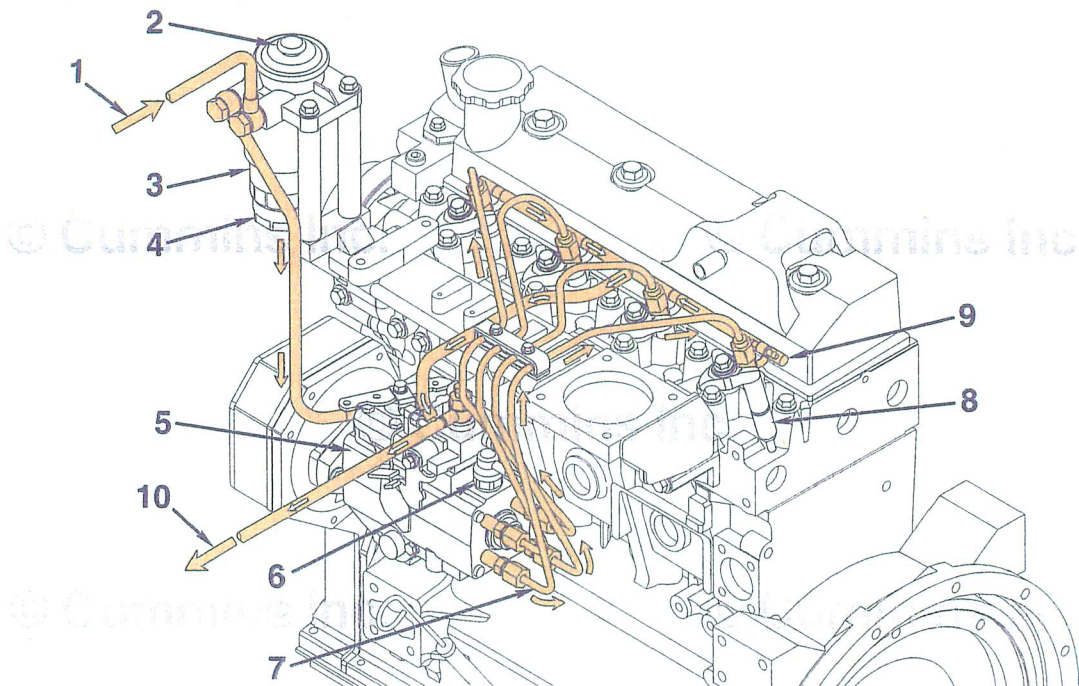
The following drawings show the flow through the engine systems. Although parts can change between different applications and installations, the flow remains the same. The systems shown are:

- Fuel System
- Lubricating Oil System
- Coolant System
- Intake Air System
- Exhaust System
- Compressed Air System.

Knowledge of the engine systems can help you in troubleshooting, service, and general maintenance of your engine.

Flow Diagram, Fuel System

Flow Diagram with Mechanically Actuated Injector

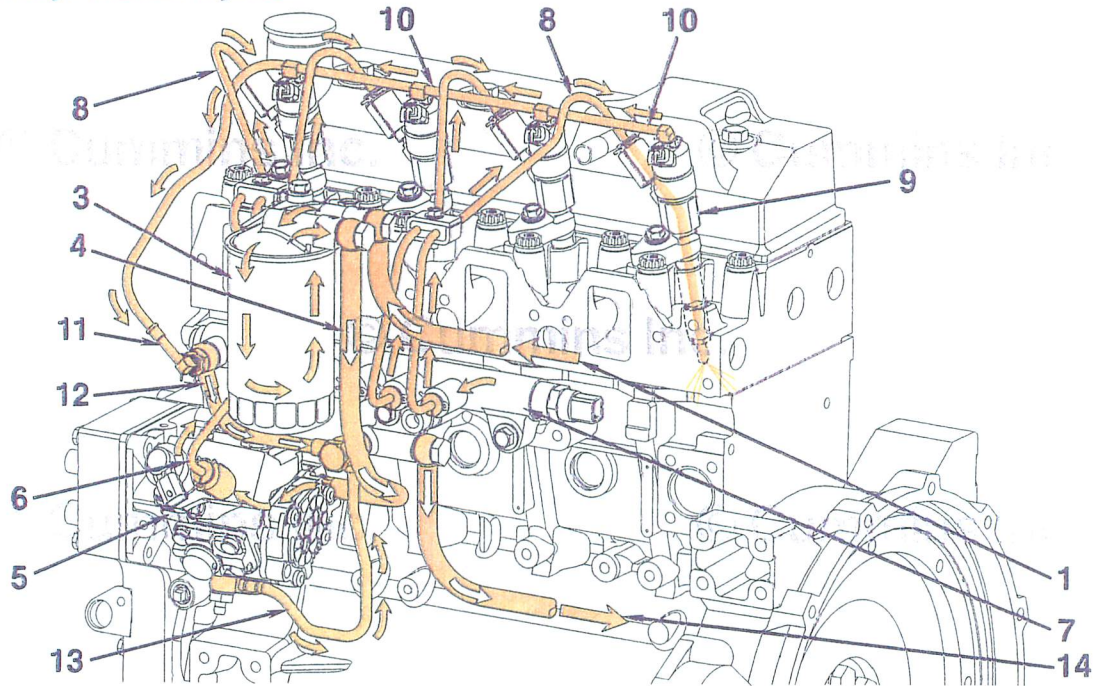


B3.3 Engine

05900870

- | | |
|--------------------------|----------------------------|
| 1. Fuel supply from tank | 6. Fuel shutoff solenoid |
| 2. Hand priming pump | 7. High-pressure fuel line |
| 3. Fuel filter | 8. Injector |
| 4. Water in fuel sensor | 9. Fuel drain manifold |
| 5. Fuel pump | 10. Fuel return to tank. |

with Electronically Actuated Injector



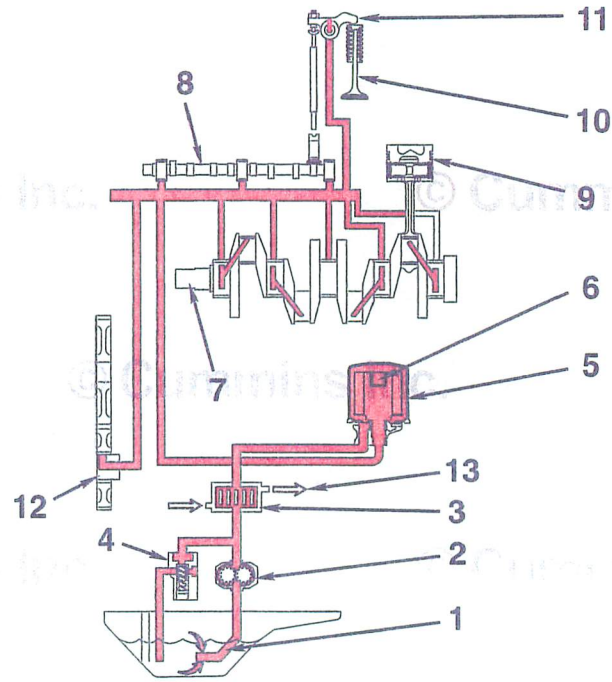
05900872

QSB3.3 Engine

- | | |
|--|--|
| 1. Fuel supply from tank | 8. High-pressure fuel lines |
| 2. Water in fuel (not mounted on engine) (not shown) | 9. Injector |
| 3. Fuel filter | 10. Fuel drain from injectors |
| 4. Fuel supply from fuel filter to fuel pump | 11. Fuel drain to common rail overflow valve fitting |
| 5. Fuel pump | 12. Fuel drain to fuel drain manifold |
| 6. Fuel supply to high-pressure common rail | 13. Fuel pump overflow to fuel drain manifold |
| 7. High-pressure common rail | 14. Fuel return to tank. |

Flow Diagram, Lubricating Oil System

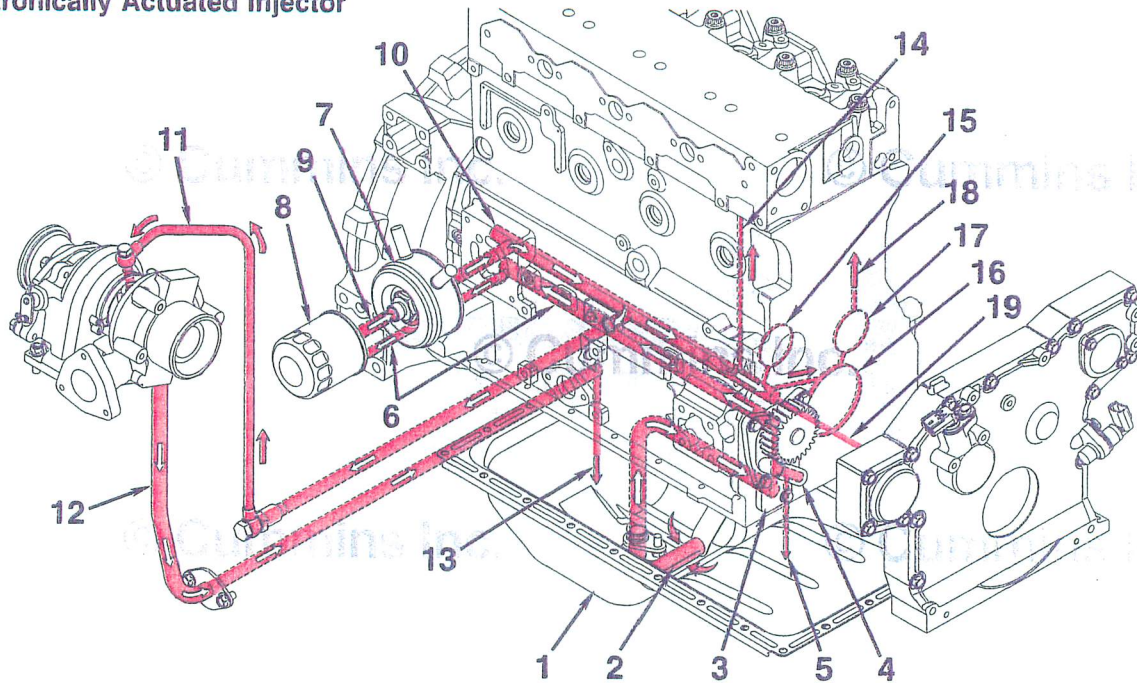
Flow Diagram with Mechanically Actuated Injector



B3.3 Engine

- | | |
|--------------------------|------------------------------|
| 1. Oil strainer | 8. Camshaft |
| 2. Oil pump | 9. Piston |
| 3. Oil cooler (optional) | 10. Intake and exhaust valve |
| 4. Regulator valve | 11. Rocker arm |
| 5. Oil filter | 12. Timing gear |
| 6. Safety valve | 13. Coolant. |
| 7. Crankshaft | |

with Electronically Actuated Injector



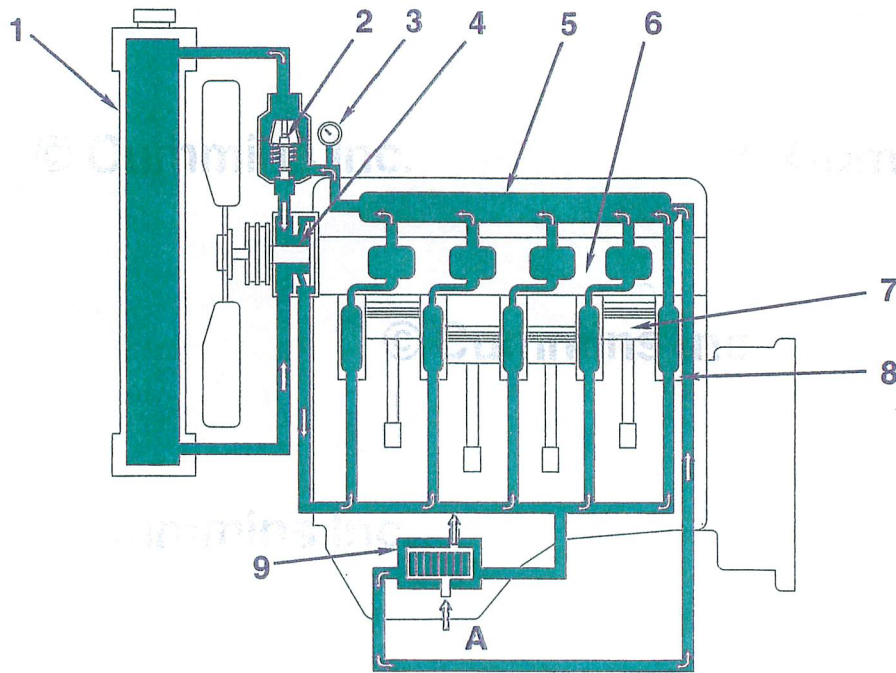
07900333

QSB3.3 Engine

- | | |
|---|--|
| 1. Lubricating oil pan | 11. Lubricating oil supply to turbocharger |
| 2. Lubricating oil sump | 12. Turbocharger oil drain |
| 3. Lubricating oil pump | 13. Lubricating oil return to lubricating oil pan |
| 4. Regulator valve | 14. Lubricating oil supply to valve drain |
| 5. Lubricating oil return to lubricating oil pan | 15. Lubricating oil around camshaft bearing |
| 6. Lubricating oil supply to lubricating oil filter | 16. Lubricating oil around crankshaft main bearing |
| 7. Lubricating oil cooler (optional) | 17. Lubricating oil around connecting rod bearing |
| 8. Lubricating oil filter | 18. Lubricating oil supply to piston |
| 9. Lubricating oil supply to main oil rifle | 19. Lubricating oil supply to timing gear. |
| 10. Main oil rifle | |

Flow Diagram, Cooling System

Flow Diagram with Mechanically Actuated Injector

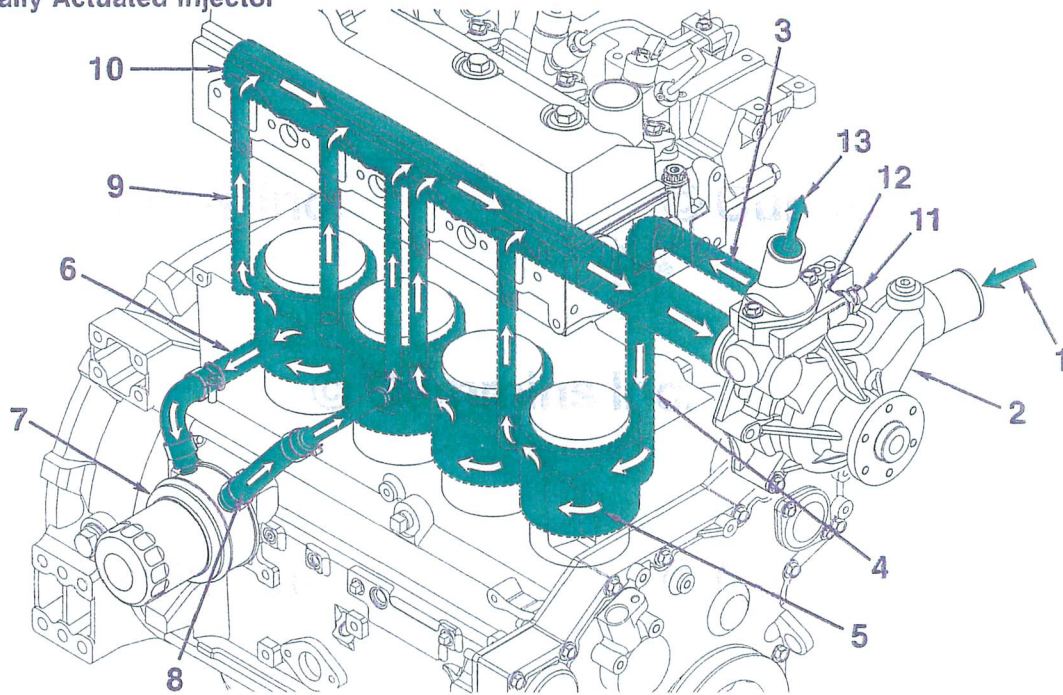


B3.3 Engine

00900147

- | | |
|----------------------------|---------------------------|
| 1. Radiator | 6. Cylinder head |
| 2. Thermostat | 7. Piston |
| 3. Water temperature gauge | 8. Cylinder block |
| 4. Water pump | 9. Oil cooler (optional). |
| 5. Water manifold | |
| A. From oil pump (oil). | |

with Electronically Actuated Injector



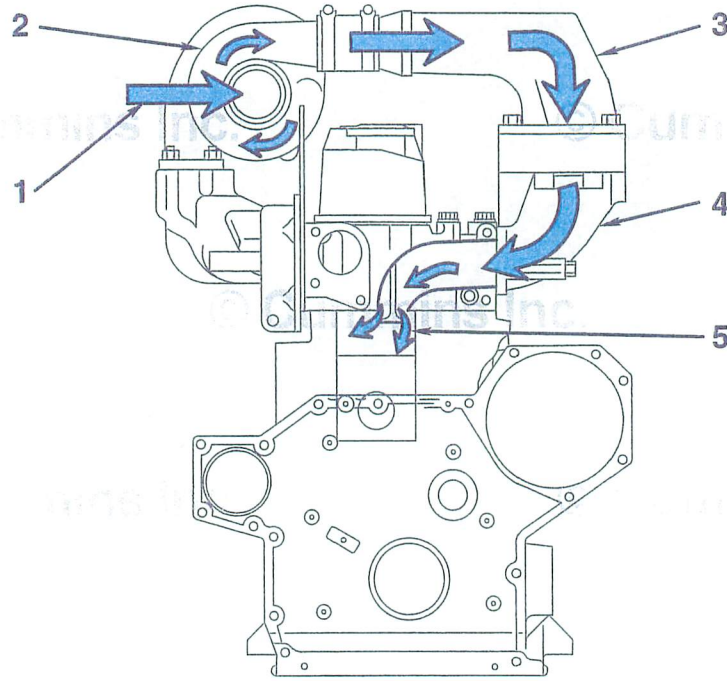
08900331

QSB3.3 Engine

1. Coolant flow from radiator
2. Water pump
3. Coolant flow to cylinder head
4. Coolant flow to cylinder block
5. Coolant flow around cylinder liners
6. Coolant flow to oil cooler (optional)
7. Lubricating oil cooler
8. Coolant return from oil cooler to water manifold
9. Coolant return from cylinder block to water manifold
10. Water manifold
11. Coolant temperature sensor
12. Thermostat housing
13. Coolant return to radiator.

Flow Diagram, Air Intake System

Flow Diagram with Mechanically Actuated Injector

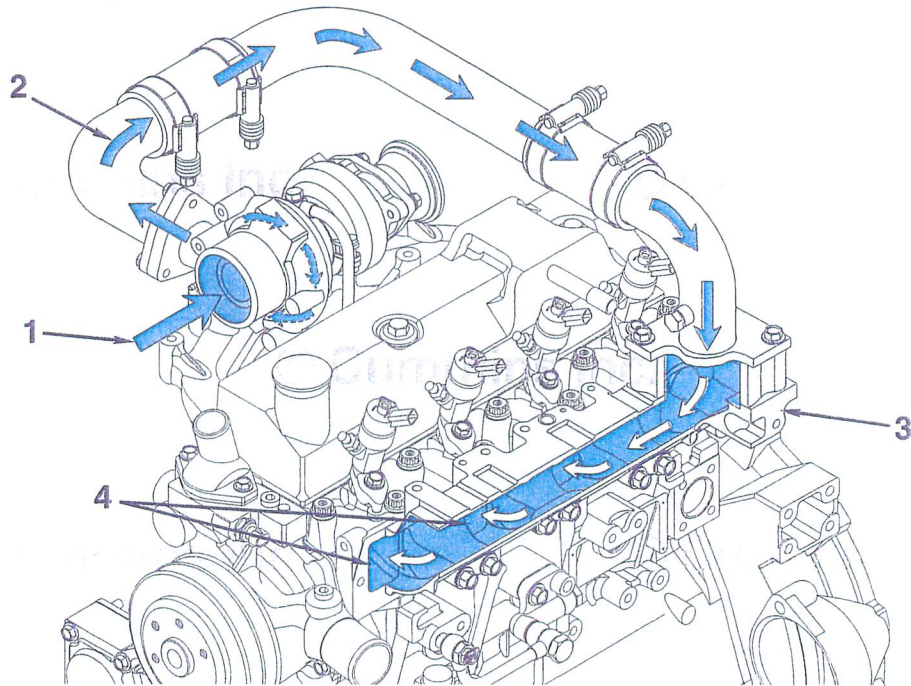


B3.3 Engine

- | | |
|---------------------------------------|-----------------------|
| 1. Filtered air inlet to turbocharger | 4. Intake manifold |
| 2. Turbocharger compressor | 5. Intake valve port. |
| 3. Air crossover tube | |

00900227

with Electronically Actuated Injector



10900371

QSB3.3 Engine

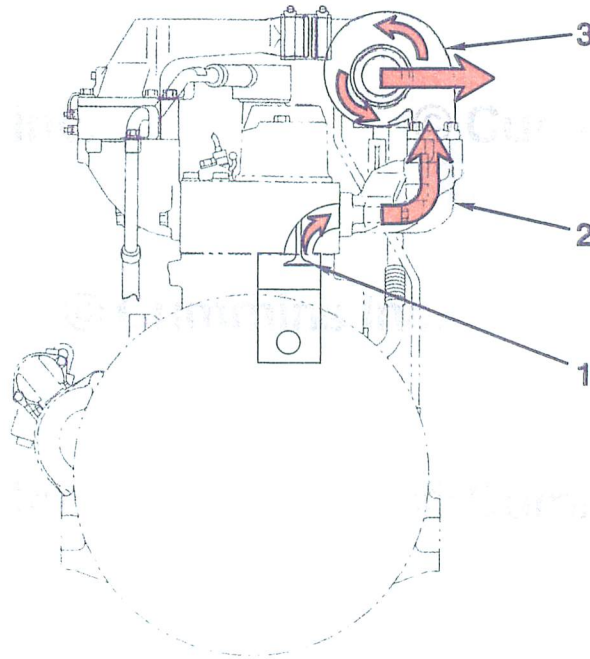
- 1. Filtered air inlet to turbocharger
- 2. Air flow to intake manifold

- 3. Intake manifold
- 4. Intake port.

Flow Diagram, Exhaust System

Flow Diagram

with Mechanically Actuated Injector



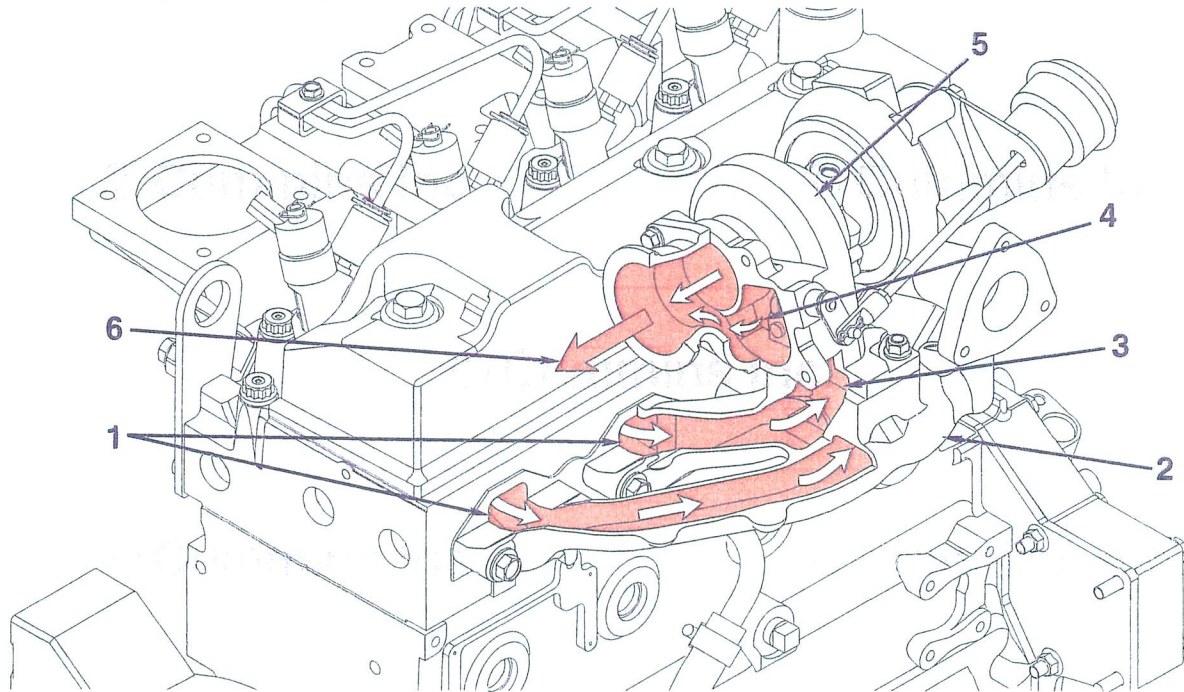
B3.3 Engine

00900232

- 1. Exhaust valve port
- 2. Exhaust manifold

- 3. Turbocharger turbine housing.

with Electronically Actuated Injector



QSB3.3 Engine

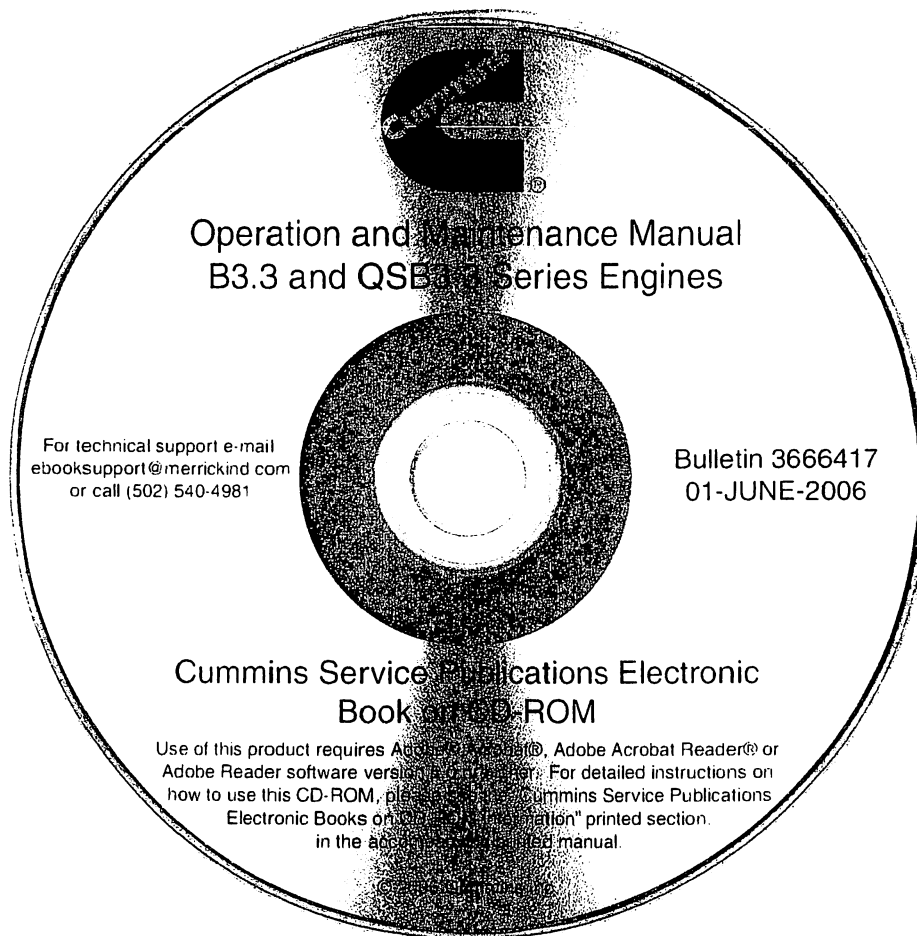
11900085

- 1. Exhaust port
- 2. Exhaust manifold
- 3. Turbocharger exhaust inlet

- 4. Exhaust outlet through open wastegate
- 5. Wastegated turbocharger
- 6. Turbocharger exhaust outlet.

Cummins Service Publications Electronic Books on CD-ROM

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Use of the Cummins Service Publications Electronic Books on CD-ROM requires Adobe Acrobat, Adobe Acrobat Reader, or Adobe Reader software to be pre-installed on your computer. This product has been tested for compatibility with Adobe Acrobat software versions 5.0, 6.0 and 7.0. It may function properly with versions later than Adobe Acrobat 7.0, but testing has not been performed. Acrobat Reader is available as a free download from www.adobe.com.

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- Microsoft Windows Auto-Play must be enabled on your computer (it is enabled by default when Windows is installed)
- CD-ROM Drive
- Color Monitor with at least 800x600 resolution graphics
- Microsoft Windows XP Professional or Microsoft Windows 2000 Professional. This CD-ROM may be compatible with Microsoft Windows 98 SE, Microsoft Windows NT 4.0, or Microsoft Windows XP Home Edition, but testing has not been performed.
- Recommended memory, processor speed and available hard-disk space is in accordance with respective Microsoft Operating System Guidelines, as well as Adobe Acrobat system requirements listed later in these instructions.

Note: The Cummins Service Publications Electronic Books on CD-ROM product is not Macintosh compatible.

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- Have your computer account enabled to have Local Administrative rights and then you can run the Cummins Service Publications Electronic Book on CD-ROM - OR -
- Have a user with Local Administrative Rights logon to your computer and run the CD-ROM one time. By doing this, the necessary files will be loaded to your computer and your computer will be enabled to have direct access to CD-ROM drives. Then restart this computer. It is very important to restart the computer after you have done this. For all future needs, you can run the Cummins Service Publications Electronic Book on CD-ROM under your own account, without requiring your logon account/profile to have Local Administrative Rights. (Note: This needs to be done only once for any Cummins Service Publications Electronic Book on CD-ROM and then does not need to be done again for other Cummins Service Publications Electronic Book on CD-ROM titles you may own.)

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Adobe Acrobat Reader 5.0 system requirements:

- PC Compatible computer w/ Intel® Pentium® processor
- One of the following Microsoft® Windows Operating Systems:
 - Microsoft Windows 98 SE
 - Microsoft Windows Millennium Edition
 - Microsoft Windows NT® 4.0 with Service Pack 5
 - Microsoft Windows 2000
 - Microsoft Windows XP

- 64MB of RAM
- 24MB of available hard-disk space
- Additional 70MB of hard-disk space for Asian fonts (optional)

(Asian fonts are not required for Cummins Service Publications Electronic Books on CD-ROM product.)

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- PC Compatible computer w/ Intel Pentium processor
- One of the following Microsoft Windows Operating Systems:
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 - Microsoft Windows Millennium Edition
 - Microsoft Windows NT 4.0 with Service Pack 6
 - Microsoft Windows 2000 with Service Pack 2
 - Microsoft Windows XP Professional or Home Edition
 - Microsoft Windows XP Tablet PC Edition
- 32MB of RAM (64MB recommended)
- 60MB of available hard-disk space
- Microsoft Internet Explorer 5.0.1, 5.5, 6.0, or 6.1

Adobe Reader 7.0 system requirements:

- PC Compatible computer w/ Intel Pentium processor
- One of the following Microsoft Windows Operating Systems:
 - Microsoft Windows 2000 with Service Pack 2
 - Microsoft Windows XP Professional or Home Edition
 - Microsoft Windows XP Tablet PC Edition
- 128MB of RAM
- Up to 90MB of available hard-disk space
- Microsoft Internet Explorer 5.5 or higher

How to Use the Cummins Service Publications Electronic Book on CD-ROM:

To use the CD-ROM, simply insert the CD-ROM into your computer and it should automatically run, open Adobe Acrobat and open the Electronic Book. (This happens with Microsoft Windows Auto-Play functionality, and Adobe Acrobat pre-loaded by you on your computer).

Cummins Service Publications Electronic Books on CD-ROM Information **(continued)**

Helpful Support Tips:

- If Windows Auto-Play is not enabled, try re-enabling it, or navigate with Windows Explorer to your CD-ROM drive and double click on the CD-ROM drive letter to open it. Then double-click on the program named "clickhere". (Do not attempt to directly open the PDF file by clicking on the PDF document.)
- In rare occasions, after inserting the CD-ROM you may receive a notice from Adobe Acrobat that it "could not open the PDF because it is either not a supported file type or the file has been corrupted". This can occur in rare occasions due to application timing issues. If this occurs there are several options to remedy the situation: 1) Simply click OK on the notice, eject the CD-ROM and re-insert it to have it restart the program, or 2) Click OK on the notice and navigate with Windows Explorer to your CD-ROM drive and double click on the CD-ROM drive letter to open it. Then double-click on the program named "clickhere". (Do not attempt to directly open the PDF file by clicking on the PDF document) or 3) Click OK on the notice, eject the CD-ROM, restart your computer and after the system has restarted, re-insert the CD-ROM and have it automatically run.
- If the Cummins Service Publications Electronic Books on CD-ROM does not function, see the prior section on "About required Local Administrative Rights:" in this documentation and verify you have Local Administrative Rights on your computer in order to run the CD-ROM.

Electronic Book Technical Support:

Support for this product is available from Monday through Friday weekly, excluding Holidays, from 8 a.m. to 5 p.m. You may call (502) 540-4981 for telephone support. For e-mail support, please e-mail ebooksupport@merrickind.com.

CD-ROM Media Replacement Options:

Up to 90 days from date of purchase:

Within the first 90 days from your date of purchase, if your copy of an Electronic Book on CD-ROM does not function, and after a Cummins Electronic Book Technical Support Technician has confirmed the situation and authorized its replacement by providing you an RMA#, you may send back the CD-ROM for a free replacement. To do so, you must package the CD-ROM and ship/mail, with postage pre-paid by you, to the below address. You must also include a photocopy of the original invoice for proof of purchase of the publication clearly indicating the bulletin # and the purchase date. The RMA# must be on the address information of the package. If the proof of purchase copy of the invoice is not enclosed, your request will not be able to be processed and will not be returned. Delivery of the replacement will be shipped to you at no charge. Allow 3 to 4 weeks for your receipt of replacement copy. Note: Return only the non-functional CD-ROM, do not return the entire printed publication. The replacement CD-ROM maintains the original purchase/invoice date for the purposes of this replacement policy. This policy is subject to change at any time, without notice. For a copy of the most current replacement options policy, please e-mail ebooksupport@merrickind.com with your request.

Media Replacement Ship to Address:

Attn: Cummins Service Publications Electronic Books Technical Support
RMA#: XXXXXX (where XXXXXX is the RMA#)
808 E. Liberty Street
Louisville, KY 40204 U.S.A.

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Intel and Pentium are trademarks of Intel Corporation.
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Section L - Service Literature

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Section L - Service Literature

Section L - Service Literature

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Additional Service Literature

General Information

The following publications can be purchased by contacting a Cummins Authorized Distributor:

Bulletin Number	Title of Publication
4021540	Service Manual, B3.3 Series Engines
3379001	Fuels for Cummins Engines
3379009	Operation of Diesel Engines in Cold Climates
3666106	Hydro-Mechanical Step Timing Control (STC) Valve
3666191	Cummins®-Branded Delco®-Remy Starters and Alternators
3379000	Air for Your Engine
3666209	Extended Service Interval, Cooling System Maintenance
3666244	Unauthorized Adjustment of Midrange Fuel Injection Pumps
3666286	Cummins Requirements For Cooling System Extended Service Intervals
3379001	Fuel for Cummins Engines
3666132	Cummins Coolant Requirements and Maintenance
3810340	Cummins Engine Oil Recommendations
3387266	Cold Weather Operation

Service Literature Ordering Location Contact Information

Region
United States and Canada

Ordering Location
Cummins Distributors
or
Credit Cards at 1-800-646-5609
or
Order online at www.powerstore.cummins.com
Cummins Distributors or Dealers

U.K., Europe, Mid-East, Africa,
and Eastern European Countries
South and Central America
(excluding Brazil and Mexico)

Cummins Americas, Inc.
16085 N.W. 52nd Avenue
Hialeah, FL 33104
Cummins Inc.
International Parts Order Dept., MC 40931
Box 3005
Columbus, IN 47202-3005

Brazil and Mexico

Cummins Diesel Sales Corp.
Literature Center
8 Tanjong Penjuru
Jurong Industrial Estate
Singapore

Far East (excluding
Australia and New Zealand)

Australia and New Zealand

Cummins
4 Dalmore Drive
Scoresby 3179
Victoria, Australia

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 contains 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. Your name and engine model identification even appears on the catalog spine. Everybody will know that Cummins created a catalog specifically for you.

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 the Cummins Electronic Parts Catalog or the Cummins Parts Microfilm System.

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 customers can contact their Cummins Distributor or call Gannett Direct Marketing Services at 1-800-646-5609 and order by credit card. Outside North America order on-line or make an International call to Gannett at (+ +)502-454-6660.

Ordering On-Line

The Customized Parts Catalog can be ordered On-Line from the Cummins Powerstore by credit card. Contact the Powerstore at WWW.POWERSTORE.CUMMINS.COM

Contact GDMS or the CUMMINS POWERSTORE for the current price; Freight may be an additional expense.

Information we need to take your Customized Parts Catalog Order. This information drives the cover content of the CPC.

- Customer Name
- Street Address
- Company Name (optional)
- Telephone no.
- Credit Card No.
- Cummins Engine Serial Number (located on the engine data plate)
- Please identify the required media: Printed Catalog, CD-ROM, or PDF File

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

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

Section M - Component Manufacturers

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Component Manufacturers

Section M - Component Manufacturers

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Component Manufacturers' Addresses

NOTE: The following list contains addresses and telephone numbers of suppliers of accessories used on Cummins engines. Suppliers can be contacted directly for any specifications **not** covered in this manual.

Air Compressors

Bendix Heavy Vehicles Systems
Div. of Allied Automotive
901 Cleveland Street
Elyria, OH 44036
Telephone: (216) 329-9000

Holset Engineering Co., Inc.
1320 Kemper Meadow Drive
Suite 500
Cincinnati, OH 45240
Telephone: (513) 825-9600

Midland-Grau
Heavy Duty Systems
Heavy Duty Group Headquarters
10930 N. Pamona Avenue
Kansas City, MO 64153
Telephone: (816) 891-2470

Air Cylinders

Bendix Ltd.
Douglas Road
Kingswood
Bristol
England
Telephone: 0117-671881

Catching Engineering
1733 North 25th Avenue
Melrose Park, IL 60160
Telephone: (708) 344-2334

TEC - Hackett Inc.
8909 Rawles Avenue
Indianapolis, IN 46219
Telephone: (317) 895-3670

Air Heaters

Fleetguard, Inc.
1200 Fleetguard Road
Cookeville, TN 38502
Telephone: (615) 526-9551

Kim Hotstart Co.
P.O. Box 11245
Spokane, WA 99211-0245
Telephone: (509) 534-6171

Air Starting Motors

Ingersoll Rand
Chorley New Road
Horwich
Bolton
Lancashire
England
BL6 6JN
Telephone: 01204-65544

Ingersoll-Rand Engine
Starting Systems
888 Industrial Drive
Elmhurst, IL 60126
Telephone: (708) 530-3875

StartMaster
Air Starting Systems
A Division of Sycon Corporation
9595 Cheney Avenue
P. O. Box 491
Marion, OH 43302
Telephone: (614) 382-5771

Alternators

Robert Bosch Ltd.
P.O. Box 98
Broadwater Park
North Orbital Road
Denham
Uxbridge
Middlesex UD9 5HG
England
Telephone: (0)1895-838383

Prestolite Electrics
Cleveland Road
Leyland
PR5 1XB
England
Telephone: (0)1772-421663

C. E. Niehoff & Co.
2021 Lee Street
Evanston, IL 60202
Telephone: (708) 866-6030

Delco-Remy America
2401 Columbus Avenue
P.O. Box 2439
Anderson, IN 46018
Telephone: (317) 646-3528

Leece-Neville Corp.
400 Main Street
Arcade, NY 14009
Telephone: (716) 492-1700

Auxiliary Brakes

The Jacobs Manufacturing Company
Vehicle Equipment Division
22 East Dudley Town Road
Bloomfield, CT 06002
Telephone: (203) 243-1441

Belts

T.B.A. Belting Ltd.
P.O. Box 77
Wigan
Lancashire
WN2 4XQ
England
Telephone: (0)1942-259221

Dayco Mfg.
Belt Technical Center
1955 Enterprize
Rochester Hills, MI 48309
Telephone: (810) 853-8300

Gates Rubber Company
900 S. Broadway
Denver, CO 80217

Goodyear Tire and
Rubber Company
Industrial Products Div.
2601 Fortune Circle East
Indianapolis, IN 46241
Telephone: (317) 898-4170

Catalytic Converters

Donaldson Company, Inc.
1400 West 94th Street
P.O. Box 1299
Minneapolis, MN 55440
Telephone: (612) 887-3835

Nelson Division
Exhaust and Filtration Systems
1801 U.S. Highway 51 P.O. Box 428
Stoughton, WI 53589
Telephone: (608) 873-4200

Walker Manufacturing
3901 Willis Road
P.O. Box 157
Grass Lake, MI 49240
Telephone: (517) 522-5500

Coolant Level Switches

Robertshaw Controls Company
P.O. Box 400
Knoxville, TN 37901
Telephone: (216) 885-1773

Clutches

Twin Disc International S.A.
Chaussee de Namur
Nivelles
Belguim
Telephone: 067-224941

Twin Disc Incorporated
1328 Racine Street
Racine, WI 53403
Telephone: (414) 634-1981

Coolant Heaters

Fleetguard, Inc.
1200 Fleetguard Road
Cookeville, TN 38502
Telephone: (615) 526-9551

Drive Plates

Detroit Diesel Allison
Division of General Motors
Corporation
P.O. Box 894
Indianapolis, IN 46206-0894
Telephone: (317) 242-5000

Electric Starting Motors

Prestolite Electrics
Cleveland Road
Leyland
PR5 1XB
England
Telephone: 01772-421663

Delco-Remy America
2401 Columbus Avenue
P.O. Box 2439
Anderson, IN 46018
Telephone: (317) 646-3528

Leece-Neville Corp.
400 Main Street
Arcade, NY 14009
Telephone: (716) 492-1700

Nippondenso Inc.
2477 Denso Drive
P.O. Box 5133
Southfield, MI 48086
Telephone: (313) 350-7500

Electronic Switches

Cutler-Hammer Products
Eaton Corporation
4201 N. 27th Street
Milwaukee, WI 53216
Telephone: (414) 449-6600

Engine Protection Controls

Flight Systems Headquarters
Hempt Road
P.O. Box 25
Mechanicsburg, PA 17055
Telephone: (717) 697-0333

The Nason Company
2810 Blue Ridge Blvd.
West Union, SC 29696
Telephone: (803) 638-9521

Teddington Industrial
Equipment
Windmill Road
Sunbury on Thames
Middlesex
TW16 7HF
England
Telephone: (0)9327-85500

Fan Clutches

Kysor Cooling Systems N.A.
6040 West 62nd Street
Indianapolis, IN 46278
Telephone: (317) 328-3330

Holset Engineering Co. Ltd.
ST Andrews Road
Huddersfield, West Yorkshire
England HD1 6RA
Telephone: (0)1484-22244

Horton Industries, Inc.
P.O. Box 9455
Minneapolis, MN 55440
Telephone: (612) 378-6410

Rockford Clutch Company
1200 Windsor Road
P.O. Box 2908
Rockford, IL 61132-2908
Telephone: (815) 633-7460

Fans

Trufflo Ltd.
Westwood Road
Birmingham
B6 7JF
England
Telephone: (0)121-3283041

Hayes-Albion Corporation
Jackson Manufacturing Plant
1999 Wildwood Avenue
Jackson, MI 49202
Telephone: (517) 782-9421

Engineered Cooling Systems, Inc.
201 W. Carmel Drive
Carmel, IN 46032
Telephone: (317) 846-3438

Brookside Corporation
P.O. Box 30
McCordsville, IN 46055
Telephone: (317) 335-2014

TCF Aerovent Company
9100 Purdue Rd., Suite 101
Indianapolis, IN 46268-1190
Telephone: (317) 872-0030

Kysor-Cadillac
1100 Wright Street
Cadillac, MI 49601
Telephone: (616) 775-4681

Schwitzer
6040 West 62nd Street
P.O. Box 80-B
Indianapolis, IN 46206
Telephone: (317) 328-3010

Fault Lamps

Cutler-Hammer Products
Eaton Corporation
4201 N. 27th Street
Milwaukee, WI 53216
Telephone: (414) 449-6600

Filters

Fleetguard International Corp.
Cavalry Hill Industrial Park
Weedon
Northampton NN7 4TD
England
Telephone: 01327-341313

Fleetguard, Inc.
1200 Fleetguard Road
Cookeville, TN 38502
Telephone: 1-800-22-Filters
(1-800-223-4583)

Flexplates

Corrugated Packing and
Sheet Metal
Hamsterley
Newcastle Upon Tyne
England
Telephone: (0)1207-560-505

Allison Transmission
Division of General Motors
Corporation
P.O. Box 894
Indianapolis, IN 46206-0894
Telephone: (317) 242-5000

Midwest Mfg. Co.
29500 Southfield Road, Suite 122
Southfield, MI 48076
Telephone: (313) 642-5355

Wohlert Corporation
708 East Grand River Avenue
P.O. Box 20217
Lansing, MI 48901
Telephone: (517) 485-3750

Fuel Coolers

Hayden, Inc.-
1531 Pomona Road
P.O. Box 848
Corona, CA 91718-0848
Telephone: (909) 736-2665

Fuel Pumps

Robert Bosch Corp.
Automotive Group
2800 South 25th Ave.
Broadview, IL 60153

Fuel Warmers

Fleetguard, Inc.
1200 Fleetguard Road
Cookeville, TN 38502
Telephone: (615) 526-9551

Gauges

Grasslin U.K. Ltd.
Vale Rise
Tonbridge
Kent
TN9 1TB
England
Telephone: (0)1732-359888

Datcon Instruments
P.O. Box 128
East Petersburg, PA 17520
Telephone: (717) 569-5713

Rochester Gauges, Inc.
11616 Harry Hines Blvd.
P.O. Box 29242
Dallas, TX 75229
Telephone: (214) 241-2161

Governors

Woodward Governor Co.
P.O. Box 1519
Fort Collins, CO 80522
Telephone: (303) 482-5811
(800) 523-2831

Barber Colman Co.
1354 Clifford Avenue
Loves Park, IL 61132
Telephone: (815) 637-3000

United Technologies
Diesel Systems
1000 Jorie Blvd.
Suite 111
Oak Brook, IL 69521
Telephone: (312) 325-2020

Heat Sleeves

Bentley Harris Manufacturing Co.
100 Bentley Harris Way
Gordonville, TN 38563
Telephone: (313) 348-5779

Hydraulic and Power Steering Pumps

Honeywell Control Systems Ltd.
Honeywell House
Arlington Business Place
Bracknell
Berks RG12 1EB
Telephone: (0)1344-656000

Sperry Vickers
P.O. Box 302
Troy, MI 48084
Telephone: (313) 280-3000

Z.F.
P.O. Box 1340
Grafvonsoden Strasse
5-9 D7070
Schwaebisch Gmuend
Germany
Telephone: 7070-7171-31510

In-Line Connectors

Pioneer-Standard Electronics, Inc.
5440 Neiman Parkway
Solon, OH 44139
Telephone: (216) 349-1300

Deutsch
Industrial Products Division
37140 Industrial Avenue
Hemet, CA 92343
Telephone: (714) 929-1200

Oil Heaters

Fleetguard, Inc.
1200 Fleetguard Road
Cookeville, TN 38502
Telephone: (615) 526-9551

Kim Hotstart Co.
P.O. Box 11245
Spokane, WA 99211-0245
Telephone: (509) 534-6171

Prelubrication Systems

RPM Industries, Inc.
Suite 109
55 Hickory Street
Washington, PA 15301
Telephone: (412) 228-5130

Radiators

JB Radiator Specialties, Inc.
P.O. Box 292087
Sacramento, CA 95829-2087
Telephone: (916) 381-4791

The G&O Manufacturing Company
100 Gando Drive
P.O. Box 1204
New Haven, CT 06505-1204
Telephone: (203) 562-5121

Young Radiator Company
2825 Four Mile Road
Racine, WI 53404
Telephone: (910) 271-2397

L and M Radiator, Inc.
1414 East 37th Street
Hibbing, MN 55746
Telephone: (218) 263-8993

Throttle Assemblies

Williams Controls, Inc.
14100 SW 72nd Avenue
Portland, OR 97224
Telephone: (503) 684-8600

Torque Converters

Twin Disc International S.A.
Chaussee de Namur
Nivelles
Belgium
Telephone: 067-224941

Twin Disc Incorporated
1328 Racine Street
Racine, WI 53403-1758
Telephone: (414) 634-1981

Rockford Powertrain, Inc.
Off-Highway Systems
1200 Windsor Road
P.O. Box 2908
Rockford, IL 61132-2908
Telephone: (815) 633-7460

Modine Mfg. Co.
1500 DeKoven Avenue
Racine, WI 53401
Telephone: (414) 636-1640

Section S - Service Assistance

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Routine Service and Parts

General Information

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

Emergency and Technical Service

General Information

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

If additional assistance is required, call Toll-Free:

1-800-DIESELS
(1-800-343-7357)

- Includes all 50 states, Bermuda, Puerto Rico, Virgin Islands, and the Bahamas.
- Outside of North America contact your Regional Office. Telephone numbers and addresses are listed in the International Directory.



Problem Solving

General Information

Normally, any problem that arises with the sale, service, or repair of your engine can be handled by a Cummins Authorized Repair Location in your area. Refer to the telephone directory yellow pages for the one nearest you. If the problem has **not** been handled satisfactorily, follow the steps outlined below:

1. If the disagreement is with a Dealer, talk to the Cummins Distributor with whom he has his service agreement.
2. If the disagreement is with a Distributor, call the nearest Cummins Division or Regional Office; however, most problems are solved below the Division or Regional office level. Telephone numbers and addresses are listed in this section. Before calling, write down the following information:
 - a. Engine model and serial number
 - b. Type and make of equipment
 - c. Total kilometers [miles] or hours of operation
 - d. Warranty start date
 - e. Nature of problem
 - f. Summary of the current problem arranged in the order of occurrence
 - g. Name and location of the Cummins Distributor or Dealer
12. If a problem can **not** be resolved satisfactorily through your Cummins Authorized Repair Location or Division Office, write to:

Cummins Customer Assistance Center - 41403, Cummins Inc., Box 3005, Columbus, IN 47202-3005

Division and Regional Offices - Locations

<p>Australia Regional Office</p>	<p>Cummins Engine Company Pty. Ltd.</p>	<p>2 Caribbean Drive Scoresby, Victoria 3179 Australia Telephone: (61-3) 9765-3222 FAX: (61-3) 9763-0079 NOTE: This office also serves New Zealand.</p>
<p>Cummins Americas Regional Office</p>	<p>Cummins Americas Inc.</p>	<p>3350 SW 148 Avenue Suite 205 Miramar, FL 33027 Telephone: [1-954] 431-5511 Fax: [1-954] 433-5797 NOTE: This office serves Puerto Rico and South America excluding Brazil.</p>
<p>China Beijing</p>	<p>Cummins (China) Investment Co. Ltd</p>	<p>28F, Tower A, GATEWAY, No.18, Xiaguangli North Road, East Third Ring, Chaoyang District Beijing, Beijing ZIP / Postal Code: 100027 China Telephone: [86-10] 84548888 Telefax: [86-10] 67876347</p>
<p>Brazil</p>	<p>Cummins Brasil Ltda.</p>	<p>Rua Jati, 266 07180-900 Guarulhos Sao Paulo Brazil Phone: [55-11] 6465-9811 Fax: [55-11] 6412-1483</p>
<p>Daventry</p>	<p>Cummins Engine Company Ltd (Africa)</p>	<p>Royal Oak Way South Daventry, Northants ZIP / Postal Code: NN11 5NU United Kingdom Telephone: [44-1327] 886000 Telefax: [44-1327] 886106</p>
<p>Daventry</p>	<p>Cummins Engine Co. Ltd (Serving Czech Republic)</p>	<p>Royal Oak Way South Daventry, Northants ZIP / Postal Code: NN11 5NU United Kingdom Telephone: [44-1327] 886000 Telefax: [44-1327] 886106</p>
<p>Daventry</p>	<p>Cummins Engine Company Ltd (Middle East)</p>	<p>Royal Oak Way South Daventry, Northants ZIP / Postal Code: NN11 5NU United Kingdom Telephone: [44-1327] 886000 Telefax: [44-1327] 886106</p>
<p>Dubai United Arab Emirates</p>	<p>Cummins Middle East FZE</p>	<p>Units ZF 5/6 Jebel Ali Free Zone P.O.Box No 17636 Dubai United Arab Emirates Phone: [971-4] 883 8998 Fax: [971-4] 883 7971</p>

India Pune	Cummins India Ltd.	Kothrud Pune, Maharashtra ZIP / Postal Code: 411029 India Telephone: [91-20] 2538-5435 / 0240 / 1105 Telefax: [91-20] 2538-0125
Korea Seoul	Cummins Korea Ltd.	25th floor, ASEM tower, 159-1, Samsung-Dong Kangnam-ku, Seoul ZIP / Postal Code: 135-798 South Korea Telephone: [82-2] 3420-0901 Telefax: [82-2] 3452-4113 / 539-6569
SLP Mexico	Cummins, S. de R.L. de C.V.	Arquimedes No. 209 Col. Polanco Mexico, Distrito Federal ZIP / Postal Code: 11560 Mexico Telephone: [52-5] 254-3822 / 3783 / 3622 Telefax: [52-5] 254-3645
Russia Moscow	Cummins Engine Company, Inc.	Park Place Office E708, 113/1 Leninskiy Prospect Moscow ZIP / Postal Code: 117198 Russia Telephone: [7-495] 956-51-22 / 23 Telefax: [7-495] 956-53-62
Singapore	Cummins Diesel Sales Corporation	8 Tanjong Penjuru Singapore ZIP / Postal Code: 609019 Singapore Telephone: [65] 6265-0155

Distributors and Branches - United States

Alabama	Birmingham Distributor	Cummins Alabama, Inc. 2200 Pinson Highway P.O. Box 1147 Birmingham, AL 35201 Telephone: (205) 841-0421 FAX: (205) 849-5926
Alabama	Mobile Branch	Cummins Alabama, Inc. 1924 N. Beltline Hwy. Mobile, AL 36601-1598 Telephone: (334) 456-2236 FAX: (334) 452-6419
Alabama	Mobile Onan/Marine Branch	Cummins Alabama, Inc. 3422 Georgia Pacific Avenue Mobile, AL 36617 Telephone: (334) 452-6426 FAX: (334) 473-6657
Alabama	Montgomery Branch	Cummins Alabama, Inc. 2325 West Fairview Avenue Montgomery, AL 36108 Telephone: (205) 263-2594 FAX: (205) 263-2594
Alaska	Anchorage - (Branch of Seattle)	Cummins Northwest, Inc. 2618 Commercial Drive Anchorage, AK 99501-3095 Telephone: (907) 279-7594 FAX: (907) 276-6340
Arizona	Phoenix Distributor and Branch	Cummins Southwest, Inc. 2239 N. Black Canyon Hgwy Phoenix, AZ 85009 Telephone: (602) 252-8021 FAX: (602) 253-6725
Arizona	Tucson Branch	Cummins Southwest, Inc. 1912 West Prince Road Tucson, AZ 85705 Telephone: (520) 887-7440 FAX: (520) 887-4173
Arkansas	Little Rock - (Branch of Memphis)	Cummins Mid-South, Inc. 6600 Interstate 30 Little Rock, AR 72209 Telephone: Sales: (501) 569-5600 Service: (501) 569-5656 Parts: (501) 569-5613 FAX: (501) 565-2199
California	San Leandro Distributor	Cummins West, Inc. 14775 Wicks Blvd. San Leandro, CA 94577-6779 Telephone: (510) 351-6101 FAX: (510) 352-3925

California	Arcata Branch	Cummins West, Inc. 4801 West End Road Arcata, CA 95521 Telephone: (707) 822-7392 FAX: (707) 822-7585
California	Bakersfield Branch	Cummins West, Inc. 4601 East Brundage Lane Bakersfield, CA 93307 Telephone: (805) 325-9404 FAX: (805) 861-8719
California	Fresno Branch	Cummins West, Inc. 2740 Church Avenue Fresno, CA 93706 Telephone: (209) 495-4745 FAX: (209) 486-7402
California	Redding Branch	Cummins West, Inc. 20247 Charlanne Drive Redding, CA 96001 Telephone: (916) 222-4070 FAX: (916) 224-4075
California	Stockton Branch	Cummins West, Inc. 41 West Yokuts Avenue Suite 131 Stockton, CA 95207 Telephone: (209) 473-0386 FAX: (209) 478-2454
California	West Sacramento Branch	Cummins West, Inc. 2661 Evergreen Avenue West Sacramento, CA 95691 Telephone: (916) 371-0630 FAX: (916) 371-2849
California	Los Angeles Distributor	Cummins Cal Pacific Inc. 1939 Deere Avenue (Irvine) Irvine, CA 92606 Telephone: (949) 253-6000 FAX: (949) 253-6080
California	Montebello Branch	Cummins Cal Pacific Inc. 1105 South Greenwood Avenue Montebello, CA 90640 Telephone: (323) 728-8111 FAX: (323) 889-7422
California	Bloomington Branch	Cummins Cal Pacific Inc. 3061 S. Riverside Avenue Bloomington, CA 92377 Telephone: (909) 877-0433 FAX: (909) 877-3787
California	San Diego Branch	Cummins Cal Pacific Inc. 310 N. Johnson Avenue El Cajon, CA 92020 Telephone: (619) 593-3093 FAX: (619) 593-0600

California	Ventura Branch	Cummins Cal-Pacific Inc. 3958 Transport St. Ventura, CA 93003 Telephone: (805) 644-7281 FAX: (805) 644-7284
Colorado	Denver Distributor	Cummins Rocky Mountain, Inc. 5100 East 58th Avenue Commerce City, CO 80022 Telephone: (303) 287-0201 FAX: (303) 288-7080
Colorado	Denver Onan/Industrial Branch	Cummins Rocky Mountain, Inc. 5100 East 58th Ave. Commerce City, CO 80022 Telephone: (303) 286-7697 FAX: (303) 287-4837
Colorado	Durango Branch	Cummins Rocky Mountain, Inc. 13595 County Road 213 Durango, CO 81301 Telephone: (970) 259-7470 FAX: (970) 259-7482
Colorado	Grand Junction Branch	Cummins Rocky Mountain, Inc. 2380 U.S. Highway 6 & 50 P.O. Box 339 Grand Junction, CO 81501 Telephone: (303) 242-5776 FAX: (303) 243-5495
Connecticut	Rocky Hill - (Branch of Bronx)	Cummins Metropower, Inc. 914 Cromwell Ave. Rocky Hill, CT 06067 Telephone: (860) 529-7474 FAX: (860) 529-7524
Florida	Tampa Distributor	Cummins Southeastern Power, Inc. Corporate Office 5421 N. 59th Street Tampa, FL 33610 Telephone: (813) 621-7202 FAX: (813) 621-8250
Florida	Ft. Myers Branch	Cummins Southeastern Power, Inc. 2671 Edison Avenue Ft. Myers, FL 33902 Telephone: (941) 337-1211 FAX: (941) 337-5374
Florida	Jacksonville Branch	Cummins Southeastern Power, Inc. 755 Pickettville Rd. Jacksonville, FL 32220 Telephone: (904) 378-1902 FAX: (904) 378-1904
Florida	Hialeah (Miami) Branch	Cummins Southeastern Power, Inc. 9900 N.W. 77th Avenue Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 FAX: (305) 557-2992

Florida	Ocala Branch	Cummins Southeastern Power 321 Southwest 52nd Ave. Ocala, FL 34474-1892 Telephone: (352) 861-1122 FAX: (352) 861-1130
Florida	Orlando Branch	Cummins Southeastern Power, Inc. 4020 North Orange Blossom Trail Orlando, FL 32810 Telephone: (407) 298-2080 FAX: (407) 290-8727
Florida	Tampa Branch	Cummins Southeastern Power, Inc. 5912 E. Hillsborough Avenue Tampa, FL 33610 Telephone: (813) 626-1101 FAX: (813) 628-4183
Georgia	Atlanta Distributor	Cummins South, Inc. 5125 Georgia Highway 85 College Park, GA 30349 Telephone: (404) 763-0151 FAX: (404) 766-2132
Georgia	Albany Branch	Cummins South, Inc. 1915 W. Oakridge Drive Albany, GA 31707-4938 Telephone: (912) 888-6210 FAX: (912) 883-1670
Georgia	Atlanta Branch	Cummins South, Inc. 100 University Avenue, S.W. Atlanta, GA 30315-2202 Telephone: (404) 527-7800 FAX: (404) 527-7832
Georgia	Augusta Branch	Cummins South, Inc. 1255 New Savannah Road Augusta, GA 30901-3891 Telephone: (706) 722-8825 FAX: (706) 722-7553
Georgia	Savannah Branch	Cummins South, Inc. 8 Interchange Court Savannah, GA 31401-1627 Telephone: (912) 232-5565 FAX: (912) 232-5145
Hawaii	Kapolei Distributor	Cummins Hawaii Diesel Power, Inc. 91-230 Kalaeloa Blvd. Kapolei, HI 96707 Telephone: (808) 682-8110 FAX: (808) 682-8477
Idaho	Boise - (Branch of Salt Lake City)	Cummins Intermountain, Inc. 2851 Federal Way City Boise, ID 83705 Telephone: (208) 336-5000 FAX: (208) 338-5436

Idaho	Pocatello - (Branch of Salt Lake City)	Cummins Intermountain, Inc. 14299 Highway 30 West Pocatello, ID 83201 Telephone: (208) 234-1661 FAX: (208) 234-1662
Illinois	Chicago Distributor	Cummins Northern Illinois, Inc. 7145 Santa Fe Drive Hodgkins, IL 60525 Telephone: (708) 579-9222 FAX: (708) 352-7547
Illinois	Bloomington-Normal - (Branch of Indianapolis)	Cummins Mid-States Power, Inc. (at U.S. 51 N and I-55) 414 W. Northtown Road Bloomington-Normal, IL 61761 Telephone: (309) 452-4454 FAX: (309) 452-1642
Illinois	Onan Branch	Cummins/Onan Northern Illinois 8745 W. 82nd Place Justin, IL 60458 Telephone: (708) 563-7070 FAX: (708) 563-7095
Illinois	Harrisburg (Branch of St. Louis)	Cummins Gateway, Inc. Highway 45 North Harrisburg, IL 62946 Telephone: (618) 273-4138 FAX: (618) 273-4531
Illinois	Rock Island - (Branch of Omaha)	Cummins Great Plains Diesel, Inc. 7820 - 42nd Street West Rock Island, IL 61204 Telephone: (309) 787-4300 FAX: (309) 787-4397
Illinois	Onan Branch	Cummins Gateway, Inc. #1 Extra Mile Drive Collinsville, IL 62234 Telephone: (618) 345-0123 FAX: (314) 531-6604
Indiana	Indianapolis Distributor	Cummins Mid-States Power, Inc. P.O. Box 42917 3762 West Morris Street Indianapolis, IN 46242-0917 Telephone: (317) 243-7979 FAX: (317) 240-1925
Indiana	Evansville - (Branch of Louisville)	Cummins Cumberland, Inc. 7901 Highway 41 North Evansville, IN 47711 Telephone: (812) 867-4400 FAX: (812) 421-3282
Indiana	Ft. Wayne Branch	Cummins Mid-States Power, Inc. 3415 Coliseum Blvd. West (At Jct. I-69 & 30/33) Ft. Wayne, IN 46808 Telephone: (219) 482-3691 FAX: (219) 484-8930

Indiana	Gary - (Branch of Chicago)	Cummins Northern Illinois, Inc. 1440 Texas Street Gary, IN 46402 Telephone: (219) 885-5591 FAX: (219) 883-4817
Indiana	Indianapolis Branch	Cummins Mid-States Power, Inc. P. O. Box 42917 3621 West Morris Street Indianapolis, IN 46242-0917 Telephone: (317) 244-7251 FAX: (317) 240-1215
Indiana	Onan Branch	Mid-States Power, Inc. 4301 W. Morris Street P.O. Box 42917 Indianapolis, IN 46240-0917 Telephone: (317) 240-1967 FAX: (317) 240-1975
Iowa	Cedar Rapids - (Branch of Omaha)	Cummins Great Plains Diesel, Inc. 625 - 33rd Avenue SW Cedar Rapids, IA 52406 Telephone: (319) 366-7537 (24 hours) FAX: (319) 366-7562
Iowa	Des Moines - (Branch of Omaha)	Cummins Great Plains Diesel, Inc. 1680 N.E. 51st Avenue P.O. Box B Des Moines, IA 50313 Telephone: (515) 262-9591 Parts: (515) 262-9744 FAX: (515) 262-0626
Iowa	Des Moines - (Branch of Omaha)	Midwestern Power Products Division of Cummins Great Plains Diesel, Inc. 5194 N.E. 17th Street Des Moines, IA 50313 Telephone: (515) 264-1650 FAX: (515) 264-1651
Kansas	Colby - (Branch of Kansas City, Missouri)	Cummins Mid-America, LLC. 1880 South Range Colby, KS 67701 Telephone: (785) 462-3945 FAX: (785) 462-3970
Kansas	Garden City - (Branch of Kansas City, Missouri)	Cummins Mid-America, Inc. 1285 Acraway Garden City, KS 67846 Telephone: (316) 275-2277 FAX: (316) 275-2533
Kansas	Wichita - (Branch of Kansas City, Missouri)	Cummins Mid-America, Inc. 5101 North Broadway Wichita, KS 67201 Telephone: (316) 838-0875 FAX: (316) 838-0704

Kentucky	Louisville Distributor	Cummins Cumberland, Inc. (Corporate Office) 2301 Nelsonville Parkway Louisville, KY 40223 Telephone: (502) 254-3363 FAX: (502) 254-9272
Kentucky	Hazard Branch	Cummins Cumberland, Inc. Highway 15 South P.O. Box 510 Hazard, KY 41701 Telephone: (606) 436-5718 FAX: (606) 436-5038
Kentucky	Louisville Branch	Cummins Cumberland, Inc. 9820 Bluegrass Parkway Louisville, KY 40299 Telephone: (502) 491-4263 FAX: (502) 499-0896
Louisiana	Morgan City - (Branch of Memphis)	Cummins Mid-South, Inc. Hwy. 90 East P.O. Box 1229 Amelia, LA 70340 Telephone: (504) 631-0576 FAX: (504) 631-0081
Louisiana	New Orleans - (Branch of Memphis)	Cummins Mid-South, Inc. 110 E. Airline Highway Kenner, LA 70062 Telephone: (504) 468-3535 FAX: (504) 465-3408
Maine	Bangor (Branch of Boston)	Cummins Northeast, Inc. 221 Hammond Street Bangor, ME 04401 Telephone: (207) 941-1061 FAX: (207) 945-3170
Maine	Scarborough - (Branch of Boston)	Cummins Northeast, Inc. 10 Gibson Road Scarborough, ME 04074 Telephone: (207) 883-8155 FAX: (207) 883-5526
Maryland	Baltimore Distributor	Cummins Power Systems, Inc. 1907 Parkwood Drive MD 21061 Telephone: (410) 590-8700 FAX: (410) 590-8723
Massachusetts	Boston Distributor	Cummins Northeast, Inc. 100 Allied Drive Dedham, MA 02026 Telephone: (781) 329-1750 FAX: (781) 329-4428
Massachusetts	Springfield Branch	Cummins Northeast, Inc. 177 Rocus Street Springfield, MA 01104 Telephone: (413) 737-2659 FAX: (413) 731-1082

Mexico	Tijuana - (Branch of Los Angeles)	Distribuidora Cummins De Baja Blvd. 3ra. Oeste No. 17523 Fracc. Industrial Garita de Otay C.P. 22400 Tijuana, Baja California Mexico Telephone: 011-52-66-238433 FAX: 011-52-66-238649
Michigan	Detroit (Novi) Distributor	Cummins Michigan, Inc. 41216 Vincenti Court Novi, MI 48375 Telephone: (248) 478-9700 FAX: (248) 478-1570
Michigan	Blissfield, Michigan	Diesel Fuel Systems, Inc. Subsidiary of Cummins Michigan Inc. 211 N. Jipson Street Blissfield, MI 49228 Telephone: (517) 486-4324 FAX: (517) 486-3614
Michigan	Dearborn Branch	Cummins Michigan, Inc. 3760 Wyoming Avenue Dearborn, MI 48120 Telephone: (313) 843-6200 FAX: (313) 843-6070
Michigan	Grand Rapids Branch	Cummins Michigan, Inc. 3715 Clay Avenue, S.W. Grand Rapids, MI 49508 Telephone: (616) 538-2250 FAX: (616) 538-3830
Michigan	Grand Rapids Branch	Standby Power, Inc. 7580 Expressway Drive S.W. Grand Rapids, MI 49548 Telephone: (616) 281-2211 FAX: (616) 281-3177
Michigan	Iron Mountain - (Branch of De Pere)	Cummins Great Lakes, Inc. 1901 Stevenson Avenue Iron Mountain, MI 49801 Telephone: (906) 774-2424 (800) 236-2424 FAX: (906) 774-1190
Michigan	Novi Branch	Cummins Michigan, Inc. 25100 Novi Road Novi, MI 48375 Telephone: (248) 380-4300 FAX: (248) 380-0910
Michigan	Power Products (Branch of Detroit)	Cummins Michigan, Inc. 41326 Vincenti Ct. Novi, MI 48375 Telephone: (248) 426-9300 FAX: (248) 473-8560
Michigan	Saginaw Branch	Cummins Michigan, Inc. 722 N. Outer Drive Saginaw, MI 48605 Telephone: (517) 752-5200 FAX: (517) 752-4194

Michigan	Standby Power - (Branch of Detroit)	Cummins Michigan, Inc. 12130 Dixie Redford, MI 48239 Telephone: (313) 538-0200 FAX: (313) 538-3966
Minnesota	St. Paul Distributor	Cummins North Central, Inc. 3030 Centre Pointe Drive Suite 500 Roseville, MN 55113 Telephone: (651) 636-1000 FAX: (651) 638-2442
Minnesota	Duluth Branch	Cummins Diesel Sales, Inc. 3115 Truck Center Drive Duluth, MN 55806-1786 Telephone: (218) 628-3641 FAX: (218) 628-0488
Minnesota	St. Paul Branch	Cummins North Central, Inc. 2690 Cleveland Ave. North St. Paul, MN 55113 Telephone: (651) 636-1000 FAX: (651) 638-2497
Mississippi	Jackson - (Branch of Memphis)	Cummins Mid-South, Inc. 325 New Highway 49 South Jackson, MS 39288-4224 Telephone: Admin.: (601) 932-7016 Parts: (601) 932-2720 Service: (601) 939-1800 FAX: (601) 932-7399
Missouri	Kansas City Distributor and Branch	Cummins Mid-America, Inc. 8201 NE Parvin Road Kansas City, MO 64161 Telephone: (816) 414-8200 FAX: (816) 414-8299
Missouri	Joplin Branch	Cummins Mid-America, Inc. 3507 East 20th Street Joplin, MO 64801 Telephone: (417) 623-1661 FAX: (417) 623-1817
Missouri	Springfield Branch	Cummins Mid-America, Inc. 3637 East Kearney Springfield, MO 65803 Telephone: (417) 862-0777 FAX: (417) 862-4429
Missouri	St. Louis Distributor	Cummins Gateway, Inc. 7210 Hall Street St. Louis, MO 63147 Telephone: (314) 389-5400 FAX: (314) 389-9671
Missouri	Columbia Branch	Cummins Gateway, Inc. 5221 Highway 763 North Columbia, MO 65202 Telephone: (314) 449-3711 FAX: (314) 449-3712

Missouri	Sikeston Branch	Cummins Gateway, Inc. 101 Keystone Drive Sikeston, MO 63801 Telephone: (314) 472-0303 FAX: (314) 472-0306
Missouri	Industrial Power Branch	Cummins Gateway, Inc. 3256 E. Outer Road Scott City, MO 63788 Telephone: (573) 335-9399 FAX: (573) 335-7062
Montana	Billings - (Branch of Denver)	Cummins Rocky Mountain, Inc. 5151 Midland Road Billings, MT 59101 Telephone: (406) 245-4194 FAX: (406) 245-7923
Montana	Great Falls - (Branch of Denver)	Cummins Rocky Mountain, Inc. 415 Vaughn Road Great Falls, MT 59404 Telephone: (406) 452-8561 FAX: (406) 452-9911
Montana	Missoula - (Branch of Seattle)	Cummins Northwest, Inc. 4950 North Reserve Street Missoula, MT 59802-1498 Telephone: (406) 728-1300 FAX: (406) 728-8523
Nebraska	Omaha Distributor and Branch	Cummins Great Plains Diesel, Inc. 5515 Center Street P.O. Box 6068 Omaha, NE 68106 Telephone: (402) 551-7678 (24 Hours) FAX: (402) 551-1952
Nebraska	Kearney Branch	Cummins Great Plains Diesel, Inc. 515 Central Avenue Kearney, NE 68847 Telephone: (308) 234-1994 FAX: (308) 234-5776
Nevada	Elko - (Branch of Salt Lake City)	Cummins Intermountain, Inc. 5370 East Idaho Street Elko, NV 89801 Telephone: (775) 738-6405 FAX: (775) 738-1719
Nevada	Las Vegas - (Branch of Salt Lake City)	Cummins Intermountain, Inc. 2750 Losee Road North Las Vegas, NV 89030 Telephone: (702) 399-2339 FAX: (702) 399-7457
Nevada	Sparks - (Branch of Salt Lake City)	Cummins Intermountain, Inc. 150 Glendale Avenue Sparks, NV 89431 Telephone: (775) 331-4983 FAX: (775) 331-7429

New Jersey	Newark - (Branch of Bronx)	Cummins Metropower, Inc. 41-85 Doremus Ave. Newark, NJ 07105 Telephone: (973) 491-0100 FAX: (973) 578-8873
New Mexico	Albuquerque - (Branch of Phoenix)	Cummins Southwest, Inc. 1921 Broadway N.E. Albuquerque, NM 87102 Telephone: (505) 247-2441 FAX: (505) 842-0436
New Mexico	Farmington - (Branch of Phoenix)	Cummins Southwest, Inc. 1101 North Troy King Road Farmington, NM 87401 Telephone: (505) 327-7331 FAX: (505) 326-2948
New York	Bronx Distributor	Cummins Metropower, Inc. 890 Zerega Avenue Bronx, NY 10473 Telephone: (718) 892-2400 FAX: (718) 892-0055
New York	Albany - (Branch of Boston)	Cummins Northeast, Inc. 101 Railroad Avenue Albany, NY 12205 Telephone: (518) 459-1710 FAX: (518) 459-7815
New York	Buffalo - (Branch of Boston)	Cummins Northeast, Inc. 480 Lawrence Bell Dr. Williamsville, NY 14221-7090 Telephone: (716) 631-3211 FAX: (716) 626-0799
New York	Syracuse - (Branch of Boston)	Cummins Northeast, Inc. 29 Eastern Avenue Syracuse, NY 13211 Telephone: (315) 437-2751 FAX: (315) 437-8141
North Carolina	Charlotte Distributor	Cummins Atlantic, Inc. 11101 Nations Ford Road (28273) P.O. Box 240729 Charlotte, NC 28224-0729 Telephone: (704) 588-1240 FAX: (704) 587-4870
North Carolina	Charlotte Branch	Cummins Atlantic, Inc. 3700 North Interstate 85 Charlotte, NC 28206 Telephone: (704) 596-7690 FAX: (704) 596-3038
North Carolina	Greensboro Branch	Cummins Atlantic, Inc. 513 Preddy Boulevard (27406) P.O. Box 22066 Greensboro, NC 27420-2066 Telephone: (336) 275-4531 FAX: (336) 275-8304

North Carolina	Wilson Branch	Cummins Atlantic, Inc. 1514 Cargill Avenue (27893) P.O. Box 1177 Wilson, NC 27894-1117 Telephone: (252) 237-9111 FAX: (252) 237-9132
North Dakota	Fargo - (Branch of St. Paul)	Cummins North Central, Inc. 3801 - 34th Ave. SW Fargo, ND 58104 Telephone: (701) 282-2466 FAX: (701) 277-5399
North Dakota	Grand Forks - (Branch of St. Paul)	Cummins North Central, Inc. 4728 Gateway Drive Grand Forks, ND 58201 Telephone: (701) 775-8197 FAX: (701) 775-4833
North Dakota	Minot - (Branch of St. Paul)	Cummins North Central, Inc. 1501 - 20th Avenue, S.E. Minot, ND 58702 Telephone: (701) 852-3585 FAX: (701) 852-3588
Ohio	Columbus Distributor and Branch	Cummins Interstate Power, Inc. 4000 Lyman Drive Hilliard (Columbus), OH 43026 Telephone: (614) 771-1000 FAX: (614) 771-0769
Ohio	Columbus Distributor	Cummins Interstate Power, Inc. 2297 Southwest Blvd., Suite K Grove City, OH 43123 Telephone: (614) 771-1000 FAX: (614) 527-2576
Ohio	Cincinnati Branch	Cummins Interstate Power, Inc. 10470 Evendale Drive Cincinnati, OH 45241 Telephone: (513) 563-6670 FAX: (513) 563-0594
Ohio	Cleveland Branch	Cummins Interstate Power, Inc. 7585 Northfield Road Cleveland, OH 44146 Telephone: (440) 439-6800 FAX: (440) 439-7390
Ohio	Strasburg Branch	Cummins Interstate Power, Inc. 777 South Wooster Avenue Strasburg, OH 44680 Telephone: (216) 878-5511 FAX: (216) 878-7666
Ohio	Toledo Branch	Cummins Interstate Power, Inc. 801 Illinois Avenue Maumee (Toledo), OH 43537 Telephone: (419) 893-8711 FAX: (419) 893-5362

Ohio	Youngstown Branch	Cummins Interstate Power, Inc. 7145 Masury Road Hubbard (Youngstown), OH 44425 Telephone: (216) 534-1935 FAX: (216) 534-5606
Oklahoma	Oklahoma City - (Branch of Arlington)	Cummins Southern Plains, Inc. 5800 West Reno Oklahoma City, OK 73127 Telephone: (405) 946-4481 (24 hours) FAX: (405) 946-3336
Oklahoma	Tulsa - (Branch of Arlington)	Cummins Southern Plains, Inc. 16525 East Skelly Drive Tulsa, OK 74116 Telephone: (918) 234-3240 FAX: (918) 234-2342
Oregon	Bend - (Branch of Seattle)	Cummins Northwest, Inc. 3500 N. Highway 97 (97701-5729) P.O. Box 309 Bend, OR 97709-0309 Telephone: (541) 389-1900 FAX: (541) 389-1909
Oregon	Coburg/Eugene - (Branch of Seattle)	Cummins Northwest, Inc. 91201 Industrial Parkway Coburg, OR 97401 (Mailing Address) P.O. Box 10877 Eugene, OR 97440-2887 Telephone: (541) 687-0000 FAX: (541) 687-1977
Oregon	Medford - (Branch of Seattle)	Cummins Northwest, Inc. 4045 Crater Lake Highway Medford, OR 97504-9796 Telephone: (541) 779-0151 FAX: (541) 772-2395
Oregon	Pendleton - (Branch of Seattle)	Cummins Northwest, Inc. 223 S.W. 23rd Street Pendleton, OR 97801-1810 Telephone: (541) 276-2561 FAX: (541) 276-2564
Oregon	Portland - (Branch of Seattle)	Cummins Northwest, Inc. 4711 N. Basin Avenue P. O. Box 2710 (97208-2710) Portland, OR 97217-3557 Telephone: (503) 289-0900 FAX: (503) 286-5938
Pennsylvania	Philadelphia Distributor	Cummins Power Systems, Inc. 2727 Ford Road Bristol, PA 19007 Telephone: (215) 785-6005 and (609) 563-0005 FAX: (215) 785-4085

Pennsylvania	Bristol Branch	Cummins Power Systems, Inc. 2727 Ford Road Bristol, PA 19007 Telephone: (215) 785-6005 and (609) 563-0005 FAX: (215) 785-4728
Pennsylvania	Pittsburgh Branch	Cummins Power Systems, Inc. 3 Alpha Drive Pittsburgh, PA 15238-2901 Telephone: (412) 820-8300 FAX: (412) 820-8308
Pennsylvania	Harrisburg Branch	Cummins Power Systems, Inc. 4499 Lewis Road Harrisburg, PA 17111-2541 Telephone: (717) 564-1344 FAX: (717) 558-8217
Puerto Rico	Puerto Nuevo - (Branch of Tampa)	Cummins Diesel Power, Inc. #31 Calle "C" El Matadero Puerto Nuevo, Puerto Rico 00920 Telephone: (787) 793-0300 FAX: (787) 793-1072
South Carolina	Charleston - (Branch of Charlotte)	Cummins Atlantic, Inc. 3028 West Montague Avenue Charleston, SC 29418-5593 Telephone: (843) 554-5112 FAX: (843) 745-0745
South Carolina	Charleston - (Branch of Charlotte)	Cummins Atlantic Inc. 231 Farmington Road Charleston, SC 29483 Telephone: (843) 851-9819 FAX: (843) 875-4338
South Carolina	Columbia - (Branch of Charlotte)	Cummins Atlantic, Inc. 1233 Bluff Road (29201) P.O. Box 13543 Columbia, SC 29201-3543 Telephone: (803) 799-2410 FAX: (803) 779-3427
South Dakota	Sioux Falls - (Branch of Omaha)	Cummins Great Plains Diesel, Inc. 701 East 54th Street North Sioux Falls, SD 57104 Telephone: (605) 336-1715 FAX: (605) 336-1748
Tennessee	Memphis Distributor & Distribution Center	Cummins Mid-South, Inc. 666 Riverside Drive Memphis, TN 38703 Telephone: (901) 577-0666 FAX: (901) 522-8758
Tennessee	Chattanooga - (Branch of Atlanta)	Cummins South, Inc. 1509 East 26th Street Chattanooga, TN 37407-1095 Telephone: (615) 629-1447 FAX: (615) 629-1494

Tennessee	Knoxville - (Branch of Louisville)	Cummins Cumberland, Inc. 1211 Ault Road Knoxville, TN 37914 Telephone: (423) 523-0446 FAX: (423) 523-0343
Tennessee	Memphis Branch	Cummins Mid-South, Inc. 1784 E. Brooks Road Memphis, TN 38116 Telephone: Sales/Admin.: (901) 345-7424 Parts: (901) 345-1784 Service: (901) 345-6185 FAX: (901) 346-4735
Tennessee	Nashville - (Branch of Louisville)	Cummins Cumberland, Inc. 706 Spence Lane Nashville, TN 37217 Telephone: (615) 366-4341 FAX: (615) 366-5693
Texas	Arlington Distributor	Cummins Southern Plains, Inc. 600 N Watson Road Arlington, TX 76004-3027 Telephone: (817) 640-6801 FAX: (817) 640-6852
Texas	Amarillo Branch	Cummins Southern Plains, Inc. 5224 Interstate 40 - Expressway East P.O. Box 31570 Amarillo, TX 79120-1570 Telephone: (806) 373-3793 (24 hours) FAX: (806) 372-8547
Texas	Dallas Branch	Cummins Southern Plains, Inc. 3707 Irving Boulevard Dallas, TX 75247 Telephone: (214) 631-6400 (24 hours) FAX: (214) 631-2322
Texas	El Paso - (Branch of Phoenix)	Cummins Southwest, Inc. 14333 Gateway West El Paso, TX 79927 Telephone: (915) 852-4200 FAX: (915) 852-3295
Texas	Fort Worth Branch	Cummins Southern Plains, Inc. 3250 North Freeway Fort Worth, TX 76111 Telephone: (817) 624-2107 (24 hours) FAX: (817) 624-3296
Texas	Houston Branch	Cummins Southern Plains, Inc. 4750 Homestead Road P.O. Box 1367 Houston, TX 77251-1367 Telephone: (713) 675-7421 (24 hours) FAX: (713) 675-1515

Texas	Mesquite Branch	Cummins Southern Plains, Inc. 2615 Big Town Blvd. Mesquite, TX 75150 Telephone: (214) 321-5555 (24 hours) FAX: (214) 328-2732
Texas	Odessa Branch	Cummins Southern Plains, Inc. 1210 South Grandview P.O. Box 633 Odessa, TX 79760-0633 Telephone: (915) 332-9121 (24 hours) FAX: (915) 333-4655
Texas	San Antonio Branch	Cummins Southern Plains, Inc. 6226 Pan Am Expressway North P.O. Box 18385 San Antonio, TX 78218-0385 Telephone: (512) 655-5420 (24 hours) FAX: (512) 655-3865
Texas	Houston Onan Branch	Southern Plains Power A Division of Cummins Southern Plains 1155 West Loop North Houston, TX 77055 Telephone: (713) 956-0020 FAX: (713) 956-0266
Utah	Salt Lake City Distributor	Cummins Intermountain, Inc. 1030 South 300 West Salt Lake City, UT 84101 Telephone: (801) 355-6500 FAX: (801) 524-1351
Utah	Vernal Branch	Cummins Intermountain, Inc. 1435 East 335 South Vernal, UT 84078 Telephone: (435) 789-5732 FAX: (435) 789-2853
Virginia	Cloverdale - (Branch of Charlotte)	Cummins Atlantic, Inc. 263 Simmons Drive Cloverdale, VA 24077 Telephone: (540) 966-3169 FAX: (540) 966-3749
Virginia	Richmond - (Branch of Charlotte)	Cummins Atlantic, Inc. 3900 Deepwater Terminal Road Richmond, VA 23234 Telephone: (804) 232-7891 FAX: (804) 232-7428
Virginia	Tidewater - (Branch of Charlotte)	Cummins Atlantic, Inc. Atlantic Power Generation 3729 Holland Blvd. Chesapeake, VA 23323 Telephone: (757) 485-4848 FAX: (757) 485-5085
Washington	Seattle Distributor	Cummins Northwest, Inc. 811 S.W. Grady Way (98055-2944) P.O. Box 9811 Renton, WA 98057-9811 Telephone: (425) 235-3400 FAX: (425) 235-8202

Washington	Chehalis Branch	Cummins Northwest, Inc. 926 N.W. Maryland Chehalis, WA 98532-0339 Telephone: (360) 748-8841 FAX: (360) 748-8843
Washington	Spokane Branch	Cummins Northwest, Inc. 11134 W. Westbow Blvd. Spokane, WA 99204 Telephone: (509) 455-4411 FAX: (509) 624-4681
Washington	Tacoma Branch	Cummins Northwest, Inc. 3701 Pacific Highway East Tacoma, WA 98424-1135 Telephone: (253) 922-2191 FAX: (253) 922-2379
Washington	Yakima Branch	Cummins Northwest, Inc. 1905 East Central Avenue (98901-3609) P.O. Box 9129 Yakima, WA 98909-0129 Telephone: (509) 248-9033 FAX: (509) 248-9035
West Virginia	Charleston - (Branch of Louisville)	Cummins Cumberland, Inc. 3100 MacCorkle Ave. SW P.O. Box 8456 South Charleston, WV 25303 Telephone: (304) 744-6373 FAX: (304) 744-8605
West Virginia	Fairmont - (Branch of Louisville)	Cummins Cumberland, Inc. South Fairmount Exit, I-79 145 Middletown Road Fairmont, WV 26554 Telephone: (304) 367-0196 FAX: (304) 367-1077
Wisconsin	DePere Distributor	Cummins Great Lakes, Inc. Corporate Office 875 Lawrence Drive P.O. Box 5070 DePere, WI 54115-5070 Telephone: (920) 337-1991 FAX: (920) 337-9746
Wisconsin	Chippewa Falls Branch	Cummins Great Lakes, Inc. 2030 St. Highway 53 Chippewa Falls, WI 54729 Telephone: (715) 720-0680 FAX: (715) 720-0685
Wisconsin	DePere Branch	Cummins Great Lakes, Inc. 939 Lawrence Drive P. O. Box 5070 DePere, WI 54115-5070 Telephone: (920) 336-9631 (800) 236-1191 FAX: (920) 336-8984

Wisconsin	Milwaukee Branch	Cummins Great Lakes, Inc. 9401 South 13th Street P.O. Box D Oak Creek, WI 53154 Telephone: (414) 768-7400 (800) 472-8283 FAX: (414) 768-9441
Wisconsin	Wausau Branch	Cummins Great Lakes, Inc. 4703 Rib Mountain Drive Wausau, WI 54401 Telephone: (715) 359-6888 (800) 236-3744 FAX: (715) 359-3744
Wyoming	Gillette - (Branch of Denver)	Cummins Rocky Mountain, Inc. 2700 Hwy. 14 & 16 North P.O. Box 1207 (82717) Gillette, WY 82716 Telephone: (307) 682-9611 FAX: (307) 682-8242
Wyoming	Rock Springs - (Branch of Salt Lake City)	Cummins Intermountain, Inc. 2000 Foothill Blvd. P.O. Box 1634 Rock Springs, WY 82901 Telephone: (307) 362-5168 FAX: (307) 362-5171

Distributors and Branches - Canada

Alberta	Edmonton Distributor and Branch	Cummins Alberta 11751 - 181 Street Edmonton, AB T5S 2K5 Telephone: (780) 455-2151 FAX: (780) 454-9512
Alberta	Calgary Branch	Cummins Alberta 4887 - 35th Street S.E. Calgary, Alberta T2B 3H6, Canada Telephone: (403) 569-1122 FAX: (403) 569-0027
Alberta	Grande Prairie	Cummins Alberta - Grande Praire RR2, Site 9, Box 22 Sexsmith, AB CN T0H 3C0 Telephone: (780) 568-3359 FAX: (780) 568-2263
Alberta	Hinton Branch	Cummins Alberta 135 Veats Avenue Hinton, Alberta T7V 1S8, Canada Telephone: (780) 865-5111 FAX: (780) 865-5714
Alberta	Lethbridge Branch	Cummins Alberta 240 - 24th Street North Lethbridge, Alberta T1H 3T8, Canada Telephone: (403) 329-6144 FAX: (403) 320-5383
British Columbia	Vancouver Distributor	Cummins British Columbia 18452 - 96th Avenue Surrey, B.C., Canada V4N 3P8 Telephone: (604) 882-5000 FAX: (604) 882-5080
British Columbia	Kamloops Branch	Cummins British Columbia 976 Laval Crescent Kamloops, B.C. Canada V2C 5P5 Telephone: (250) 828-2388 FAX: (250) 828-6713
British Columbia	Prince George Branch	Cummins British Columbia 102- 3851- 18th Avenue Prince George, B.C. V2N 1B1 Telephone: (250) 564-9111 FAX: (250) 564-5853
British Columbia	Sparwood Branch	Cummins British Columbia 731 Douglas Fir Road Sparwood, B.C. VOB 2G0, Canada Telephone: (250) 425-0522 FAX: (250) 425-0323
British Columbia	Tumbler Ridge Branch	Cummins British Columbia Industrial Site, Box 226 Tumbler Ridge, B.C. Canada VOC 2W0 Telephone: (250) 242-4217 FAX: (250) 242-4906

Manitoba	Winnipeg Distributor	Cummins Mid-Canada Ltd. 489 Oak Point Road P.O. Box 1860 Winnipeg, MB R3C 3R1, Canada Telephone: (204) 632-5470 FAX: (204) 697-0267
New Brunswick	Fredericton - (Branch of Montreal)	Cummins Eastern Canada, Inc. R.R.#1 Doak Road P.O. Box 1178, Station 'A' Fredericton, New Brunswick E3B 4X2, Canada Telephone: (506) 451-1929 FAX: (506) 451-1921
Newfoundland	St. John's - (Branch of Montreal)	Cummins Eastern Canada, Inc. 122 Clyde Avenue Donovans Industrial Park Mount Pearl, Newfoundland A1N 2C2 Canada Telephone: (709) 747-0176 FAX: (709) 747-2283
Newfoundland	Wabush - (Branch of Montreal)	Cummins Eastern Canada, Inc. Wabush Industrial Park Wabush, Newfoundland A0R 1B0 Telephone: (709) 282-3626 FAX: (709) 282-3108
Nova Scotia	Halifax - (Branch of Montreal)	Cummins Eastern Canada, Inc. 50 Simmonds Drive Dartmouth, Nova Scotia B3B 1R3 Telephone: (902) 468-7938 FAX: (902) 468-5177 Parts: (902) 468-6560
Ontario	Toronto Distributor	Cummins Ontario, Inc. 7175 Pacific Circle Mississauga, ON L5T 2A5 Telephone: (905) 795-0050 FAX: (905) 795-0021
Ontario	Kenora - (Branch of Winnipeg)	Cummins Mid-Canada Ltd. Highway 17 East P.O. Box 8 Kenora, Ontario P9N 3X1 Telephone: (807) 548-1941 FAX: (807) 548-8302
Ontario	Ottawa Branch	Cummins Ontario Inc. 3189 Swansea Crescent Ottawa, Ontario K1G 3W5, Telephone: (613) 736-1146 FAX: (613) 736-1202
Ontario	Thunder Bay Branch	Cummins Ontario Inc. 1400 W. Walsh Street Thunder Bay Ontario P7E 4X4 Telephone: (807) 577-7561 FAX: (807) 577-1727

Ontario	Whitby Branch	Cummins Ontario Inc. 1311 Hopkins Street Whitby, Ontario L1N 2C2, Canada Telephone: (905) 668-6886 FAX: (905) 668-1375
Quebec	Montreal Distributor	Cummins Eastern Canada, Inc. 7200 Trans Canada Highway Pointe Claire, Quebec H9R 1C2, Telephone: (514) 695-8410 FAX: (514) 695-8917
Quebec	Montreal Branch	Cummins Eastern Canada, Inc. 7200 Trans Canada Highway Pointe Claire, Québec H9R 1C2, Canada Telephone: (514) 695-8410 Sales: (514) 695-4555 Parts: (514) 694-5880 FAX: (514) 695-8917
Quebec	Dorval Onan Branch	Cummins, Eastern Canada, Inc. 580 Lepihe Dorval, Quebec H9H 1G2 Telephone: (514) 631-5000 FAX: (514) 631-0104
Quebec	Quebec City Branch	Cummins Diesel Branch of Cummins Americas, Inc. 2575 Dalton Street Ste. Foy, Quebec G1P 3S7 Telephone: (418) 653-6411 FAX: (418) 653-5844
Quebec	Val D'Or Branch	Cummins, Eastern Canada, Inc. 1025 Rue Del Val D'Or, Quebec 59P 4P6 Telephone: (819) 825-0993 FAX: (819) 825-8488
Saskatchewan	Lloydminster - (Branch of Winnipeg)	Cummins Mid-Canada Ltd. 4005 52nd Lloydminster, SK S9V 0Y9 Telephone: (305) 825-2062 FAX: (305) 825-6702
Saskatchewan	Regina - (Branch of Winnipeg)	Cummins Mid-Canada Ltd. 110 Kress Street P.O. Box 98 Regina, SK S4P 2Z5 Telephone: (306) 721-9710 FAX: (306) 721-2962
Saskatchewan	Saskatoon - (Branch of Winnipeg)	Cummins Mid-Canada, Ltd. 3001 Faithful Avenue P.O. Box 7679 Saskatoon, SK S7K 4R4, Canada Telephone: (306) 933-4022 FAX: (306) 242-1722

Distributors and Branches - Australia

Branches:	Gepps Cross	Cummins Engine Company, Pty. Ltd. P.O. Box 108 Blair Athol, 5084 South Australia, Australia Location: 45-49 Cavan Road Gepps Cross, 5094 Telephone: (61-8) 8262-5211
Branches:	Dosra	Cummins Engine Company, Pty. Ltd. P.O. Box 124 Darra, 4076 Queensland, Australia Location: 33 Kimberley Street Darra, 4076, Australia Telephone: (61-7) 3375-3277
Branches:	Bunbury	Cummins Engine Company, Pty. Ltd. P.O. Box 1751 Bunbury, WA 6230 Australia Location: 11 Dryanda Court Picton, WA 6230 Telephone: (61-8) 9725-6777 FAX: (61-8) 9725-6444
Branches:	Cairns	Cummins Engine Company, Pty. Ltd. P.O. Box 7189 Cairns Mail Centre, 4870 Queensland, Australia Location: Liberty Street Cairns, 4870 Telephone: (61-7) 935-2999
Branches:	Campbellfield	Cummins Engine Company, Pty. Ltd. Private Bag 9 Campbellfield, 3061 Victoria, Australia Location: 1788-1800 Hume Highway Campbellfield, 3061 Telephone: (613) 9357-9200
Branches:	Dandenong	Cummins Engine Company, Pty. Ltd. Lot 7 Greens Road Dandenong, 3175 Victoria, Australia Telephone: (613) 9706-8088
Branches:	Darwin	Cummins Engine Company, Pty. Ltd. P.O. Box 37587 Winnellie, 0821 Northern Territory, Australia Location: Lot 1758 Graffin Crescent Winnellie, 0821 Telephone: (61-8) 8947-0766

Branches:	Devonport	Cummins Engine Company, Pty. Ltd. P.O. Box 72E Tasmania, Australia Location: 2 Matthews Way Devonport, 7310 Telephone: (61-3) 6424-8800
Branches:	Emerald	Cummins Engine Company, Pty. Ltd. P.O. Box 668 Emerald, 4720 Queensland, Australia Location: Capricorn Highway Emerald, 4720 Telephone: (61-7) 4982-4022
Branches:	Grafton	Cummins Engine Company, Pty. Ltd. P.O. Box 18 South Grafton, 2461 New South Wales, Australia Location: 18-20 Induna Street South Grafton, 2461 Telephone: (61-2) 6642-3655
Branches:	Hexham	Cummins Engine Company, Pty. Ltd. 21 Galleghan Street Hexham New South Wales, Australia Telephone: (61-2) 4964-8466 FAX: (61-2) 4964-8616
Branches:	Kalgoorlie	Cummins Engine Company, Pty. Ltd. P.O. Box 706 Kalgoorlie, 6430 Western Australia, Australia Location: 16 Atbara Street Kalgoorlie, 6430 Telephone: (61-8) 9021-2588
Branches:	Karratha	Cummins Engine Company, Pty. Ltd. P.O. Box 377 Karratha, WA 6714 Australia Location: 1490 Lambert Road Karratha, WA 6714 Australia Telephone: (61-8) 9144-4646 FAX: (61-8) 9143-1507
Branches:	Laverton	Cummins Engine Company, Pty. Ltd. Locked Bag 1 Laverton, Victoria 3028 Australia Location: 195 Boundary Road Laverton North, Victoria 3028 Australia Telephone: (61-3) 9360-0800 FAX: (61-3) 9360-0438

Branches:	Leeton	Cummins Engine Company, Pty. Ltd. P.O. Box 775 Leeton, NSW 2705 Australia Location: 29 Brady Way Leeton, NSW 2705 Australia Telephone: (61-2) 6953-3077 FAX: (61-2) 6953-3109
Branches:	Mackay	Cummins Engine Company, Pty. Ltd. P.O. Box 842 Mackay, 4740 Queensland, Australia Location: 4 Presto Avenue Mackay, 4746 Telephone: (61-7) 4955-1222
Branches:	Mount Gambier	Cummins Engine Company, Pty. Ltd. P.O. Box 2219 Mount Gambier, 5290 South Australia, Australia Location: 2 Avey Road Mount Gambier, 5290 Telephone: (61-87) 25-6422
Branches:	Penrith	Cummins Engine Company, Pty. Ltd. P.O. Box 132 Cambridge Park, 2747 New South Wales, Australia Location: 7 Andrews Road Penrith, 2750 Telephone: (61-2) 4729-1313
Branches:	Queanbeyan	Cummins Engine Company, Pty. Ltd. P.O. Box 527 Queanbeyan, 2620 New South Wales, Australia Location: 15-27 Bayldon Road Queanbeyan, 2620 Telephone: (61-2) 6297-3433 FAX: (61-2) 6297-6709
Branches:	Regency Park	Cummins Engine Company, Pty. Ltd. P.O. Box 2147 Regency Park, SA 5942 Australia Location: 11 Manton Street Hindmarsh, SA 5942 Australia Telephone: (61-8) 8346-3832 FAX: (61-8) 8340-2045

Branches:	Swan Hill	Cummins Engine Company, Pty. Ltd. P.O. Box 1264 Swan Hill, 3585 Victoria, Australia Location: 5 McAllister Road Swan Hill, 3585 Telephone: (61-3) 5032-1511
Branches:	Tamworth	Cummins Engine Company, Pty. Ltd. P.O. Box 677 Tamworth, 2320 New South Wales, Australia Location: Lot 65 Gunnedah Road Tamworth, 2340 Telephone: (61-2) 6765-5455
Branches:	Townsville	Cummins Engine Company, Pty. Ltd. P.O. Box 7339 Garbutt Business Centre, QLD4814 Australia Location: 704-710 Ingham Road Townsville, QLD 4814 Telephone: (61-7) 4774-7733 FAX: (61-7) 4774-7640
Branches:	Welshpool	Cummins Engine Company, Pty. Ltd. P. O. Box 52 Welshpool, 6986 Western Australia, Australia Location: 50 Kewdale Road Welshpool, 6106 Telephone: (61-8) 9458-5911
Branches:	Wetherill Park	Cummins Engine Company, Pty. Ltd. Private Bag 150 Wetherill Park, NSW 2164 Australia Location: 492-494 Victoria Street Wetherill Park, NSW 2164 Australia Telephone: (61-2) 9616-5300 FAX: (61-2) 9616-5399
Branches:	Wodonga	Cummins Engine Company, Pty. Ltd. P.O. Box 174 Wodonga, 3690 Victoria, Australia Location: 9-11 McKoy Street Wodonga, 3690 Telephone: (61-2) 6024-3655

Distributors and Branches - New Zealand

<p>Auckland</p>		<p>Cummins Engine Company, Pty. Ltd. Private Bag 92804 Penrose, Auckland, New Zealand Location: 440 Church Street Penrose Telephone: (64-9) 579-0085</p>
<p>Branches:</p>	<p>Auckland</p>	<p>Cummins Engine Company, Pty. Ltd. Private Bag 92804 Penrose, Auckland, New Zealand Location: 440 Church Street Penrose Telephone: (64-9) 579-0085</p>
<p>Branches:</p>	<p>Christchurch</p>	<p>Cummins Engine Company, Pty. Ltd. P.O. Box 16-149 Hornby, Christchurch, New Zealand Location: 35 Parkhouse Road Sockburn, Christchurch Telephone: (64-3) 348-8170</p>
<p>Branches:</p>	<p>Dunedin</p>	<p>Cummins Engine Company, Pty. Ltd. P.O. Box 2333 South Dunedin, New Zealand Location: 8 Devon Street Dunedin Telephone: (643) 477-8818</p>
<p>Branches:</p>	<p>Palmerston North</p>	<p>Cummins Engine Company, Pty. Ltd. P.O. Box 9024 Palmerston North, New Zealand Location: 852-860 Tremaine Avenue Telephone: (64-6) 356-2209</p>
<p>Branches:</p>	<p>Rotorua</p>	<p>Cummins Engine Company, Pty. Ltd. P.O. Box 934 Rotorua, New Zealand Location: 328 Te Ngae Road Rotorua Telephone: (647) 345-6699</p>

Regional Offices - International - Locations

European Regional Office - Mechelen																												
<p>Cummins Diesel N.V. Blarenberglaan 4 Industriepark Noord 2 2800 Mechelen Brussels Telephone: (32-15) 89000</p>																												
<p>Countries Covered:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">Austria</td> <td style="width: 33%;">Luxembourg</td> <td style="width: 33%;"></td> </tr> <tr> <td>Belgium</td> <td>Netherlands</td> <td></td> </tr> <tr> <td>Czech Republic</td> <td>Norway</td> <td></td> </tr> <tr> <td>Denmark</td> <td>Portugal</td> <td></td> </tr> <tr> <td>Finland</td> <td>Slovakia</td> <td></td> </tr> <tr> <td>Greece</td> <td>Spain</td> <td></td> </tr> <tr> <td>Hungary</td> <td>Sweden</td> <td></td> </tr> <tr> <td>Iceland</td> <td>Switzerland</td> <td></td> </tr> <tr> <td>Israel</td> <td></td> <td></td> </tr> </table>		Austria	Luxembourg		Belgium	Netherlands		Czech Republic	Norway		Denmark	Portugal		Finland	Slovakia		Greece	Spain		Hungary	Sweden		Iceland	Switzerland		Israel		
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Iceland	Switzerland																											
Israel																												
Cumbrasa Regional Office - Brazil																												
<p>Cummins Brasil S.A. Rua Jati, 266 07180-900 Guarulhos Sao Paulo, Brazil</p>	<p>Mailing Address: P.O. Box 13 07180-900 Guarulhos Sao Paulo, Brazil Telephone: (55-11) 945-9811</p>																											
<p>Country Covered: Brazil</p>																												
Beijing Regional Office - China																												
<p>Cummins Corporation China World Tower, Suite 917 China World Trade Center No. 1 Jian Guo Men Wai Beijing 100004 People's Republic of China Telephone: (86-1) 6505-1658 Fax: (88-10) 6505-4211</p>																												
<p>Countries Covered: China Mongolia</p>																												

Bogota Regional Office - Columbia									
Cummins Engine Co. de Colombia S.A. Carrera 11A No. 90-15 Of. 601/602 Bogota, D.E., Colombia Telephone: (57-1) 610-4849	Mailing Address: Apartado Aereo 90988 Bogota D.E., Colombia								
Countries Covered: <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Argentina</td> <td style="width: 50%;">Ecuador</td> </tr> <tr> <td>Bolivia</td> <td>Paraguay</td> </tr> <tr> <td>Chile</td> <td>Peru</td> </tr> <tr> <td>Colombia</td> <td>Uruguay</td> </tr> </table>		Argentina	Ecuador	Bolivia	Paraguay	Chile	Peru	Colombia	Uruguay
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Bolivia	Paraguay								
Chile	Peru								
Colombia	Uruguay								

Gross-Gerau Regional Office - Germany															
Cummins Diesel Deutschland GmbH Odenwaldstr. 23 D-4521 Gross-Gerau Germany Telephone: (49-6152) 174-0															
Countries Covered: <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Albania</td> <td style="width: 50%;">Poland</td> </tr> <tr> <td>Bulgaria</td> <td>Romania</td> </tr> <tr> <td>Latvia</td> <td>Lithuania</td> </tr> <tr> <td>Germany</td> <td>Estonia</td> </tr> <tr> <td>Luxembourg</td> <td>Croatia</td> </tr> <tr> <td>Slovenia</td> <td>Bosnia</td> </tr> <tr> <td>Macedonia</td> <td></td> </tr> </table>		Albania	Poland	Bulgaria	Romania	Latvia	Lithuania	Germany	Estonia	Luxembourg	Croatia	Slovenia	Bosnia	Macedonia	
Albania	Poland														
Bulgaria	Romania														
Latvia	Lithuania														
Germany	Estonia														
Luxembourg	Croatia														
Slovenia	Bosnia														
Macedonia															

Hong Kong Regional Office - Hong Kong	
Cummins Engine H.K. Ltd. Unison Industrial Centre 15th Floor, Units C & D 27-31 Au Pui Wan Street P. O. Box 840 Shatin Fo Tan, Shatin, N.T. Hong Kong Telephone: (852) 2606-5678 Fax: (852) 2691-1641, 2687-3552	
Country Covered: Hong Kong, Macau	

Pune Kirloskar Regional Office - India							
Kirloskar Cummins Limited Kothrud Pune - 411 029, India Telephone: (91-212) 33-0240, 33-5435, 33-1105							
Countries Covered: <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Bhutan</td> <td style="width: 50%;"></td> </tr> <tr> <td>India</td> <td></td> </tr> <tr> <td>Nepal</td> <td></td> </tr> </table>		Bhutan		India		Nepal	
Bhutan							
India							
Nepal							

Milan Regional Office - Italy	
Cummins Diesel Italia S.P.A. Piazza Locatelli 8 Zona Industriale 20098 San Giuliano Milanese Milan, Italy Telephone: (+ 39-02) 98-83-111	
Country Covered:	Italy
North Asia Regional Office - Japan	
Cummins Diesel Sales Corporation 1-12-10 Shintomi Chuo-ku, Tokyo 104 Japan Telephone: (81-3) 3555-3131/2/3/4/5	
Country Covered:	Japan
Seoul Regional Office - Korea	
Cummins Korea Ltd. 5th Floor, Hye Sung Building 35-26 Sam Sung Dong, Kang Nam Ku Seoul, South Korea Telephone: (82-2) 516-0431/2/3, 517-3370/1	
Country Covered:	South Korea
Cummsa Regional Office - Mexico	
Cummins, S.A. de C.V. Arquimedes No. 209 Col. Polanco 11560 Mexico, D.F. Mexico Telephone: (52-5) 254-3822/3783/3622	Mailing/Shipping Address: Gonzalez de Castilla Inc. P.O. Box 1391 4605 Modern Lane Modern Industrial Park Laredo, TX 78040 Telephone: (512) 722-5207
Country Covered:	Mexico

Moscow Regional Office - Russia

Cummins Engine Co., Inc.
 Park Place
 Office E708
 Leninsky Prospect 113
 Russia 117198
 Telephone: (7-502) 256-5122 or 256-5123

Countries Covered:

Armenia	Moldova
Azerbaijan	Russia
Belarus	
Tajikistan	Turkmenistan
Georgia	Ukraine
Kyrgyzstan	Uzbekistan
Kazakhstan	

South And East Asia Area Office - Singapore

Cummins Diesel Sales Corporation
 8 Tanjong Penjuru
 Jurong Industrial Estate
 Singapore 2260
 Telephone: (65) 265-0155

Countries Covered:

Bangladesh	Malaysia
Brunei	Mongolia
Burma/Mynamar	Philippines
Cambodia	Singapore
	Sri Lanka
Indonesia	Thailand
Laos	Vietnam

Taipei Regional Office - Taiwan

Cummins Corporation - Taiwan
 12th Floor, No. 149
 Min-Sheng E. Road
 Section 2
 Taipei, Taiwan
 R.O.C. 104
 Telephone: (886-2) 2503-8441

Country Covered: Taiwan

Middle East Regional Office

Cummins Diesel FZE
Units ZF 5 & 6, Jebel Ali Free Zone
Dubai
United Arab Emirates
Telephone: (971) 4 883-8998
Fax: (971) 4 883-8997
E-mail: cdfze@emirates.net.ae)

Countries Covered:

MIDEAST

Afghanistan	Jordan	Saudi Arabia
Bahrain	Kuwait	Sudan
Cyprus	Lebanon	Syria
Djibouti	Oman	U.A.E.
Egypt	Pakistan	United Kingdom
Iraq	Qatar	Yemen
Iran	Turkey	

North/West/East and Central Africa Regional Office - Daventry (U.K.)

Cummins Engine Company Ltd.
Royal Oak Way South
Daventry, Northants NN11 5NU
England
Telephone: (44-1327) 886000

Countries Covered:

NORTH/WEST/EAST AND CENTRAL AFRICA

Benin (from Togo)	Gabon	Mauritania
Burkina-Faso	Gambia	Morocco
Burundi	Ghana	Niger
Cameroon	Guinea	Nigeria
Cape Verde	Guinea-Bissau	Sao Tome & Principe
Central African Republic	Ivory Coast	
Chad	Liberia	Senegal
Congo (D.R.)		Seychelles
Congo (P.R.)	Libya	Siera Leone
Djibouti		Somalia
Equatorial Guinea	Mali	Togo
	Malta	Tunisia
		Uganda

Latin America Regional Office - Miramar (U.S.A.)			
<p>Cummins Americas, Inc. Miramar Park of Commerce 3450 Executive Way Miramar, FL 33025 Telephone: (305) 431-5511</p>			
<p>Countries Covered:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>Argentina Bolivia Chile Colombia Costa Rica Dominican Republic El Salvador Ecuador</p> </td> <td style="width: 50%; vertical-align: top;"> <p>Guatemala Honduras Nicaragua Panama Paraguay Peru Uruguay Venezuela</p> </td> </tr> </table>		<p>Argentina Bolivia Chile Colombia Costa Rica Dominican Republic El Salvador Ecuador</p>	<p>Guatemala Honduras Nicaragua Panama Paraguay Peru Uruguay Venezuela</p>
<p>Argentina Bolivia Chile Colombia Costa Rica Dominican Republic El Salvador Ecuador</p>	<p>Guatemala Honduras Nicaragua Panama Paraguay Peru Uruguay Venezuela</p>		

Caracas Regional Office - Venezuela			
<p>Cummins Engine Company Oficina de Delegado Torre La Primera, Oficina 5-D Av. Francisco de Miranda Chacao, Caracas 1060</p>	<p>Mailing Address: Cummins Engine Company M-227 c/o Jet Cargo International P.O. Box 020010 Miami, FL 33102-0010 U.S.A. Telephone: (58-2) 32-0563, 32-718</p>		
<p>Countries Covered:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>Costa Rica Dominican Republic El Salvador Guatemala</p> </td> <td style="width: 50%; vertical-align: top;"> <p>Honduras Nicaragua Panama Venezuela</p> </td> </tr> </table>		<p>Costa Rica Dominican Republic El Salvador Guatemala</p>	<p>Honduras Nicaragua Panama Venezuela</p>
<p>Costa Rica Dominican Republic El Salvador Guatemala</p>	<p>Honduras Nicaragua Panama Venezuela</p>		

Southern Africa Regional Office			
<p>Cummins Diesel South Africa (Pty) Ltd 13 Eastern Service Road Kelvin View 2054 South Africa Telephone: (00 27 11) 321 8700 (from U.K.) Fax: (00 27 11 444 1899)</p>	<p>Mailing Address: Wendywood 2144 Gauteng South Africa</p>		
<p>Countries Covered:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>Angola Botswana Comoros Island Lesotho Madagascar Malawi Mauritius Mozambique Namibia</p> </td> <td style="width: 50%; vertical-align: top;"> <p>Swaziland South Africa ST. Helena Tanzania Zambia Zimbabwe</p> </td> </tr> </table>		<p>Angola Botswana Comoros Island Lesotho Madagascar Malawi Mauritius Mozambique Namibia</p>	<p>Swaziland South Africa ST. Helena Tanzania Zambia Zimbabwe</p>
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Distributors - International - Locations

ABU DHABI		- See United Arab Emirates
AFGHANISTAN		- See Middle East Regional Office
ALBANIA		- See Germany Regional Office - Gross-Gerau
ALGERIA		- See Cummins Diesel S.A. - Lyon
AMERICAN SAMOA		- See South Pacific Regional Office
ANDORRA		- See European Regional Office - Mechelen
ANGOLA	Luanda	Hull Blyth (Angola) Ltd Casa Inglesa Rua Major Kahangulo, 134/140 Luanda Republic of Angola Telephone: (244-2) 331817/337184/310026 Fax: (244-2) 335602
ANTIGUA		Miami (Office In U.S.A.) Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
ARGENTINA	Buenos Aires	Distribuidora Cummins, S.A. (DICUMAR) Av. Del Libertador 602 Piso 5 Buenos Aires, Argentina Telephone: (54-1)814-1895/1395/1393
ARUBA, ISLAND OF		- See Netherlands Antilles
AUSTRIA	Neudoerfl	Cummins Diesel Motorenvertriebsges m.b.H. Trenner & Co. Bickfordstr. 25 A-7201 Neudoerfl Austria Telephone: (43-2622) 77418/77625
BAHAMAS	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
BAHRAIN	Bahrain	Yusuf Bin Ahmed Kanoo W.L.L. P.O. Box 45, Manama Bahrain Telephone: (973) 738200
BALEARIC ISLANDS	Madrid (Office in Spain)	Cummins Ventas y Servicio, S.A. Torrelaguna, 56 28027 Madrid, Spain Telephone: (34-91) 367-2000 376-2404

BANGLADESH	Dhaka	Equipment & Engineering Co., Ltd. G.P.O. Box 2339 Dhaka 1000, Bangladesh Location: 56, Dilkusha Commercial Area 2nd Floor/Eastern Block Telephone: (880-2) 234357, 234060
BARBADOS	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
BELGIUM	Brussels	Cummins Distributor Belgium S.A. 623/629 Chaussee de Haecht B-1030 Brussels, Belgium Telephone: (24 hr.) (32-2) 216-81-10
BELIZE	Tampa (Office in U.S.A.)	Cummins Southeastern Power, Inc. 5421 N. 59th Street Tampa, FL 33610 Telephone: (813) 621-7202
BENIN		- See Togo
BERMUDA	Bronx (Office in U.S.A.)	Cummins Metropower, Inc. 890 Zerega Avenue Bronx, NY 10473 Telephone: (718) 892-2400
BHUTAN	Pune (Office in India)	Cummins Diesel Sales & Service (India) Ltd. 35A/1/2, Erandawana Pune - 411 038, India (State of Maharashtra) India Telephone: (91-212) 331234/331554/ 331635/330066/ 330166/330356/ 31703
BOLIVIA	La Paz	Machinery & Auto Service Casilla 4042 La Paz, Bolivia Location: Av. 20 de Octubre Esq. Rosendo Gutierrez Telephone: (591-2) 379650, 366394
BONAIRE, ISLAND OF		- See Netherlands Antilles
BOTSWANA		- See Southern Africa Regional Office - Kelvin
BRAZIL	Ananindeua	Marcos Marcelino & Companhia Ltda. Rodovia BR-316, Km 9 67020-010 Ananindeua, Para, Brazil Telephone: (55-91) 235-4100/4132/ 4143/4012

BRAZIL	Belo Horizonte	Distribuidora Cummins Minas S.A. 31950-640 Olhos D'Agua Norte Belo Horizonte, MG Brazil Telephone: (55-31) 288-1344
BRAZIL	Campo Grande	Distribuidora Cummins Mato Grosso Ltda. Rodovia BR 163 Km 01 79060-000 Campo Grande Mato Grosso do Sul, Brazil Telephone: (55-67) 787-1166
BRAZIL	Curitiba	Distribuidora Cummins Parana S.A. Rua Brasílio Itibere, 2195 80230 Curitiba, Parana Brazil Telephone: (55-41) 222-4036
BRAZIL	Fortaleza	Distribuidora Cummins Diesel Do Nordeste Ltda. Av. da Abolicão, 3882, Mucuripe 60165-081 Fortaleza, Ceara Brazil Telephone: (55-85) 263-1212
BRAZIL	Goianian	Distribuidora de Motores Cummins Centro Oeste Ltda. Av. Caiapo 777 - Setor Sta. Genoveva 74672-400 Goiania, Goias Brazil Telephone: (55-62) 207-1010
BRAZIL	Manaus	Distribuidora Cummins Amazonas Ltda. Estrada da Ponta Negra, 6080 - Sao Jorge 69037 Manaus, Amazonas, Brazil Telephone: (55-92) 656-5444
BRAZIL	Porto Alegre	Distribuidora Cummins Meridional S.A. Rua Dona Alzira, 98, Sarandi 91110-010 Porto Alegre, Rio Grande do Sul, Brazil Telephone: (55-51) 340-8222
BRAZIL	Rio de Janeiro	Distribuidora Cummins Leste Ltda. Rua Sariema, 138-Olaria 21030-550 Rio de Janeiro, Rio de Janeiro, Brazil Telephone: (55-21) 290-7899
BRAZIL	Sao Paulo	Companhia Distribuidora de Motores Cummins Rua Martin Burchard, 291 - Bras 03043-020 Sao Paulo, Sao Paulo, Brazil Telephone: (55-11) 270-2311

BRITISH VIRGIN ISLANDS		- See Puerto Rico
BRUNEI		- See Malaysia
BURKINA - FASO		- See North/West/East and Central Africa Regional Office - Daventry
BULGARIA		-See Germany Regional Office - Gross-Gerau
BURMA	Kuala Lumpur (Office In Malaysia)	Contact: Scott & English (M) Sdn Bhd P.O. Box 10324 50710 Kuala Lumpur West Malaysia Location: 16 Jalan Chan Sow Lin 55200 Kuala Lumpur West Malaysia Telephone: (60-3) 2211033
BURUNDI	Brussels (Office in Belgium)	Bia, S.A. Rameistraat, 123 B-3090 - Overijse, Belgium Telephone: (32-2) 6892811
CAMBODIA		- See South & East Asia Regional Office - Singapore
CANARY ISLANDS	Madrid (Office in Spain)	Cummins Ventas y Servicio, S.A. Torrelaguna, 56 28027 Madrid, Spain Telephone: (34-91) 3672000/3672404
CAPE VERDE		- See ECV Portugal
CENTRAL AFRICAN REPUBLIC		- See North/West Africa Regional Office - Daventry
CEYLON		- See Sri Lanka
CHAD		- See North/West/East and Central Africa Regional Office - Daventry
CHILE	Santiago	Distribuidora Cummins Diesel S.A.C.I. Casilla Postal 1230 Calle Bulnes 1203 Santiago, Chile Corporate Office: Av. Providencia 2653, Office 1901 Santiago, Chile Telephone: (56-2) 698-2113/4/5, 697-3566/7/8, 697-2709
CHINA, PEOPLE'S REPUBLIC	Beijing	Cummins Engine (Beijing) Co., Ltd. No. 8, Wan Yuan Street Beijing Economic and Technology Development Zone Beijing, 100176 People's Republic of China Telephone: (86-10) 67882258 Fax: (86-10) 67882285

CHINA, PEOPLE'S REPUBLIC	Shenyang	Cummins Engine (China) Investment Co., Ltd. - Shenyang No. 198, Lianhe Rd., Dadong District Shenyang, 110044 People's Republic of China Telephone: (86-24) 88094014, 88905794 Fax: (86-24) 88905970
CHINA, PEOPLE'S REPUBLIC	Kunming	Cummins Engine (China) Investment Co., Ltd. - Kunming Suite A4, A5 No. 114 East 2nd Ring Rd. Kunming, 650224 People's Republic of China Telephone: (86-871) 5629579, 5630958 Fax: (86-871) 5632210
CHINA, PEOPLE'S REPUBLIC	Urumqi	Cummins Engine (China) Investment Co., Ltd. - Urumqi No. 275, A Le Tai Rd., Urumqi, 830011 Xinjiang, People's Republic of China Telephone: (86-991) 3844712, 3844723 Fax: (86-991) 3849232
CHINA, PEOPLE'S REPUBLIC	Shanghai	Cummins Engine (China) Investment Co., Ltd. - Shanghai 1st Floor, 555 Zhong Shan Nan Er Rd., Shanghai, 200032 People's Republic of China Telephone: (86-21) 64033999 Fax: (86-21) 64033111
CHINA, PEOPLE'S REPUBLIC	Wuhan	Cummins Engine (China) Investment Co., Ltd. - Wuhan No. 198, Jianshe Rd., Jiangnan District Wuhan, 430030 People's Republic of China Telephone: (86-27) 83330180, 83330182 Fax: (86-27) 83330180 ext. 812
CHINA, PEOPLE'S REPUBLIC	Guangzhou - South China Regional Office	Cummins Engine (China) Investment Co., Ltd. - Guangzhou Rm. 211, Bai Yun Hotel, 367 Huan Shi Dong Rd. Guangzhou, 510065 People's Republic of China Telephone: (86-20) 83313136, 83313137 Fax: (86-20) 83313135
CHINA, PEOPLE'S REPUBLIC	Shenzhen (JV)	Shenzhen Chongfa Cummins Engine Co., Ltd. Unit D2-F2.6 Tian An Che Gong Miao Industrial Estate Shen Nan Rd., Shenzhen, 518040 People's Republic of China Telephone: (86-755) 3415479 Fax: (86-755) 3415480
COLOMBIA	Barranquilla	Cummins de Colombia S.A. Apartado Aereo 5347 Barranquilla, Colombia Location: Calle 30, No. 19 - 21 Telephone: (57-58) 40-02-06/40-13-46

COLOMBIA	Bogota	Cummins Colombiana Ltda. Apartado Aereo No. 7431 Bogota, D.E. Colombia Location: Av. Americas X Carrera 42C No. 19-45 Telephone: (57-1) 244-5688/5882
COLOMBIA	Bucaramanga	Cummins API, Ltda. Apartado Aereo 352 Bucaramanga, Colombia Location: Autopista a Giron, Km 7 Telephone: (57-76) 468060
COLOMBIA	Cali	Distribuidora Cummins del Valle, Ltda. Apartado Aereo No. 6398 Cali, Colombia Location: Av. 3a. #39-35 - Vipasa Telephone: (57-3) 65-4343
COLOMBIA	Medellin	Equipos Tecnicos Ltda. Apartado Aereo No. 2046 Medellin, Colombia Location: Carrera 52 No. 10-184 Telephone: (57-4) 255-4200
COLOMBIA	Pereira	Equipos Tecnicos Ltda. C.Q.R. Apartado Aereo No. 1240 Pereira, Colombia Location: Carrera 8a. No. 45-39 Telephone: (57-63) 366341
COMOROS		- See Southern Africa Regional Office - Kelvin
CONGO, PEOPLE'S REPUBLIC	Brussels (Office in Belgium)	Bia, S.A. Rameistraat, 123 B-3090 Overijse, Belgium Telephone: (32-2) 6892811
CORSICA		- See France
COSTA RICA	San Jose	Servicios Unidos, S.A. P.O. Box 559 San Jose, Costa Rica Location: 100 metros al este de Excelsior Antiguo Curridabat, San Jose Telephone Office: (506) 53-93-93 Telephone Service Shop: (506) 26-00-76
CUBA	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200

CYPRUS	Nicosia	Alexander Dimitriou & Sons Ltd. P.O. Box 21932 Nicosia, Cyprus CY-1515 Location: 4 Salamis Avenue Telephone: (357-2) 349450
CZECH REPUBLIC		- See Austrian Distributor
DENMARK	Glostrup	Cummins Diesel Salg & Service A/S Hovedvejen 233B. Osted DK-4000 Roskilde Denmark Telephone: (45-46) 423 552
DJIBOUTI		- See North/West/East and Central Africa
DOMINICA	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
DOMINICAN REPUBLIC	Santo Domingo	Argico C. Por A. P.O. Bóx 292-2 FERIA Santo Domingo Dominican Republic, ZP-6 Location: Calle Jose A. Soler No. 3, ESQ. Avenida Lope de Vega Telephone: (809) 562-6281
DUBAI		- See United Arab Emirates
ECUADOR	Guayaquil	Motores Cummins (MOTCUM) S.A. P.O. Box 1062 Guayaquil, Ecuador Location: Avenida Carlos Julio Arosemena Km. 4 Telephone: (593-4) 203995/201177
ECUADOR	Quito	Rectificadora Botar S.A. P.O. Box 17-01-3344 Quito, Ecuador Location: Av. 10 de Agosto No. 5980 Telephone: (593-2) 465-176/177/ 178/195/197
EGYPT	Cairo	ADAT P.O. Box 1572 Cairo, Egypt Sales and Service Location: 25, Pyramid Road Giza, Cairo, Egypt Telephone: (20-2) 385-4001/2/4/5/6/8/9

EL SALVADOR	San Salvador	Salvador Machinery Company, S.A. de C.V. P.O. Box 125 San Salvador, El Salvador Location: Blvd. Ejercito Nacional Telephone: (503) 711022, 228388
ENGLAND		- See United Kingdom
EQUATORIAL GUINEA		- See North/West/East and Central Africa Regional Office - Daventry
ESTONIA		- See Gross Gerau Regional Office - Germany
FAROE ISLANDS	Wellingborough (Office in United Kingdom)	Cummins Diesel Rutherford Drive Park Farm South Wellingborough Northants NN8 2QH, England Telephone: (44-1933) 334200
FERNANDO PO		- See Spain
FIJI		- See Cummins Diesel Sales & Service New Zealand Ltd.
FINLAND	Helsinki	Machinery OY P.O. Box 560 FIN 01741 Varta Finland Telephone: Int: (358-9) 8955 2215
FRANCE	Lyon	Cummins Diesel S.A. Sales Corporation 39, rue Ampere Z.I. 69680 Chassieu, France Telephone: (33) 72-22-92-72 Parts and Service Telephone: (33) 72-22-92-69
GABON		- See North/West/East and Central Africa Regional Office - Daventry
GAMBIA		- See Matforce Senegal
GEORGIA		- See Moscow Regional Office - Moscow
GERMANY	Gross-Gerau	Cummins Diesel Deutschland GmbH P.O. Box 1134 D-6080 Gross-Gerau, Germany Location: Odenwaldstr. 23 Telephone: (49-6152) 174-0
GHANA	Accra	J&D Diesels and Systems P.O. Box c2381 Cantonments Accra, Ghana Telephone: (233-21) 30-14-51

GREECE	Athens	Ergotrak Box 51528 14 Km. National Rd. Athens-Lamia 14510 Kifissia, Greece Telephone: (30-1) 6293400/41
GREENLAND		- See Denmark
GRENADA	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
GUADELOUPE	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
GUAM	Barrigada	Mid-Pac Far East, Inc. Airport Industrial Park 825 Tiyan Parkway Barrigada, Guam 96921 Telephone: (671) 632-5160
GUATEMALA	Guatemala City	Maquinaria y Equipos, S.A. P.O. Box 2304 Guatemala City, Guatemala Location: Carretera Amatitlan Km 12 zona 12 Telephone: (502-2) 773334/719
GUINEA	Brussels (Office in Belgium)	BIA s.a. Rameistraat, 123 B-3090 - Overijse, Belgium Telephone: (32-2) 6892811
GUINEA BISSAU		- See North/West/East and Central Africa Regional Office - Daventry
GUYANA	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
GUYANA, FRENCH	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
HAITI	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
HOLLAND		- See Netherlands

HONDURAS	Tegucigalpa	Comercial Laeisz Honduras, S.A. P.O. Box 1022 Tegucigalpa, D.C., Honduras Location: Zona La Burrera, Blvd. Toncontin Frente a Gasolinera Esso. Telephone: (504) 333570/335615
HONG KONG	Kowloon	Cummins Engine H. K. Ltd. P.O. Box 840 Shatin N.T., Hong Kong Location: Unison Industrial Centre 15th Floor, Units C & D 27-31 Au Pui Wan Street Fo Tan, Shatin, Hong Kong Telephone: (852) 2606-5678 Fax: (852) 2691-1641, 2687-3552
ICELAND	Velasalan H.F.	Ananaustrum 1 121 Reykjavik Iceland Telephone: (354) 5526122
INDIA	Pune	Cummins Diesel Sales & Service (India) Ltd. 35A/1/2, Erandawana Pune - 411 038, (State of Maharashtra) India Telephone: (91-212) 331234, 331554, 331635, 330066, 330166, 330356, 331703
INDIA	Bombay	Cummins Diesel Sales & Service (I) Ltd. 298, Perin Nariman Street, Fort, Bombay 400001, India Telephone: (91-22) 2863566/2862247
INDIA	Calcutta	Cummins Diesel Sales & Service (I) Ltd. 94, Tivoli Court, I/C Ballygunge Circular Road Calcutta 700 019 (West Bengal), India Telephone: (91-33) 2478065/2470481/ 2470774
INDIA	New Delhi	Cummins Diesel Sales & Service (I) Ltd. Flat No. 307, Meghdoot Building 94 Nehru Place New Delhi 110 019, India Telephone: (91-11) 6431051/6445756/ 6452817
INDIA	Raipur	Cummins Diesel Sales & Service (I) Ltd. Plot No. 15, Jalashay Marg Choube Colony Raipur 492 001 (Madhya Pradesh), India Telephone: (91-771) 24994/23157/29498

INDIA	Ranchi	Cummins Diesel Sales & Service (I) Ltd. 'Shanti Kunj' C-202, Vidyalaya Marg Road No. 1, Ashoknagar Ranchi 834 002 (Bihar) India Telephone: (91-651) 301948/303623
INDONESIA	Jakarta	P.T. Alltrak 1978 P.O. Box 64/KBYL Jakarta Selatan 12330, Indonesia Location: J1. R.S.C. Veteran No. 4 Bintaro, Rempoa Telephone: (62-21) 736-1978/736-3302
IRAN		- See Middle East Regional Office - United Arab Emirates
IRAQ		- See Middle East Regional Office or United Arab Emirates
IRELAND	Wellingborough (Office in England)	Cummins Diesel Denington Estate Wellingborough Northants NN8 2QH, England Telephone: (44-1933) 334200
ISRAEL	Tel Aviv	Israel Engines & Trailers Co. Ltd. Levinson Brothers Engineers P. O. Box 390 33 Hahashmal Street Tel Aviv, Israel 61003 Telephone: (972-3) 7106222
ITALY	Milan	Cummins Diesel Italia S.p.A. Piazza Locatelli, 8 Zona Industriale Sesto Ulteriano 20098 S. Giuliano Milanese (Milan), Italy Telephone: (39-2) 9828-1235/6/7
IVORY COAST		- See Cote d' Ivoire
JAMAICA	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
JAPAN	Tokyo	Cummins Diesel (Japan) Ltd. 1-12-10-Shintomi Chuo-ku, Tokyo 104 Japan Telephone: (81-3) 3555-8511
JORDAN	Amman	S.E.T.I. Jordan Limited P.O. Box 8053 Amman, Jordan Telephone: (962-6) 621867/621884

KENYA	Nairobi	Werrot & Company Limited P.O. Box 41216 Nairobi, Kenya Location: Lusaka Road Telephone: (254-150) 20316
KOREA, SOUTH	Seoul	Hwa Chang Trading Co., Ltd. Central P.O. Box No. 216 Seoul, South Korea Location: 143-11 Doksan-dong, Kuro-ku Telephone: (82-2) 854-0071/2/3/4/5, 869-1411/2/3
KUWAIT	Kuwait	General Transportation & Equipment Co. (Sales Department) P.O. Box 1096 13011 Safat, Kuwait Location: Shuwaikh Behind Canada Dry Factory Telephone: (965) 4833380/1/2
KUWAIT	Kuwait	General Transportation & Equipment Co. (Service Department) East Ahmadi Area 13011 Safat, Kuwait Telephone: (965) 3981577
LAOS		- See South and East Asia Regional Office - Singapore
LATVIA		- See Moscow Regional Office - Moscow
LEBANON	Beirut	S.E.T.I. Charles Keller S.A.L. B.P. 16-6726 Beirut, Lebanon Location: Corniche du Fleuve Telephone: (961-1) 425040/41
LESOTHO		- See South Africa
LIBYA		- See North/West Africa Regional Office - Daventry
LIECHTENSTEIN		- See Switzerland
LUXEMBOURG	Gross-Gerau (Office in Germany)	Cummins Diesel Deutschland GmbH P.O. Box 11 34 Odenwaldstrasse 23 D-6080 Gross-Gerau, Germany Telephone: (49-6152) 174-0
MACAU		- See Hong Kong
MADAGASCAR		- See East and Southern Africa Regional Office - Harare
MADEIRA ISLANDS		- See Portugal

MALAYSIA	Kuala Lumpur	Cummins Diesel Sales & Service Div. of Scott & English (M) Sdn. Bhd. P.O. Box 10324 50710 Kuala Lumpur, West Malaysia Location: 16 Jalan Chan Sow Lin 55200 Kuala Lumpur Telephone: (60-3) 2211033
MALI		- See Senegal (Matforce)
MALTA	Valletta	Plant & Equipment Ltd. Regency House 254, Republic Street Valletta, Malta Telephone: (356) 23-26-20, 23-33-43, 23-16-23, 24-75-17
MARTINIQUE	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
MEXICO	Guadalajara	Cummins Del Occidente, S.A. Lazaro Cardenas No. 2950 Fracc. Alamo Industrial 45560 Guadalajara, Jal. Mexico Telephone: (52-3) 670-93-06, 670-53-38, 670-63-61, 670-62-33
MEXICO	Monterrey	Tecnica Automotriz, S.A. Av. Alfonso Royes No. 3637 Nte. Monterrey, Nuevo Leon, Mexico Telephone: (52-83) 51-41-51, 51-46-56
MEXICO	Merida	Cummins Del Sureste, S.A. de C.V. Av. Aviacion Civil No. 647 Esquina Calle 100 Col. Sambula 97259 Merida, Yucatan, Mexico Telephone: (52-99) 24-11-55, 24-00-15
MEXICO	Puebla	Cummins de Oriente, S.A. de C.V. Av. Reforma No. 2112, Puebla, Pue. Mexico Telephone: (52-22) 48-76-74, 48-76-75
MEXICO	Queretaro	Distribuidor Cummins Del Centro, S.A. de C.V. Blvd. Bernardo Quintana No. 518 Col. Arboledas C.P. 76140 Queretaro, Qro., Mexico Telephone: (52-42) 12-41-90, 12-58-90, 12-62-94, 14-04-16, 14-08-81, 14-15-91
MEXICO	Tlalnepantla	Distribuidor Cummins Metropolitana, S.A. DE C.V. Sor Juana Ines de la Cruz No. 555 54000 Tlalnepantla, Edo. de Mexico, Mexico Telephone: (52-5) 327-38-00, 390-64-37, 390-12-27

MOROCCO	Casablanca	Soberma (Groupe Auto Hall) Société Soberma Chamin Ain Borja Quartier Beausite Ain Sebaâ Casablanca, Morocco Telephone: (212-22) 66 66 40-43 Fax: (212-22) 66 66 45-46
MOZAMBIQUE		- See Southern Africa Regional Office - Kelvin
NAMIBIA (Southwest Africa)	Walvis Bay	Namib Diesel P.O. Box 2449, Walvis Bay, Namibia Location: 210, 2nd Street Walvis Bay, Namibia Telephone: 064-203971
NEPAL	Pune (Office in India)	Cummins Diesel Sales & Service (India) Ltd. 35A/1/2, Erandawana Pune, - 411 038, (State of Maharashtra) India Telephone: (91-212) 331234, 331554, 331635, 330066, 330166, 330356, 331703
NETHERLANDS	Dordrecht	Cummins Diesel Sales & Service, B.C. Galvanistraat 35 3316 GH Dordrecht Netherlands Telephone: (31-78) 618-12-00
NETHERLANDS ANTILLES	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
NEW CALEDONIA		- See South Pacific Regional Office - Melbourne
NEW GUINEA		- See Papua New Guinea
NICARAGUA	Managua	F. Alf. Pellas & Cia. Apartado Postal No. 46 Managua, Nicaragua Location: 6a. Calle 30 y 31 Avs. N.O., Zona 5 Telephone: (505-2) 660616
NIGERIA	Lagos	SCOA TRAC P.M.B. 21108 Ikéja, Lagos Nigeria Location: Apapa-Oshodi Expressway Isolo Industrial Estate, Isolo Telephone: (234-1) 45-21-539/45-21-803

NIGERIA	Paris (Office in France)	SCOA INTER Immeuble Marie-Joseph Rue du Maréchal de Lattre de Tassigny 78990 Elancourt France Telephone: (33-1) 30-68-82-68
NORTHERN IRELAND		- See United Kingdom
NORWAY	Oslo	Cummins Diesel Salg & Service A/S Hestehagen 3 Postboks 151 N-1441 DRØBAK Norway Telephone: (47) 64 90 70 80
OMAN	Ruwi	Universal Engineering Services L.L.C. P.O. Box 2688 Ruwi Sultanate of Oman Telephone: (968) 590830, 591304
PAKISTAN	Karachi	Diesel Power Systems 2 Bangalore Town Main Shahrah-e-Faisal Karachi 75350 Pakistan Telephone: (92) 21-453 9603/4/5
PANAMA	Panama City	Grupo Tiesa, S.A. Apartado Postal #55-0549 Partillo, Panama Telephone: (507) 67-3866
PAPUA NEW GUINEA	Sydney (Office in Australia)	Cummins Diesel Sales & Service P.O. Box 150 Cabramatta, 2166 New South Wales, Australia
PARAGUAY	Asuncion	Automotores y Maquinaria, S.R.L. Yegros y Fulgencio R. Moreno P.O. Box 1160 Asuncion, Paraguay Telephone: (595-21) 493111, 493115
PERU	Lima	Comercial Diesel del Peru S.A. P.O. Box 14-0234 Lima, Peru Location: Ave. V.R. Haya de la Torre 2648 Lima 3, Peru Telephone: (51-14) 74-3173/4374/ 3144/2281

PHILIPPINES	EDSA	Power Systems, Inc. EDSA P.O. Box 3241 Manila Philippines 1501 Location: 79E. Delos Santos Ave. Mandaluyong, Metro Manila Telephone: (63-2) 791769, 791771, 5311945, 5315448, 5311934, 5312531, 53414513
POLAND		Polremaco 30-709 Krakow Ul. Stoczniewcow 3 Poland Telephone: (48-12) 6561917
PORTUGAL	Lisbon	Electro Central Vulcanizadora, Lda. P.O. Box 3077 1302 Lisbon, Portugal Location: Rua Conselheiro Martins de Carvalho Lote 1480 1400 Lisboa (Restelo) Telephone: (351-2) 303 4800
QATAR	Doha	Jaldah Motors & Trading Co. P.O. Box 150 Doha, Qatar (Arabian Gulf) Telephone: (974) 442-6161
REUNION		- See Lyon Regional Office - Lyon
RIO DE ORO		- See Spain
ROMANIA		- See Germany Regional Office - Gross-Gerau
RUSSIA		- See Moscow Regional Office - Moscow
RWANDA	Brussels (Office in Belgium)	Bia, S.A. Rameistraat, 123 B-3090 - Overijse, Belgium Telephone: (32-2) 6892811
ST. LUCIA	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
ST. VINCENT	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
SAN MARINO		- See Italy
SAO TOME AND PRINCIPE		- See North/West/East and Central Africa Regional Office - Daventry

SAUDI ARABIA	Al-Khobar	GCC Olayan P.O. Box 356 Al-Khobar 31952 Saudi Arabia Telephone: (966-3) 882-0888
SCOTLAND		- See United Kingdom
SENEGAL	Dakar	Matforce B.P. 397 Dakar, Senegal Location: 10 Avenue Faidherbe Telephone: (221-8) 399500 Fax: (221-8) 399531/399550 Equipements et Services (Mining Only) BP 15372-Fann Dakar Senegal Contacts: Mr. Jean Smets Tel: (221-8) 60 77 76 & 24 73 62 Fax: (221-8) 60 95 98
SEYCHELLES		- See North/West/East & Central Regional Office - Daventry
SIERRA LEONE		- See North/West/East and Central Africa Regional Office - Daventry
SINGAPORE	Singapore	Applied Diesel Sales & Service Pte Ltd 8 Tanjong Penjuru Jurong Industrial Estate Singapore 2260 Telephone: (65) 261-3555
SLOVAKIA		- See European Regional Office - Gross-Gerau
SOLOMON ISLANDS		- See South Pacific Regional Office - Melbourne
SOMALIA		- See East and Southern Africa Regional Office - Harare
SOUTH AFRICA	Johannesburg	Cummins Diesel South Africa Pty. Ltd. Private Bag X7 Wendywood 2144 South Africa Location: 13 Eastern Service Road Kelvin View 2054 Telephone: (27-11) 321 8700
SOUTHWEST AFRICA		- See Namibia
SPAIN	Madrid	Cummins Ventas y Servicio S.A. Torrelaguna, 56 28027 Madrid, Spain Telephone: (34-91) 367-2000/3672404
SPANISH GUINEA		- See Spain

SRI LANKA	Colombo	Trade Promoters Ltd P.O. Box 321 69, Walukarama Road Colombo 3 Sri Lanka Telephone: (94-1) 573927, 574651, 575005
SUDAN		- See Middle East Regional Office - United Arab Emirates
SURINAM	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
SWAZILAND		- See South Africa
SWEDEN	Stockholm	SMA Maskin AB Aggelundavagen 7 S-17562 Jarfalla Sweden Telephone: (46-8) 56-222-500
SWITZERLAND	Regensdorf	Robert Aebi S.A. Riedhofstrasse 100 8105 Regensdorf Switzerland Telephone: (41-1) 842-5111
SYRIA	Damascus	Puzant Yacoubian & Sons P.O. Box 3617 Damascus, Syria Location: Abou Baker El Saddik Street Kafar Sousse Square Telephone: (963-11) 212-8600
TAHITI, ISLAND OF		- See French Polynesia
TAIWAN	Taipei (JV)	Cummins Power Service & Parts Corp. No. 115, Wu Ko 1st Rd., Wu Ku, Industrial District Taipei, Taiwan, R.O.C. Telephone: (886-2) 2290-0331 Fax: (886-2) 2290-0393
TANZANIA		- See South African Regional Office - Kelvin
THAILAND	Bangkok	Diethelm & Company Ltd. 1696 New Petchburi Road Bangkok 10310, Thailand Telephone: (66-2) 254-4900
TOGO (and BENIN)	Lome	Togomat B.P. 1641 Lome, Togo Location: Zone Industrielle CNPPME Telephone: (228) 27-23-95
TONGA, ISLAND OF		- See South Pacific Regional Office - Melbourne

TRINIDAD and TOBAGO	Miami (Office in U.S.A.)	Cummins Southeastern Power Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
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UKRAINE		- See Moscow Regional Office - Moscow
UNITED ARAB EMIRATES	Dhabi	Cummins Diesel FZE P.O. Box 17636 Units ZF516, Jebel Ali Free Zone Dhabi, United Arab Emirates Telephone: (971) 4-883-8998
UNITED KINGDOM	Wellingborough	Cummins Diesel Rutherford Drive Park Farm South Wellingborough Northants NN8 2QH, England Telephone: (44-1933) 334200
URUGUAY	Montevideo	Santaro S.A. P.O. Box 379 Montevideo Uruguay Location: Avenida Millan No. 2441 Telephone:(598-2) 293908
VATICAN CITY		- See Italy
VENEZUELA	Caracas	Sudimat Apartado Postal 1322 Carmelitas Caracas 1010 Venezuela Location: Final Avenida San Martin Urb. la Quebradita Caracas 1061 Telephone: (58-2) 442-6161/2647
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WESTERN SAMOA		- See South Pacific Regional Office - Melbourne

YEMEN	Sana'a	Zubieri Trading Co. P.O. Box 535 Sana'a, Yemen Arab Republic Telephone: (967) 1-223943/224051
YUGOSLAVIA		Cummins Dizel Motori Doo Prodaja I Servis Autoput 22 11080 Zemun Beograd F.R. Yugoslavia Telephone: (381-11) 314 9071
ZAMBIA	Ndola	Cummins Diesel Services (Zambia) Ltd. P.O. Box 71501 Ndola, Zambia Telephone: (260-2) 610729
ZIMBABWE	Harare	Cummins Zimbabwe (Pvt) Ltd. P.O. Box ST363 Southerton Harare, Zimbabwe Location: 72 Birmingham Road Southerton, Harare Telephones: (263-4) 621871/2/3/4/5

Section TS - Troubleshooting Symptoms

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Section TS - Troubleshooting Symptoms

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Troubleshooting Procedures and Techniques

General Information

This guide describes some typical engine operating problems, their causes, and some acceptable corrections to those problems. Unless noted otherwise, the problems listed are those which an operator can diagnose and repair.

▲ WARNING ▲

Performing troubleshooting procedures NOT outlined in this section can result in equipment damage or personal injury or death. Troubleshooting must be performed by trained, experienced technicians. Consult a Cummins Authorized Repair Location for diagnosis and repair beyond that which is outlined, and for symptoms not listed in this section. Before beginning any troubleshooting, refer to General Safety Instructions in Section i of this manual.

Follow the suggestions below for troubleshooting:

- Study the complaint thoroughly before acting
- Refer to the engine system diagrams
- Do the easiest and most logical things first
- Find and correct the cause of the complaint

Troubleshooting Symptoms Charts

General Information

Use the charts on the following pages of this section to aid in diagnosing specific engine symptoms. Read each row of blocks from top to bottom. Follow through the chart to identify the corrective action.



WARNING

Troubleshooting presents the risk of equipment damage, personal injury or death. Troubleshooting must be performed by trained, experienced technicians.

Air Compressor Air Pressure Rises Slowly

Cause

Correction

STEP 1

Air intake system restriction to air compressor is excessive

Replace the air compressor air cleaner (if installed). Check the air intake piping. Check engine air intake restriction if the air compressor inlet is plumbed to the vehicle or equipment intake system. Refer to Procedure 010-058 (Air Intake Piping) in Section 4.

OK

Go To Next Step

STEP 2

Air system leaks

Block the vehicle wheels and check the air system for leaks with spring brakes applied and released. Check for leaks from the air compressor gaskets and the air system hoses, fittings, tanks, and valves. Refer to the OEM service manuals.

OK

Go To Next Step

STEP 3

Carbon buildup is excessive in the air discharge line, downstream air valves, or cylinder head

Check for carbon buildup. Replace the air compressor discharge line and cylinder head assembly if necessary. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 4

Contact a Cummins Authorized Repair Facility

Air Compressor Cycles Frequently

Cause

Correction

STEP 1

Air system leaks

Block the vehicle wheels and check the air system for leaks with spring brakes applied and released. Check for leaks from the air compressor gaskets and the air system hoses, fittings, tanks, and valves. Refer to the OEM service manual.

OK

Go To Next Step

STEP 2

Carbon buildup is excessive in the air discharge line, check valve, or cylinder head

Check for carbon buildup. Replace the air compressor discharge line, if necessary. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 3

Air compressor pumping time is excessive

Replace the desiccant cartridge on the air dryer (if equipped). Refer to the OEM service manual. Check the air compressor duty cycle. Install a larger air compressor, if necessary. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 4

Contact a Cummins Authorized Repair Facility

Air Compressor Noise is Excessive

Cause

Correction

STEP 1

Carbon buildup is excessive in the air discharge line, downstream air valves, or cylinder head

Check for carbon buildup. Replace the air compressor discharge line and cylinder head assembly if necessary. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 2

Air compressor is sending air pulses into the air tanks

Install a ping tank between the air dryer and the wet tank. Refer to the manufacturer's instructions.

OK

Go To Next Step

STEP 3

Ice buildup in the air system components

For all models, check for ice in low spots of the air discharge line, dryer inlet, and elbow fittings. On Holset® models, also check the Econ valve (if equipped). Refer to the OEM service manual.

OK

Go To Next Step

STEP 4

Contact a Cummins Authorized Repair Facility

Air Compressor Pumping Excess Lubricating Oil into the Air System

Cause

Correction

STEP 1

Lubricating oil drain interval is excessive

Verify the correct lubricating oil drain interval. Refer to Procedure 102-002 (Maintenance Schedule) in Section 2.

OK

Go To Next Step

STEP 2

Air intake system restriction to air compressor is excessive

Replace the air compressor air cleaner (if installed). Check the air intake piping. Check engine air intake restriction if the air compressor inlet is plumbed to the vehicle or equipment intake system. Refer to Procedure 010-058 (Air Intake Piping) in Section 4.

OK

Go To Next Step

STEP 3

Air compressor pumping time is excessive

Replace the desiccant cartridge on the air dryer (if equipped). Refer to the OEM service manual. Check the air compressor duty cycle. Install a larger air compressor, if necessary. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 4

Carbon buildup is excessive in the air discharge line, check valve, or cylinder head

Check for carbon buildup. Replace the air compressor discharge line, if necessary. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 5

Contact a Cummins Authorized Repair Facility

Air Compressor Will Not Maintain Adequate Air Pressure (Not Pumping Continuously)

Cause

Correction

STEP 1

Air system leaks

Block the vehicle wheels and check the air system for leaks with spring brakes applied and released. Check for leaks from the air compressor gaskets and the air system hoses, fittings, tanks, and valves. Refer to the OEM service manual.

OK

Go To Next Step

STEP 2

Contact a Cummins Authorized Repair Facility

Air Compressor Will Not Stop Pumping

Cause

Correction

STEP 1
Air system leaks

Block the vehicle wheels and check the air system for leaks with spring brakes applied and released. Check for leaks from the air compressor gaskets and the air system hoses, fittings, tanks, and valves. Refer to the OEM service manual.

OK.

Go To Next Step

STEP 2
Contact a Cummins Authorized Repair Facility

Alternator Not Charging or Insufficient Charging

Cause

Correction

<p>STEP 1 Alternator pulley is loose on the shaft</p> <p>OK Go To Next Step</p>	<p>Tighten the pulley. Refer to the OEM service manual.</p>
<p>STEP 2 Batteries have malfunctioned</p> <p>OK Go To Next Step</p>	<p>Check the condition of the batteries. Replace the batteries, if necessary. Refer to the OEM service manual.</p>
<p>STEP 3 Battery cables or connections are loose, broken, or corroded (excessive resistance)</p> <p>OK Go To Next Step</p>	<p>Check the battery cables and connections.</p>
<p>STEP 4 Alternator is overloaded, or alternator capacity is below specification</p> <p>OK Go To Next Step</p>	<p>Install an alternator with a higher capacity. Refer to the OEM service manual.</p>
<p>STEP 5 Alternator or voltage regulator is malfunctioning</p> <p>OK Go To Next Step</p>	<p>Test the alternator output. Replace the alternator or voltage regulator if necessary. Refer to the OEM service manual.</p>
<p>STEP 6 Battery temperature is above specification</p> <p>OK Go To Next Step</p>	<p>Position the batteries away from heat sources. Refer to the OEM service manual.</p>
<p>STEP 7 Electrical system is "open" (blown fuses, broken wires, or loose connections)</p> <p>OK Go To Next Step</p>	<p>Check the fuses, wires, and connections. Refer to the OEM service manual and the manufacturer's wiring diagram.</p>
<p>STEP 8 Vehicle gauge is malfunctioning</p> <p>OK Go To Next Step</p>	<p>Check the vehicle gauge. Refer to the OEM service manual.</p>
<p>STEP 9 Contact a Cummins Authorized Repair Facility</p>	

Alternator Overcharging

Cause

Correction

STEP 1
Batteries have failed

Check the condition of the batteries. Replace the batteries, if necessary. Refer to the OEM service manual.

OK
Go To Next Step

STEP 2
Voltage regulator is malfunctioning

Check the voltage regulator. Replace the voltage regulator, if necessary. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 3
Contact a Cummins Authorized Repair Facility

Coolant Contamination

Cause

Correction

STEP 1
Coolant is rusty and has debris

Drain and flush the cooling system. Fill with correct mixture of antifreeze and water. Refer to Procedure 008-018 (Cooling System) in Section 7.

OK
Go To Next Step

STEP 2
Transmission oil cooler or torque converter cooler is leaking

Check the transmission oil cooler and torque converter cooler for coolant leaks. Refer to the OEM service manual.

OK
Go To Next Step

STEP 3
Lubricating oil cooler is leaking

Check the lubricating oil cooler for coolant leaks and cracks. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 4
Cylinder head gasket is leaking

Check the cylinder head gasket. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 5
Contact a Cummins Authorized Repair Facility

Coolant Loss - External

Cause

Correction

STEP 1
Coolant level is below specification

Inspect the engine and cooling system for external coolant leaks. Repair if necessary. Add coolant. Refer to the OEM service manual.

OK
Go To Next Step

STEP 2
External coolant leak

Inspect the engine for coolant leaking from hoses, draincocks, water manifold, jumper tubes, expansion and pipe plugs, fittings, radiator core, air compressor and cylinder head gaskets, lubricating oil cooler, water pump seal, cylinder block, and OEM-mounted components that have coolant flow. Refer to the OEM service manual.

OK
Go To Next Step

STEP 3
Radiator cap is **not** correct, is malfunctioning, or has low-pressure rating

Check the radiator pressure cap. Refer to the OEM service manual.

OK
Go To Next Step

STEP 4
Cooling system hose is collapsed, restricted, or leaking

Inspect the hoses. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 5
Coolant fill line is restricted or obstructed

Check the coolant fill line for restrictions or obstructions. Refer to Procedure 008-066 (Coolant Level) in Section 3.

OK
Go To Next Step

STEP 6
Coolant is rusty and has debris

Drain and flush the cooling system. Fill with correct mixture of antifreeze and water. Refer to Procedure 008-018 (Cooling System) in Section 7.

OK
Go To Next Step

STEP 7
Engine is overheating

Refer to the Coolant Temperature Above Normal symptom tree.

OK
Go To Next Step

STEP 8
Contact a Cummins Authorized Repair Facility

Coolant Temperature Above Normal - Gradual Overheat

Cause	Correction
<p>STEP 1 Charge air cooler fins, radiator fins, or air conditioner condenser fins are damaged or obstructed with debris</p>	<p>Inspect the charge air cooler, air conditioner condenser, and radiator fins. Clean, if necessary. Refer to the OEM service manual.</p>
<p>OK Go To Next Step</p>	
<p>STEP 2 Cold weather radiator cover or winterfront is closed</p>	<p>Open the cold weather radiator cover or the winterfront. Maintain a minimum of 387 cm² [60 in²] of opening at all times. Refer to Procedure 101-004 (Cold Weather Starting) in Section 1.</p>
<p>OK Go To Next Step</p>	
<p>STEP 3 Coolant level is below specification</p>	<p>Inspect the engine and cooling system for external coolant leaks. Repair if necessary. Add coolant. Refer to Procedure 008-066 (Coolant Level) in Section 3.</p>
<p>OK Go To Next Step</p>	
<p>STEP 4 Fan shroud is damaged or missing or the air recirculation baffles are damaged or missing</p>	<p>Inspect the shroud and the recirculation baffles. Repair, replace, or install, if necessary. Refer to the OEM service manual.</p>
<p>OK Go To Next Step</p>	
<p>STEP 5 Lubricating oil is contaminated with coolant or fuel</p>	<p>Refer to the Lubricating Oil Contaminated symptom tree.</p>
<p>OK Go To Next Step</p>	
<p>STEP 6 Cooling system hose is collapsed, restricted, or leaking</p>	<p>Inspect the hoses. Refer to a Cummins Authorized Repair Location.</p>
<p>OK Go To Next Step</p>	
<p>STEP 7 Coolant mixture of antifreeze and water is not correct</p>	<p>Verify the concentration of antifreeze in the coolant. Add antifreeze or water to correct the concentration. Refer to Procedure 008-046 (Supplemental Coolant Additive (SCA) and Antifreeze Concentration) in Section 5 and Procedure 018-004 (Coolant Recommendations and Specifications) in Section V.</p>
<p>OK Go To Next Step</p>	
<p>STEP 8 Lubricating oil level is above or below specification</p>	<p>Check the oil level. Add or drain oil, if necessary. Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3 and Procedure 007-002 (Lubricating Oil and Filters) in Section 4.</p>
<p>OK Go To Next Step</p>	

Coolant Temperature Above Normal - Gradual Overheat

Cause

Correction

STEP 9

Coolant temperature gauge is malfunctioning

Test the temperature gauge. Repair or replace the gauge, if necessary.

OK

Go To Next Step

STEP 10

Fan drive belt is loose, tight, or not in alignment

Check the fan drive belt. Refer to Procedure 008-002 (Drive Belt, Cooling Fan) in Section A.

OK

Go To Next Step

STEP 11

Vehicle cooling system is not adequate

Verify that the engine and vehicle cooling systems are using the correct components. Refer to the OEM specifications.

OK

Go To Next Step

STEP 12

Contact a Cummins Authorized Repair Facility

Coolant Temperature Above Normal - Sudden Overheat

Cause

Correction

<p>STEP 1 Coolant level is below specification</p>	<p>Inspect the engine and cooling system for external coolant leaks. Repair if necessary. Add coolant. Refer to Procedure 008-066 (Coolant Level) in Section 3.</p>
<p>OK Go To Next Step</p>	
<p>STEP 2 Air in the cooling system</p>	<p>Inspect and vent the cooling system. Refer to Procedure 008-018 (Cooling System) in Section 7.</p>
<p>OK Go To Next Step</p>	
<p>STEP 3 Fan drive belt is broken</p>	<p>Check the fan drive belt. Replace the belt, if necessary. Refer to Procedure 008-002 (Drive Belt, Cooling Fan) in Section A.</p>
<p>OK Go To Next Step</p>	
<p>STEP 4 Radiator cap is not correct, is malfunctioning, or has low-pressure rating</p>	<p>Check the radiator pressure cap. Refer to the OEM service manual.</p>
<p>OK Go To Next Step</p>	
<p>STEP 5 Cooling system hose is collapsed, restricted, or leaking</p>	<p>Inspect the hoses. Refer to a Cummins Authorized Repair Location.</p>
<p>OK Go To Next Step</p>	
<p>STEP 6 Coolant temperature gauge is malfunctioning</p>	<p>Test the temperature gauge. Repair or replace the gauge, if necessary.</p>
<p>OK Go To Next Step</p>	
<p>STEP 7 Charge air cooler fins, radiator fins, or air conditioner condenser fins are damaged or obstructed with debris</p>	<p>Inspect the charge air cooler, air conditioner condenser, and radiator fins. Clean, if necessary. Refer to the OEM service manual.</p>
<p>OK Go To Next Step</p>	
<p>STEP 8 Cold weather radiator cover or winterfront is closed</p>	<p>Open the cold weather radiator cover or the winterfront. Maintain a minimum of 387 cm² [60 in²] of opening at all times. Refer to Procedure 101-004 (Cold Weather Starting) in Section 1.</p>
<p>OK Go To Next Step</p>	
<p>STEP 9 Contact a Cummins Authorized Repair Facility</p>	

Coolant Temperature Below Normal

Cause

Correction

STEP 1
Coolant temperature gauge or sensor is malfunctioning

Test the gauge and the sensor. Repair or replace, if necessary. Refer to the OEM service manual.

OK
Go To Next Step

STEP 2
Engine is operating at low ambient temperature

Check the winterfront, shutters, and under-the-hood air. Use under-the-hood intake air in cold weather. Refer to Operation of Diesel Engines in Cold Climates, Bulletin 3379009, and Procedure 101-004 (Cold Weather Starting) in Section 1.

OK
Go To Next Step

STEP 3
Fan drive or fan controls are malfunctioning

Check the fan drive and controls. Refer to the OEM service manual.

OK
Go To Next Step

STEP 4
Coolant temperature gauge is malfunctioning

Test the temperature gauge. Repair or replace the gauge, if necessary.

OK
Go To Next Step

STEP 5
Thermostat is not correct or is malfunctioning

Check the thermostat for the correct part number and for correct operation. Contact a Cummins Authorized Repair Facility.

OK
Go To Next Step

STEP 6
Contact a Cummins Authorized Repair Facility

Engine Acceleration or Response Poor

Cause

Correction

STEP 1
Operator technique is **not** correct

Refer to Procedure 101-999 (Operating Instructions) in Section 1.

OK
Go To Next Step

STEP 2
Fuel level is low in the tank

Fill the supply tank. Refer to the OEM service manual.

OK
Go To Next Step

STEP 3
Vehicle parasitics are excessive

Check the vehicle brakes for dragging, transmission malfunction, cooling fan operation cycle time, and engine-driven units. Refer to the OEM service manual.

OK
Go To Next Step

STEP 4
Clutch is malfunctioning or is **not** correct

Compare the drivetrain specifications to Cummins recommendations. Check the clutch for correct operation. Refer to the OEM service manual.

OK
Go To Next Step

STEP 5
Drivetrain is **not** correctly matched to the engine

Check for correct gearing and drivetrain components. Refer to the OEM vehicle specifications.

OK
Go To Next Step

STEP 6
Fuel leak

Check the fuel lines, fuel connections, and fuel filters for leaks. Check the fuel lines to the supply tanks. Refer to the OEM service manual.

OK
Go To Next Step

STEP 7
Intake manifold air temperature is above specification

Refer to the Intake Manifold Air Temperature Above Specification symptom tree.

OK
Go To Next Step

STEP 8
Charge air cooler is restricted or leaking

Inspect the charge air cooler for air restrictions or leaks. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

Engine Acceleration or Response Poor

Cause

Correction

STEP 9

Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section 5.

OK

Go To Next Step

STEP 10

Air intake or exhaust leaks

Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 11

Air intake system restriction is above specification

Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-058 (Air Intake Piping) in Section 4.

OK

Go To Next Step

STEP 12

Fuel grade is not correct for the application or the fuel quality is poor

Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.

OK

Go To Next Step

STEP 13

Fuel filter is plugged

Measure the fuel pressure before and after the fuel filter. Refer to Procedure 006-015 (Fuel Filter Spin-on) in Section 5.

OK

Go To Next Step

STEP 14

Fuel supply is not adequate

Check the flow through the filter to locate the source of the restriction. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 15

Fuel lift pump is malfunctioning

Check the fuel lift pump for correct operation. Check the pump output pressure. Replace the fuel lift pump if necessary. Refer to a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 16

Contact a Cummins Authorized Repair Facility

Engine Difficult to Start or Will Not Start (Exhaust Smoke)

Cause

Correction

STEP 1

Starting procedure is not correct

Verify the correct starting procedure. Refer to Procedure 101-014 (Normal Starting Procedure) in Section 1.

OK

Go To Next Step

STEP 2

Fuel level is low in the tank

Fill the supply tank. Refer to the OEM service manual.

OK

Go To Next Step

STEP 3

Starting aid, if necessary for cold weather, is malfunctioning

Check for correct operation of the cold weather starting aid. Refer to Procedure 101-004 (Cold Weather Starting) in Section 1.

OK

Go To Next Step

STEP 4

Engine block heater is malfunctioning (if equipped)

Check the electrical sources and wiring to the cylinder block heater. Replace the block heater, if necessary. Refer to the OEM service manual.

OK

Go To Next Step

STEP 5

Fuel heater is malfunctioning (if equipped)

Check the fuel heater and replace, if necessary. Refer to the manufacturer's instructions.

OK

Go To Next Step

STEP 6

Battery voltage is low

Check the batteries and the unswitched battery supply circuit. Refer to the OEM service manual.

OK

Go To Next Step

STEP 7

Keyswitch circuit is malfunctioning

Check the vehicle keyswitch circuit. Refer to the OEM service manual.

OK

Go To Next Step

STEP 8

Engine cranking speed is too slow

If the cranking speed is slower than 150 rpm, refer to the Engine Will Not Crank or Cranks Slowly symptom tree.

OK

Go To Next Step

STEP 9

Vehicle parasitics are excessive

Check the vehicle brakes for dragging, transmission malfunction, cooling fan operation cycle time, and engine-driven units. Refer to the OEM service manual.

OK

Go To Next Step

Engine Difficult to Start or Will Not Start (Exhaust Smoke)

Cause

Correction

STEP 10
Fuel leak

Check the fuel lines, fuel connections, and fuel filters for leaks. Check the fuel lines to the supply tanks. Refer to the OEM service manual.

OK
Go To Next Step

STEP 11
Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section 5.

OK
Go To Next Step

STEP 12
Air intake system restriction is above specification

Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-058 (Air Intake Piping) in Section 4.

OK
Go To Next Step

STEP 13
Fuel grade is not correct for the application or the fuel quality is poor

Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.

OK
Go To Next Step

STEP 14
Fuel filter is plugged

Measure the fuel pressure before and after the fuel filter. Refer to Procedure 006-015 (Fuel Filter Spin-on) in Section 5.

OK
Go To Next Step

STEP 15
Fuel supply is not adequate

Check the flow through the filter to locate the source of the restriction. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 16
Fuel pump overflow valve is malfunctioning

Check the overflow valve. Replace if necessary. Refer to a Cummins Authorized Repair Facility.

OK
Go To Next Step

STEP 17
Fuel lift pump is malfunctioning

Check the fuel lift pump for correct operation. Check the pump output pressure. Replace the fuel lift pump if necessary. Refer to a Cummins Authorized Repair Facility.

OK
Go To Next Step

Engine Difficult to Start or Will Not Start (Exhaust Smoke)

Cause

Correction

STEP 18

Throttle linkage adjustment is not correct

Check the fuel pump throttle linkage adjustment.
Refer to the OEM service manual.

OK

Go To Next Step

STEP 19

Contact a Cummins Authorized Repair Facility

Engine Difficult to Start or Will Not Start (No Exhaust Smoke)

Cause

Correction

STEP 1

Starting procedure is not correct

Verify the correct starting procedure. Refer to Procedure 101-014 (Normal Starting Procedure) in Section 1.

OK

Go To Next Step

STEP 2

Fuel level is low in the tank

Fill the supply tank. Refer to the OEM service manual.

OK

Go To Next Step

STEP 3

Fuel grade is not correct for the application or the fuel quality is poor

Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.

OK

Go To Next Step

STEP 4

Fuel shutoff is malfunctioning

Check for loose wires and verify that the fuel shutoff valve is functioning. Refer to the OEM service manual.

OK

Go To Next Step

STEP 5

OEM engine protection system is malfunctioning

Isolate the OEM engine protection system. Follow the OEM service manuals to check for a malfunction.

OK

Go To Next Step

STEP 6

Battery voltage is low

Check the batteries and the unswitched battery supply circuit. Refer to the OEM service manual.

OK

Go To Next Step

STEP 7

Keyswitch circuit is malfunctioning

Check the vehicle, equipment, or vessel keyswitch circuit. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 8

Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section 5.

OK

Go To Next Step

Engine Difficult to Start or Will Not Start (No Exhaust Smoke)

Cause

Correction

<p>STEP 9 Fuel filter is plugged</p>	<p>Measure the fuel pressure before and after the fuel filter. Refer to Procedure 006-015 (Fuel Filter Spin-on) in Section 5.</p>
<p>OK Go To Next Step</p>	
<p>STEP 10 Fuel supply is not adequate</p>	<p>Check the flow through the filter to locate the source of the restriction. Refer to a Cummins Authorized Repair Location.</p>
<p>OK Go To Next Step</p>	
<p>STEP 11 Fuel pump overflow valve is malfunctioning</p>	<p>Check or replace the return overflow valve. Refer to the OEM service manual.</p>
<p>OK Go To Next Step</p>	
<p>STEP 12 Fuel transfer pump malfunctioning</p>	<p>Inspect the fuel transfer pump. Replace if necessary. Refer to a Cummins Authorized Repair Location.</p>
<p>OK Go To Next Step</p>	
<p>STEP 13 Fuel drain backup</p>	<p>Verify the fuel return line is plumbed to the bottom of the fuel tank.</p>
<p>OK Go To Next Step</p>	
<p>STEP 14 Throttle linkage misadjusted or damaged</p>	<p>Adjust or repair the linkage. Refer to the OEM service manual.</p>
<p>OK Go To Next Step</p>	
<p>STEP 15 Contact a Cummins Authorized Repair Facility</p>	

Engine Noise Excessive

Cause

Correction

STEP 1

Fan drive belt is loose, tight, or not in alignment

Check the fan drive belt. Refer to Procedure 103-002 (Drive Belts) in Section 3.

OK

Go To Next Step

STEP 2

Lubricating oil is thin or diluted

Refer to Procedure 018-003 (Lubricating Oil Recommendations and Specifications) in Section V.

OK

Go To Next Step

STEP 3

Air intake or exhaust leaks

Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 4

Air intake or exhaust piping is contacting the chassis or cab

Inspect the air piping, chassis, and cab for contact points. Refer to the OEM service manual.

OK

Go To Next Step

STEP 5

Air intake system restriction is above specification

Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-059 (Air Cleaner Restriction) in Section 4.

OK

Go To Next Step

STEP 6

Coolant temperature is above specification

Refer to the Coolant Temperature is Above Normal - Sudden Overheat or the Coolant Temperature is Above Normal - Gradual Overheat symptom tree.

OK

Go To Next Step

STEP 7

Engine mounts are worn, damaged, or not correct

Check the engine mounts. Refer to the OEM service manual.

OK

Go To Next Step

STEP 8

Fan clutch, hydraulic pump, or refrigerant compressor noise is excessive

Isolate each component and check for noise. Refer to the OEM service manual.

OK

Go To Next Step

STEP 9

Fan is loose, damaged, or has excessive hub bearing end play

Check the fan. Refer to Procedure 008-040 (Fan, Cooling) in Section 3.

OK

Go To Next Step

Engine Noise Excessive

Cause

Correction

STEP 10

Contact a Cummins Authorized Repair Facility

Engine Noise Excessive — Combustion Knocks

Cause

Correction

STEP 1

Engine is operating at low ambient temperature

Check the winterfront, shutters, and under-the-hood air. Use under-the-hood intake air in cold weather. Refer to Operation of Diesel Engines in Cold Climates, Bulletin 3379009, and Procedure 101-004 (Cold Weather Starting) in Section 1.

OK

Go To Next Step

STEP 2

Ether starting aid is malfunctioning

Repair or replace the ether starting aids. Refer to the manufacturer's instructions.

OK

Go To Next Step

STEP 3

Fuel grade is not correct for the application or the fuel quality is poor

Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.

OK

Go To Next Step

STEP 4

Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section 5.

OK

Go To Next Step

STEP 5

Coolant temperature is below specification

Refer to the Coolant Temperature Below Normal symptom tree.

OK

Go To Next Step

STEP 6

Contact a Cummins Authorized Repair Facility

Engine Power Output Low

Cause

Correction

STEP 1

Fuel grade is **not** correct for the application or the fuel quality is poor

Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.

OK

Go To Next Step

STEP 2

Engine is operating above recommended altitude

Engine power decreases above recommended altitude. Refer to the Engine Data Sheet for specifications.

OK

Go To Next Step

STEP 3

Tachometer is **not** calibrated or is malfunctioning

Compare the tachometer reading with a handheld tachometer. Replace the tachometer as necessary. Refer to the OEM service manual.

OK

Go To Next Step

STEP 4

Intake and exhaust system restricted

Check the intake and exhaust systems for restrictions. Inspect the intake air filter and replace as necessary.

OK

Go To Next Step

STEP 5

Air intake system restriction is above specification

Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-059 (Air Cleaner Restriction) in Section 4.

OK

Go To Next Step

STEP 6

Air intake or exhaust leaks

Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 7

Air leak between the turbocharger and the intake manifold

Check for leaks in the air crossover tube, charge air cooler connections, hoses, or through holes in the manifold cover and repair or replace if necessary. Refer to the OEM service manual.

OK

Go To Next Step

STEP 8

Charge air cooler is restricted or leaking

Inspect the charge air cooler for air restrictions or leaks. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

Engine Power Output Low

Cause

Correction

STEP 9
Fuel leak

Check the fuel lines, fuel connections, and fuel filters for leaks. Check the fuel lines to the supply tanks. Refer to the OEM service manual.

OK
Go To Next Step

STEP 10
Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section 5.

OK
Go To Next Step

STEP 11
Fuel supply is **not** adequate

Check the flow through the filter to locate the source of the restriction. Refer to the OEM service manual.

OK
Go To Next Step

STEP 12
Fuel return restriction excessive

Inspect the fuel return lines for restrictions. Refer to the OEM service manual.

OK
Go To Next Step

STEP 13
Fuel filter is plugged

Measure the fuel pressure before and after the fuel filter. Refer to Procedure 006-015 (Fuel Filter Spin-on) in Section 5.

OK
Go To Next Step

STEP 14
Fuel pump overflow valve is malfunctioning

Check the overflow valve. Replace if necessary. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 15
Fuel lift pump is malfunctioning

Check the fuel lift pump for correct operation. Check the pump output pressure. Replace the fuel lift pump if necessary. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 16
Vehicle parasitics are excessive

Check the vehicle brakes for dragging, transmission malfunction, cooling fan operation cycle time, and engine-driven units. Refer to the OEM service manual.

OK
Go To Next Step

Engine Power Output Low

Cause

Correction

STEP 17
Lubricating oil level above specification

Check the oil level. Verify the oil pan capacity. Fill the system to the specified level. Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3.

OK
Go To Next Step

STEP 18
Contact a Cummins Authorized Repair Facility

Engine Runs Rough at Idle

Cause

Correction

STEP 1
Engine is cold

Allow the engine to warm to operating temperature. If the engine will **not** reach operating temperature, refer to the Coolant Temperature Below Normal symptom tree.

OK
Go To Next Step

STEP 2
Idle speed is set too low for accessories

Check and adjust the low-idle screw. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 3
Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section 5.

OK
Go To Next Step

STEP 4
Fuel filter is plugged

Measure the fuel pressure before and after the fuel filter. Refer to Procedure 006-015 (Fuel Filter Spin-on) in Section 5.

OK
Go To Next Step

STEP 5
Fuel supply is **not** adequate

Check the flow through the filter to locate the source of the restriction. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 6
Fuel lift pump is malfunctioning

Check the fuel lift pump for correct operation. Check the pump output pressure. Replace the fuel lift pump if necessary. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 7
Engine mounts are worn, damaged, or **not** correct.

Check the engine mounts. Refer to the OEM service manual.

OK
Go To Next Step

STEP 8
Fuel grade is **not** correct for the application or the fuel quality is poor

Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.

OK
Go To Next Step

STEP 9
Contact a Cummins Authorized Repair Facility

Engine Runs Rough or Misfires

Cause

Correction

STEP 1
Engine is cold

Allow the engine to warm to operating temperature. If the engine will **not** reach operating temperature, refer to the Coolant Temperature Below Normal symptom tree.

OK
Go To Next Step

STEP 2
Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section 5.

OK
Go To Next Step

STEP 3
Fuel grade is **not** correct for the application or the fuel quality is poor

Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.

OK
Go To Next Step

STEP 4
Fuel leak

Check the fuel lines, fuel connections, and fuel filters for leaks. Refer to the OEM service manual.

OK
Go To Next Step

STEP 5
Fuel filter is plugged

Measure the fuel pressure before and after the fuel filter. Refer to Procedure 006-015 (Fuel Filter Spin-on) in Section 5.

OK
Go To Next Step

STEP 6
Fuel supply is **not** adequate

Check the flow through the filter to locate the source of the restriction. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 7
Fuel lift pump is malfunctioning

Check the fuel lift pump for correct operation. Check the pump output pressure. Replace the fuel lift pump if necessary. Refer to a Cummins Authorized Repair Facility.

OK
Go To Next Step

STEP 8
Engine mounts are worn, damaged, or **not** correct

Check the engine mounts. Refer to the OEM service manual.

OK
Go To Next Step

STEP 9
Contact a Cummins Authorized Repair Facility

Engine Shuts Off Unexpectedly or Dies During Deceleration

Cause

Correction

STEP 1

Engine will not restart

Refer to the Engine Difficult to Start or Will Not Start symptom tree.

OK

Go To Next Step

STEP 2

Fuel level is low in the tank

Fill the supply tank. Refer to the OEM service manual.

OK

Go To Next Step

STEP 3

Fuel shutoff is malfunctioning

Check for loose wires and verify that the fuel shutoff valve is functioning. Refer to the OEM service manual.

OK

Go To Next Step

STEP 4

OEM engine protection system is malfunctioning

Isolate the OEM engine protection system. Follow the OEM service manuals to check for a malfunction.

OK

Go To Next Step

STEP 5

Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe, and fuel filters as necessary. Refer to Procedure 006-003 (Air in Fuel) in Section 5.

OK

Go To Next Step

STEP 6

Contact a Cummins Authorized Repair Facility

Engine Speed Surges at Low or High Idle

Cause

Correction

STEP 1
Fuel level is low in the tank

Fill the supply tank. Refer to the OEM service manual.

OK
Go To Next Step

STEP 2
Engine idle speed is set too low

Adjust the idle speed. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 3
Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section 5.

OK
Go To Next Step

STEP 4
Fuel filter is plugged

Measure the fuel pressure before and after the fuel filter. Refer to Procedure 006-015 (Fuel Filter Spin-on) in Section 5.

OK
Go To Next Step

STEP 5
Fuel supply is not adequate

Check the flow through the filter to locate the source of the restriction. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 6
Fuel lift pump is malfunctioning

Check the fuel lift pump for correct operation. Check the pump output pressure. Replace the fuel lift pump if necessary. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 7
Fuel grade is not correct for the application or the fuel quality is poor

Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.

OK
Go To Next Step

STEP 8
Contact a Cummins Authorized Repair Facility

Engine Speed Surges Under Load or in Operating Range

Cause

Correction

STEP 1

Fuel level is low in the tank

Fill the supply tank. Refer to the OEM service manual.

OK

Go To Next Step

STEP 2

Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section 5.

OK

Go To Next Step

STEP 3

Fuel filter is plugged

Measure the fuel pressure before and after the fuel filter. Refer to Procedure 006-015 (Fuel Filter Spin-on) in Section 5.

OK

Go To Next Step

STEP 4

Fuel supply is not adequate

Check the flow through the filter to locate the source of the restriction. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 5

Idling with excessive load

Use the PTO feature for loaded conditions at low engine speeds. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 6

Vehicle parasitics are excessive

Check the vehicle brakes for dragging, transmission malfunction, cooling fan operation cycle time, and engine-driven units. Refer to the OEM service manual.

OK

Go To Next Step

STEP 7

Clutch is malfunctioning or is not correct

Compare the drivetrain specifications to Cummins recommendations. Check the clutch for correct operation. Refer to the OEM service manual.

OK

Go To Next Step

STEP 8

Fuel grade is not correct for the application or the fuel quality is poor

Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.

OK

Go To Next Step

STEP 9

Contact a Cummins Authorized Repair Facility

Engine Starts But Will Not Keep Running

Cause

Correction

<p>STEP 1 Fuel level is low in the tank</p>	<p>Fill the supply tank. Refer to the OEM service manual.</p>
<p>OK Go To Next Step</p>	
<p>STEP 2 Idle speed is set too low for accessories</p>	<p>Check and adjust the low-idle screw. Refer to a Cummins Authorized Repair Location.</p>
<p>OK Go To Next Step</p>	
<p>STEP 3 Engine-driven units are engaged</p>	<p>Disengage engine-driven units. Refer to the OEM service manual.</p>
<p>OK Go To Next Step</p>	
<p>STEP 4 Fuel shutoff is malfunctioning</p>	<p>Check for loose wires and verify that the fuel shutoff valve is functioning. Check to be sure manual shutoff lever is in the run position. Refer to the OEM service manual.</p>
<p>OK Go To Next Step</p>	
<p>STEP 5 Air in the fuel system</p>	<p>Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section 5.</p>
<p>OK Go To Next Step</p>	
<p>STEP 6 Fuel filter or fuel suction line is restricted</p>	<p>Replace the fuel filter. Refer to Procedure 006-015 (Fuel Filter Spin-on) in Section 5.</p>
<p>OK Go To Next Step</p>	
<p>STEP 7 Fuel grade is not correct for the application or the fuel quality is poor</p>	<p>Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.</p>
<p>OK Go To Next Step</p>	
<p>STEP 8 Contact a Cummins Authorized Repair Facility</p>	

Engine Vibration Excessive

Cause

Correction

STEP 1

Belt-driven accessories are malfunctioning

Check the fan hub, alternator, refrigerant compressor, and hydraulic pump for interference. Isolate belt-driven accessories and check for vibration. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 2

Air compressor pumping time is excessive

Refer to the Air Compressor Cycles Frequently symptom tree.

OK

Go To Next Step

STEP 3

Engine idle speed is set too low

Adjust the idle speed. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 4

Engine mounts are worn, damaged, or not correct

Check the engine mounts. Refer to the OEM service manual.

OK

Go To Next Step

STEP 5

Fan is loose, damaged, or has excessive hub bearing end play

Check the fan. Refer to Procedure 008-040 (Fan, Cooling) in Section 3.

OK

Go To Next Step

STEP 6

Engine is misfiring

Refer to the Engine Runs Rough or Misfires symptom tree.

OK

Go To Next Step

STEP 7

Alternator bearing worn or damaged

Clean and replace the alternator. Refer to the OEM service manual.

OK

Go To Next Step

STEP 8

Contact a Cummins Authorized Repair Facility

Engine Will Not Crank or Cranks Slowly (Air Starter)

Cause

Correction

STEP 1

Air pressure is low in the air tanks

Increase air pressure with an external air source. Refer to the OEM service manual.

OK

Go To Next Step

STEP 2

Engine-driven units are engaged

Disengage engine-driven units. Refer to the OEM Service Manual.

OK

Go To Next Step

STEP 3

Lubricating oil level above specification

Check the oil level. Verify the oil pan capacity. Fill the system to the specified level. Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3.

OK

Go To Next Step

STEP 4

Lubricating oil does **not** meet specifications for operating conditions

Change the oil and filters. Refer to Procedures 007-002 (Lubricating Oil and Filters) and 007-013 (Lubricating Oil Filters Spin-on) in Section 4. Use the oil recommended in Section V.

OK

Go To Next Step

STEP 5

Electrical system is "open" (blown fuses, broken wires, or loose connections)

Check the fuses, wires, and connections. Refer to the OEM service manual and the manufacturer's wiring diagram.

OK

Go To Next Step

STEP 6

Battery charge is low

Check battery. If the battery is low, check the alternator for proper charging. Charge the battery, and replace if necessary. Refer to the OEM service manual.

OK

Go To Next Step

STEP 7

Keyswitch circuit is malfunctioning

Check the vehicle, equipment, or vessel keyswitch circuit. Refer to the OEM service manual.

OK

Go To Next Step

STEP 8

Starter solenoid is **not** receiving voltage

Check the battery supply to the starter solenoid. Refer to the OEM service manual.

OK

Go To Next Step

STEP 9

Starting motor is malfunctioning or starting motor is **not** correct

Check the starting motor operation. Compare the starting motor with the engine and vehicle specifications. Refer to the manufacturer's instructions.

OK

Go To Next Step

Engine Will Not Crank or Cranks Slowly (Air Starter)

Cause

Correction

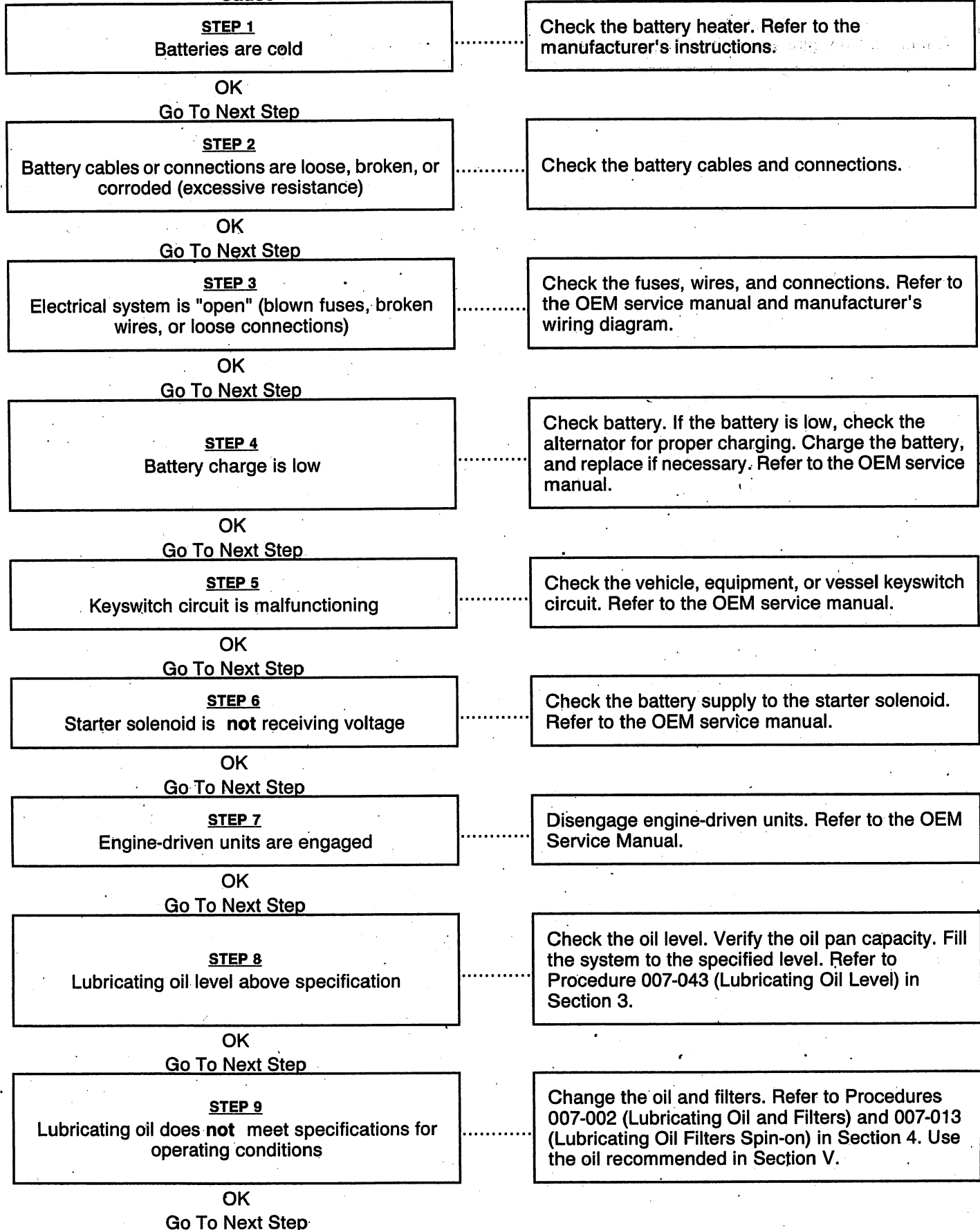
STEP 10

Contact a Cummins Authorized Repair Facility

Engine Will Not Crank or Cranks Slowly (Electric Starter)

Cause

Correction



Engine Will Not Crank or Cranks Slowly (Electric Starter)
Cause

Correction

STEP 10
Contact a Cummins Authorized Repair Facility

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Engine Will Not Reach Rated Speed (RPM)

Cause

Correction

STEP 1

Vehicle speed is too low for adequate cooling with high engine load

Reduce the engine load. Increase the engine (fan) rpm by downshifting.

OK

Go To Next Step

STEP 2

Tachometer is **not** calibrated or is malfunctioning

Compare the tachometer reading with a handheld tachometer. Replace the tachometer as necessary. Refer to the OEM service manual.

OK

Go To Next Step

STEP 3

Air-fuel tube leaking, wastegate diaphragm ruptured, or wastegate plumbing damaged

Tighten the fittings, repair plumbing, replace wastegate diaphragm. Refer to the OEM service manual or a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 4

Charge air cooler restricted (if equipped)

Inspect the air cooler for internal and external restrictions. Replace the restricted cooler if necessary. Refer to the OEM service manual.

OK

Go To Next Step

STEP 5

Fuel supply is **not** adequate

Check the flow through the filter to locate the source of the restriction. Refer to the OEM service manual.

OK

Go To Next Step

STEP 6

Exhaust back pressure too high

Measure and correct if above specification. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 7

Fuel lift pump is malfunctioning

Check the fuel lift pump for correct operation. Check the pump output pressure. Replace the fuel lift pump if necessary. Refer to a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 8

Vehicle parasitics are excessive

Check the vehicle brakes for dragging, transmission malfunction, cooling fan operation cycle time, and engine-driven units. Refer to the OEM service manual.

OK

Go To Next Step

STEP 9

Engine power output is low

Refer to the Engine Power Outlet Low symptom tree.

OK

Go To Next Step

Engine Will Not Reach Rated Speed (RPM)

Cause

Correction

STEP 10

Contact a Cummins Authorized Repair Facility

Engine Will Not Shut Off

Cause

Correction

STEP 1
Fuel shutoff is malfunctioning

Check for loose wires and verify that the fuel shutoff valve is functioning. Refer to the OEM service manual.

OK
Go To Next Step

STEP 2
Engine running on fumes drawn into the air intake

Inspect the air intake ducts. Locate and isolate the source of the fumes. Make repairs as needed. Refer to the OEM service manual.

OK
Go To Next Step

STEP 3
Fuel leak

Check the fuel lines, fuel connections, and fuel filters for leaks using the combustible gas detector service tool. Refer to the OEM service manual.

OK
Go To Next Step

STEP 4
Contact a Cummins Authorized Repair Facility



Exhaust Smoke Excessive Under Load

Cause

Correction

STEP 1
Engine is being lugged down

Use lower gear.

OK
Go To Next Step

STEP 2
Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section 5.

OK
Go To Next Step

STEP 3
Air filter is restricted

Check the air filter for restrictions. Refer to Procedure 010-059 (Air Cleaner Restriction) in Section 4.

OK
Go To Next Step

STEP 4
Intake or exhaust leak

Check intake and exhaust systems for loose or damaged piping connections and/or missing pipe plugs. Check turbocharger and exhaust manifold mounting. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 5
Engine is cold

Allow the engine to warm to operating temperature. If the engine will not reach operating temperature, refer to the Coolant Temperature Below Normal symptom tree.

OK
Go To Next Step

STEP 6
Air-fuel (AFC) control is leaking or obstructed

Check the AFC for leaks. Repair any leaks found, if necessary. Check and clean AFC tubing and fittings for obstructions. Refer to the OEM service manual or a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 7
Contact a Cummins Authorized Repair Facility

Fault Code Warning Lamps Stay On (No Apparent Reason)

Cause

Correction

STEP 1

Diagnostic shorting plug is installed

Remove the diagnostic shorting plug.

OK

Go To Next Step

STEP 2

Diagnostic switch is in the ON position

Turn off the diagnostic switch.

OK

Go To Next Step

STEP 3

Electronic fault codes are active

For instructions on how to read active fault codes, refer to Procedure 101-007 (Electronic Controlled Fuel System) in Section 1. If fault codes are active, contact a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 4

Contact a Cummins Authorized Repair Facility

Fault Code Warning Lamps Do Not Illuminate

Cause

Correction

STEP 1

Keyswitch is in the OFF position

Turn the keyswitch to the ON position.

OK

Go To Next Step

STEP 2

Battery voltage supply to the electronic control module (ECM) is low, interrupted, or open

Check the battery connections, the fuses, and the unswitched battery supply circuit. Refer to the OEM service manual.

OK

Go To Next Step

STEP 3

Idle shutdown or PTO shutdown features are activated

Check the time limit on idle and PTO shutdowns with an electronic service tool. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 4

Contact a Cummins Authorized Repair Facility

Fuel Consumption Excessive

Cause

Correction

STEP 1
Operator technique is **not** correct.

Refer to Procedure 101-015 (Operating the Engine) in Section 1.

OK
Go To Next Step

STEP 2
Fuel leak

Check the fuel lines, fuel connections, and fuel filters for leaks. Check the fuel lines to the supply tanks. Refer to the OEM service manual.

OK
Go To Next Step

STEP 3
Hubometer or odometer is miscalibrated

Check the hubometer and odometer calibrations. Calibrate or replace the hubometer or odometer, if necessary. Calculate fuel consumption with new mileage figures.

OK
Go To Next Step

STEP 4
Hour meter is miscalibrated

Check the hour meter. Calibrate or replace the hour meter if necessary. Calculate fuel consumption with new figures.

OK
Go To Next Step

STEP 5
Air intake or exhaust leaks

Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 6
Air intake system restriction is above specification

Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-059 (Air Cleaner Restriction) in Section 4.

OK
Go To Next Step

STEP 7
Equipment and environmental factors are affecting fuel consumption

Consider ambient temperatures, wind, tire size, axle alignment, routes, and use of aerodynamic aids when evaluating fuel consumption.

OK
Go To Next Step

STEP 8
Lubricating oil level above specification

Check the oil level. Verify the oil pan capacity. Fill the system to the specified level. Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3 and Procedure 018-003 (Lubricating Oil Recommendations and Specifications) in Section V.

OK
Go To Next Step

Fuel Consumption Excessive

Cause

Correction

STEP 9

Contact a Cummins Authorized Repair Facility

Fuel in Coolant

Cause

Correction

STEP 1

Bulk coolant supply is contaminated

Check the bulk coolant supply. Drain the coolant and replace with noncontaminated coolant. Replace the coolant filters. Refer to Procedure 008-018 (Cooling System) in Section 7.

OK

Go To Next Step

STEP 2

Contact a Cummins Authorized Repair Facility

Fuel in the Lubricating Oil

Cause

Correction

STEP 1

Engine idle time is excessive

Low oil and coolant temperatures can be caused by long idle time (greater than 10 minutes). Shut off the engine rather than idle for long periods. If idle time is necessary, raise the idle speed.

OK

Go To Next Step

STEP 2

Bulk oil supply is contaminated

Check the bulk oil supply. Drain the oil and replace with noncontaminated oil. Replace the oil filter(s). Refer to Procedure 008-018 (Cooling System) in Section 7.

OK

Go To Next Step

STEP 3

Contact a Cummins Authorized Repair Facility

Fuel or Lubricating Oil Leaking From Exhaust Manifold

Cause

Correction

STEP 1

Intake air restriction is high

Check the air intake system for restriction. Refer to the OEM service manual.

OK

Go To Next Step

STEP 2

Turbocharger oil drain-line is restricted

Remove the turbocharger oil drain line and check for restriction. Clean or replace the oil drain line. Refer to the OEM service manual or a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 3

Turbocharger oil seal is leaking

Check the turbocharger for oil seals and for leaks. Refer to the Turbocharger Leaks Engine Oil or Fuel Symptom tree.

OK

Go To Next Step

STEP 4

Contact a Cummins Authorized Repair Facility

Intake Manifold Air Temperature Above Specification

Cause

Correction

STEP 1

Charge air cooler fins, radiator fins, or air conditioner condenser fins are damaged or obstructed with debris

Inspect the charge air cooler, air conditioner condenser, and radiator fins. Clean, if necessary. Refer to the OEM service manual.

OK

Go To Next Step

STEP 2

Cold weather radiator cover or winterfront is closed

Open the cold weather radiator cover or the winterfront. Maintain a minimum of 387 cm² [60 in²] of opening at all times. Refer to Procedure 101-004 (Cold Weather Starting) in Section 1.

OK

Go To Next Step

STEP 3

Fan drive belt or water pump belt is broken

Check the fan drive belt and water pump belt. Replace the belts if necessary. Refer to Procedure 008-002 (Drive Belt, Cooling Fan) in Section A.

OK

Go To Next Step

STEP 4

Fan shroud is damaged or missing or the air recirculation baffles are damaged or missing

Inspect the shroud and the recirculation baffles. Repair, replace, or install, if necessary. Refer to the OEM service manual.

OK

Go To Next Step

STEP 5

Radiator shutters are **not** opening completely or the shutterstat setting is wrong

Inspect the radiator shutters. Repair or replace if necessary. Refer to the manufacturer's instructions. Check the shutterstat setting. Refer to the OEM service manual.

OK

Go To Next Step

STEP 6

Vehicle speed is too low for adequate cooling with high engine load

Reduce the engine load. Increase the engine (fan) rpm by downshifting.

OK

Go To Next Step

STEP 7

Vehicle cooling system is **not** adequate

Verify that the engine and vehicle cooling systems are using the correct components. Refer to the OEM service manual.

OK

Go To Next Step

STEP 8

Intake manifold temperature gauge is malfunctioning, if equipped

Test the temperature gauge. Refer to the OEM service manual.

OK

Go To Next Step

Intake Manifold Air Temperature Above Specification

Cause

Correction

STEP 9

Fan is **not** an adequate size for the application

Verify that the fan is the correct size. Refer to the engine data tag and OEM service manual.

OK

Go To Next Step

STEP 10

Contact a Cummins Authorized Repair Facility

Intake Manifold Pressure (Boost) is Below Normal

Cause

Correction

STEP 1

Air intake or exhaust leaks

Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 2

Air intake system restriction is above specification

Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-059 (Air Cleaner Restriction) in Section 4.

OK

Go To Next Step

STEP 3

Charge air cooler is restricted or leaking

Inspect the charge air cooler for air restrictions or leaks. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 4

Engine power output is low

Refer to the Engine Power Output Low symptom tree.

OK

Go To Next Step

STEP 5

Contact a Cummins Authorized Repair Facility

Lubricating Oil Consumption Excessive

Cause

Correction

STEP 1
Crankcase ventilation system is plugged

Check and clean the crankcase breather and vent tube. Refer to Procedure 003-018 (Crankcase Breather Tube) in Section 3 .

OK
Go To Next Step

STEP 2
Lubricating oil does **not** meet specifications for operating conditions

Change the oil and filters. Refer to Procedure 007-013 (Lubricating Oil Filter Spin-on) in Section 4 and Procedure 018-003 (Lubricating Oil Recommendations and Specifications) in Section V.

OK
Go To Next Step

STEP 3
Lubricating oil drain interval is excessive

Verify the correct lubricating oil drain interval. Refer to Procedure 102-002 (Maintenance Schedule) in Section 2 .

OK
Go To Next Step

STEP 4
Lubricating oil leak (external)

Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to Procedure 018-006 (Engine Component Torque Values) in Section V and a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 5
Verify the oil consumption rate

Check the amount of oil added versus the hours of operation.

OK
Go To Next Step

STEP 6
Air compressor is pumping lubricating oil into the air system

Check the air lines for carbon buildup and lubricating oil. Refer to a Cummins Authorized Repair Location.

OK
Go To Next Step

STEP 7
Contact a Cummins Authorized Repair Facility

Lubricating Oil Contaminated

Cause

Correction

STEP 1

Lubricating oil sludge is excessive

Change the oil and filters. Refer to Procedure 007-013 (Lubricating Oil Filters Spin-on) in Section 4 and the Lubricating Oil Sludge in the Crankcase Excessive symptom tree.

OK

Go To Next Step

STEP 2

Lubricating oil is contaminated with coolant or fuel

Change the oil and filters. Refer to Procedure 007-013 (Lubricating Oil Filters Spin-on) in Section 4 and Procedure 018-003 (Lubricating Oil Recommendations and Specifications) in Section V.

OK

Go To Next Step

STEP 3

Fuel lift pump is malfunctioning

Check the fuel lift pump for correct operation. Check the pump output pressure. Replace the fuel lift pump if necessary. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 4

Bulk oil supply is contaminated

Check the bulk oil supply. Drain the oil and replace with noncontaminated oil. Replace the oil filter(s). Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 4.

OK

Go To Next Step

STEP 5

Contact a Cummins Authorized Repair Facility

Lubricating Oil Loss

Cause	Correction
<p>STEP 1 Lubricating oil leak (external)</p>	<p>Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to the OEM service manual.</p>
<p>OK Go To Next Step</p>	
<p>STEP 2 Lubricating oil level below specification</p>	<p>Check the oil level. Verify the oil pan capacity. Fill the system to the specified level. Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3 and Procedure 018-003 (Lubricating Oil Recommendations and Specifications) in Section V.</p>
<p>OK Go To Next Step</p>	
<p>STEP 3 Lubricating oil does not meet specifications for operating conditions</p>	<p>Change the oil and filters. Refer to Procedure 007-013 (Lubricating Oil Filters Spin-on) in Section 5.</p>
<p>OK Go To Next Step</p>	
<p>STEP 4 Lubricating oil pressure switch, gauge, or sensor is malfunctioning or is not in the correct location</p>	<p>Check the oil pressure switch, gauge, or sensor for correct operation and location. Refer to a Cummins Authorized Repair Location.</p>
<p>OK Go To Next Step</p>	
<p>STEP 5 Lubricating oil cooler is leaking</p>	<p>Check the lubricating oil cooler for coolant leaks and cracks. Refer to the OEM service manual or a Cummins Authorized Repair Location.</p>
<p>OK Go To Next Step</p>	
<p>STEP 6 Air compressor is pumping lubricating oil into the air system</p>	<p>Check the air lines for carbon buildup and lubricating oil. Refer to the OEM service manual or a Cummins Authorized Repair Location.</p>
<p>OK Go To Next Step</p>	
<p>STEP 7 Blowby excessive</p>	<p>Check for excessive blowby. Refer to the OEM service manual or a Cummins Authorized Repair Location.</p>
<p>OK Go To Next Step</p>	
<p>STEP 8 Turbocharger oil seal is leaking</p>	<p>Check the turbocharger for oil seals and for leaks. Refer to the Turbocharger Leaks Engine Oil or Fuel symptom tree.</p>
<p>OK Go To Next Step</p>	
<p>STEP 9 Contact a Cummins Authorized Repair Facility</p>	

Lubricating Oil Pressure High

Cause

Correction

STEP 1

Coolant temperature is below specification

Refer to the Coolant Temperature Below Normal symptom tree.

OK

Go To Next Step

STEP 2

Lubricating oil does **not** meet specifications for operating conditions

Change the oil and filters. Refer to Procedure 007-013 (Lubricating Oil Filters Spin-on) in Section 4. Use the oil recommended in Section V.

OK

Go To Next Step

STEP 3

Lubricating oil pressure switch, gauge, or sensor is malfunctioning or is **not** in the correct location

Check the oil pressure switch, gauge, or sensor for correct operation and location. Refer to the OEM service manual.

OK

Go To Next Step

STEP 4

Contact a Cummins Authorized Repair Facility

Lubricating Oil Pressure Low

Cause

Correction

STEP 1

Lubricating oil does **not** meet specifications for operating conditions

Change the oil and filters. Refer to Procedure 007-013 (Lubricating Oil Filters Spin-on) in Section 4.

OK

Go To Next Step

STEP 2

Lubricating oil is diluted with water

Check for a missing dipstick, rain caps, or oil fill caps. Change the oil. Refer to the OEM service manual.

OK

Go To Next Step

STEP 3

Lubricating oil filter is plugged

Change the oil and filter. Refer to Procedure 007-013 (Lubricating Oil Filters Spin-on) in Section 4.

OK

Go To Next Step

STEP 4

Lubricating oil is contaminated with coolant or fuel

Refer to the Lubricating Oil Contaminated symptom tree.

OK

Go To Next Step

STEP 5

Lubricating oil leak (external)

Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to Procedure 018-006 (Engine Component Torque Values) in Section V.

OK

Go To Next Step

STEP 6

Lubricating oil level is above or below specification

Check the oil level. Add or drain oil, if necessary. Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3 and Procedure 007-013 (Lubricating Oil Filters Spin-on) in Section 4.

OK

Go To Next Step

STEP 7

Engine angularity during operation exceeds specification

Refer to the Engine Data Sheet, the OEM service manual, or a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 8

Lubricating oil pressure switch, gauge, or sensor is malfunctioning or is **not** in the correct location

Check the oil pressure switch, gauge, or sensor for correct operation and location. Refer to the OEM service manual.

OK

Go To Next Step

STEP 9

Contact a Cummins Authorized Repair Facility.

Lubricating Oil Sludge in the Crankcase Excessive

Cause

STEP 1

Bulk oil supply is contaminated

OK

Go To Next Step

STEP 2

Coolant temperature is below specification

OK

Go To Next Step

STEP 3

Crankcase ventilation system is plugged

OK

Go To Next Step

STEP 4

Fuel grade is not correct for the application or the fuel quality is poor

OK

Go To Next Step

STEP 5

Lubricating oil does not meet specifications for operating conditions

OK

Go To Next Step

STEP 6

Contact a Cummins Authorized Repair Facility

Correction

Check the bulk oil supply. Drain the oil and replace with noncontaminated oil. Replace the oil filter(s). Refer to Procedures 007-002 (Lubricating Oil and Filters) and 007-013 (Lubricating Oil Filters Spin-on) in Section 4.

Refer to the Coolant Temperature Below Normal symptom tree.

Check and clean the crankcase breather and vent tube. Refer to Procedure 003-018 (Crankcase Breather Tube) in Section 3.

Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.

Change the oil and filters. Refer to Procedure 007-013 (Lubricating Oil Filters Spin-on) in Section 4.

Smoke, Black — Excessive

Cause

Correction

STEP 1

Air intake system restriction is above specification

Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-059 (Air Cleaner Restriction) in Section 4.

OK

Go To Next Step

STEP 2

Air intake or exhaust leaks

Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 3

Charge air cooler is restricted or leaking

Inspect the charge air cooler for air restrictions or leaks. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 4

Contact a Cummins Authorized Repair Facility

Smoke, White — Excessive

Cause

Correction

STEP 1

Starting procedure is not correct

Verify the correct starting procedure. Refer to Procedure 101-014 (Normal Starting Procedure) in Section 1.

OK

Go To Next Step

STEP 2

Engine is cold

Allow the engine to warm to operating temperature. If the engine will not reach operating temperature, refer to the Coolant Temperature Below Normal symptom tree.

OK

Go To Next Step

STEP 3

Engine is operating at low ambient temperature

Check the winterfront, shutters, and under-the-hood air. Use under-the-hood intake air in cold weather. Refer to Operation of Diesel Engines in Cold Climate, Bulletin 3379009, and Procedure 101-004 (Cold Weather Starting) in Section 1.

OK

Go To Next Step

STEP 4

Starting aid is malfunctioning

Check for correct operation of cold-starting aid. Refer to Procedure 101-004 (Cold Weather Starting) in Section 1.

OK

Go To Next Step

STEP 5

Coolant temperature is below specification

Refer to the Coolant Temperature is Below Normal symptom tree.

OK

Go To Next Step

STEP 6

Fuel grade is not correct for the application or the fuel quality is poor.

Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.

OK

Go To Next Step

STEP 7

Air intake or exhaust leaks

Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 8

Air intake system restriction is above specification

Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-059 (Air Cleaner Restriction) in Section 4.

OK

Go To Next Step

Smoke, White — Excessive

Cause

Correction

STEP 9
Charge air cooler is restricted or leaking

Inspect the charge air cooler for air restrictions or leaks. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 10
Contact a Cummins Authorized Repair Facility



Turbocharger Leaks Engine Oil or Fuel

Cause

Correction

STEP 1

Engine is operating for extended periods under light or no-load conditions (slobbering)

Review the engine operating instructions. Refer to Procedure 101-999 (Operating Instructions) in Section 1.

OK

Go To Next Step

STEP 2

Lubricating oil or fuel is entering the turbocharger

Remove the intake and exhaust piping, and check for oil or fuel. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 3

Turbocharger oil drain line is restricted

Remove the turbocharger oil drain line and check for restriction. Clean or replace the oil drain line. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 4

Turbocharger oil supply line loose or leaking

Check and tighten oil supply line fitting(s), if necessary. Refer to a Cummins Authorized Repair Location.

OK

Go To Next Step

STEP 5

Contact a Cummins Authorized Repair Facility

Section V - Maintenance Specifications

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General Engine

Specifications

Engine Weight (Dry) Less Flywheel and Electronics	
Naturally Aspirated.....	245 kg [540 lb]
Turbocharged/Mechanically Actuated Injector.....	255 kg [562 lb]
Turbocharged/Electronically Actuated Injector.....	275 kg [606 lb]
Compression Ratio	
Naturally Aspirated.....	18:1
Turbocharged/Mechanically Actuated Injector.....	17:1
Turbocharged/Electronically Actuated Injector.....	17:1
Bore.....	95 mm [3.74 in]
Stroke.....	115 mm [4.53 in]
Displacement.....	3.3 liters [201 C.I.D.]
Firing Order.....	1-2-4-3
Valve Clearance	
Intake.....	0.35 mm [0.014 in]
Exhaust.....	0.50 mm [0.020 in]
Rotation Viewed from the Front of the Engine.....	Clockwise

Fuel System

Specifications

Maximum Allowable Restriction to the Fuel Transfer Pump or Filter Head Must Not Exceed	76 mm Hg [3 in Hg]
Maximum Allowable Return Line Restriction Must Not Exceed	76 mm Hg [3 in Hg]
Maximum Fuel Restriction.....	76 mm Hg [3 in Hg]
Nominal Inline Transfer Pump Pressure.....	157 kPa [23 psi]
Inlet Pressure to Injection Pump Range	
Mechanically Actuated Injector.....	0.00 kPa [0.00 psi] to 82.7 kPa [12.00 psi]
Inlet Pressure to Injection Pump Range	
Electronically Actuated Injector.....	0.00 kPa [0.00 psi]

Lubricating Oil System

Specifications

Regulating Valve Opening Pressure	
Naturally Aspirated.....	490 kPa [71 psi]
Turbocharged	
Mechanically Actuated Injector.....	588 kPa [85 psi]
Electronically Actuated Injector.....	588 kPa [85 psi]
Lubricating Oil Capacity	
Total System	
Naturally Aspirated.....	7.5 liters [8.0 qt]
Turbocharged.....	8.5 liters [9.0 qt]
Standard Oil Pan Only	7.0, 8.0, or 11 liters [7.4, 8.5, or 11.6 qt]
Lubricating Oil Pressure	
At Idle (Minimum Allowable).....	69 kPa [10 psi]
At Rated Speed (Minimum Allowable).....	245 kPa [35 psi]
At High Idle	
(Minimum Allowable).....	540 kPa [78 psi]
(Maximum Allowable).....	635 kPa [92 psi]
Oil Filter Differential Pressure to Open Bypass Valve.....	98 kPa [14 psi]
Number of liters [qt] from Low to High.....	1.5 liters [1.6 qt]

Cooling System

Specifications

Coolant Capacity (Engine Only).....	4.5 liters [4.75 qt]
Standard Modulating Thermostat Range	
Start.....	82°C [180°F]
Fully Open.....	95°C [203°F]
Maximum Pressure Cap at Seal Level.....	50 kPa [7 psi]

Air Intake System

Specifications

Maximum Allowable Intake Restriction at Rated Speed and Load with Dirty Filter Element	
Naturally Aspirated.....	762 mm H ₂ O [30 in H ₂ O]
Turbocharged.....	762 mm H ₂ O [30 in H ₂ O]



Exhaust System

Specifications

Maximum Allowable Exhaust Restriction at Rated Speed and Load 76 mm Hg [3 in. Hg]

Electrical System

Specifications

Minimum Recommended Battery Capacity with Light Accessories²:

12-VDC Starter.....	550 CCA ¹
24-VDC Starter.....	225 CCA ¹

Minimum Recommended Battery Capacity with Heavy Accessories³:

12-VDC Starter.....	730 CCA ¹
24-VDC Starter.....	365 CCA ¹

Maximum Allowable Resistance of the Starting Circuit:

12-VDC Starter.....	0.0012 ohm
24-VDC Starter.....	0.0020 ohm

¹Cold Cranking Amp (CCA)

²Typical light accessories include the following:

- Alternator
- Small steering pump
- Disengaged clutch.

³Typical heavy accessories include the following:

- Hydraulic pump
- Torque Converter.

Cummins/Fleetguard® Filter Specifications

General Information

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

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

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

B3.3 Fuel Filter (Spin-on)	
Cummins Part Number	Fleetguard® Part Number
C6003117460	FF5114
C6003117480 ¹	FS19594 ¹
C6003112110 ²	FF5432 ²
C6003194110	N/A
C6003113530	N/A
¹ Fuel-water separator.	
² Fuel-water separator with a water-in-fuel sensor.	

B3.3 Lubricating Oil Filter (Spin-on)	
Cummins Part Number	Fleetguard® Part Number
N/A	LF16011 ¹
3926762S (for remote mount application)	N/A
3926763S (Perma-Cool 111)(for remote mount application)	N/A
¹ Filter used in standard applications.	

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 from dirt or water. Dirt or water in the system can cause severe damage to both the fuel pump and the fuel injectors.

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

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

NOTE: Lighter fuels can reduce fuel economy.

NOTE: Engines equipped with diesel particulate filters require the use of diesel fuel with 30 ppm sulfur maximum. There are no acceptable substitutes.

The viscosity of the fuel **must** be kept above 1.3 cSt at 40°C [104°F] to provide adequate pumping and lubricating characteristics to fuel system components.

The following chart lists acceptable substitute fuels.

Acceptable Substitute Fuels									
Number 1D Diesel (1)(2)(3)	Number 2D Diesel (3)	Number 1K Kerosene	Jet-A	Jet A1	JP-5	JP-8	Jet-B	JP-4	CITE
A	OK	Not OK	A	A	A	A	Not OK	Not OK	Not OK
<p>(1) An "A" means OK only if fuel lubricity is adequate. 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 Reciporating Rig (HFRR) in which the fuel must have a wear scar diameter of 0.45 mm [0.02 in] or less.</p> <p>(2) Any adjustment to compensate for reduced performance with a fuel system using alternate fuel is not warrantable.</p> <p>(3) Winter blend fuels, such as those found at commercial fuel-dispensing outlets, are combinations of number 1D and 2D diesel fuels and are acceptable.</p>									

Additional information for fuel recommendations and specifications can be found in Fuel for Cummins Engines, Bulletin 3379001. Refer to Procedure 205-001 (Service Literature) in Section L for ordering information.

Lubricating Oil Recommendations and Specifications

General Information

⚠CAUTION⚠

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

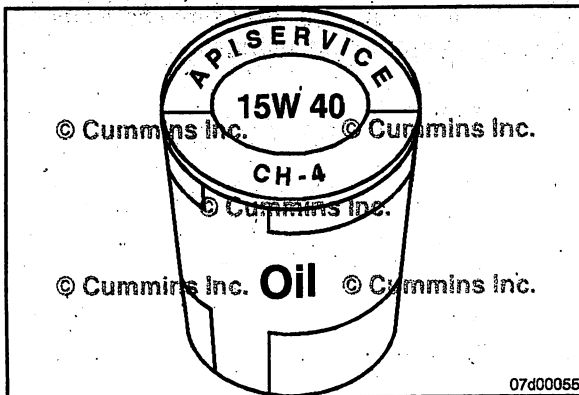
The use of quality engine lubricating oils, combined with appropriate oil drain and filter change intervals, is a critical factor in maintaining engine performance and durability.

Cummins Inc. recommends the use of high-quality SAE 15W-40 heavy-duty engine oil, such as Valvoline® Premium Blue®, which meets performance specifications as listed in the following table.

NOTE: In areas where CH-4/SJ or CG-4/SH oils are not available, refer to Procedure 102-002 (Maintenance Schedule - Oil Drain Intervals) in Section 2.

Cummins Engineering Standard Classification (CES)	American Petroleum Institute Classification (API)	International Classifications	Comments
N/A	API CD, API CE, API CG-4/SH	ACEA E-1	OBSOLETE, DO NOT USE
CES-20075	API CF-4/SG	ACEA E-2, ACEA E-3, JAMA DH-1	Minimum acceptable oil classification for midrange engines.
CES-20071, CES-20076	API CH-4/SJ, API CH-4	Global DHD-1	Acceptable oil classification for midrange engines.
CES-20072, CES 20077	API GH-4	ACEA E-5, Global DHD-1	Similar in performance to CES-20071 but validated under European test standards. Excellent oil for midrange engines.
CES-20078	API CI-4/SK, API CI-4	N/A	Excellent oil for midrange engines.

A sulfated ash limit of 1.0 mass percent is suggested for optimum valve and piston deposit and oil consumption control. For further details and discussion of engine lubricating oils for Cummins® engines, refer to Cummins Engine Oil Recommendations, Bulletin 3810340.



The API service symbols are shown in the accompanying illustration. The upper half of the symbols displays the appropriate oil categories.

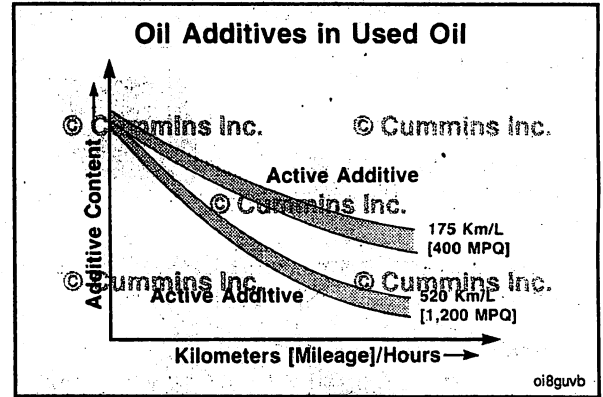
The lower half can contain words to describe oil energy-conserving features.

The center section identifies the SAE oil viscosity grade.

As the engine oil becomes contaminated, essential oil additives are depleted. Lubricating oils protect the engine as long as these additives are functioning properly. Progressive contamination of the oil between oil and filter change intervals is normal. The amount of contamination will vary depending on the operation of the engine, kilometers or miles on the oil, fuel consumed, and new oil added.

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

Refer to Procedure 102-002 (Maintenance Schedule - Oil Drain Intervals) in Section 2 to determine which oil drain interval to use for an specific engine application.

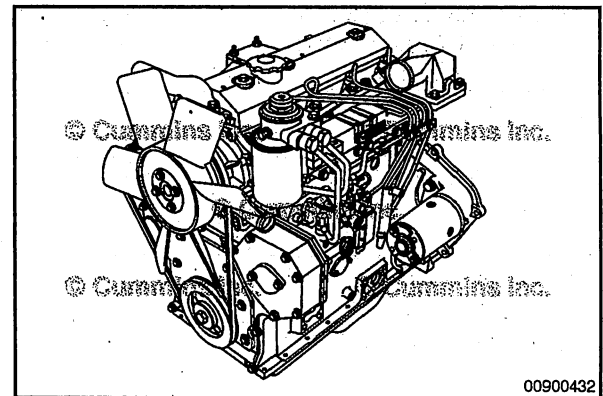


New Engine Break-in Oils

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

Additional information regarding lubricating oil availability throughout the world is available in the EMA Lubricating Oils Data Book for Heavy-Duty Automotive and Industrial Engines. The data book can be ordered from the following address:

Engine Manufacturers Association
 Two North LaSalle Street
 Suite 2200
 Chicago, IL U.S.A 60602
 Telephone: (312) 827-8733



Arctic Operation

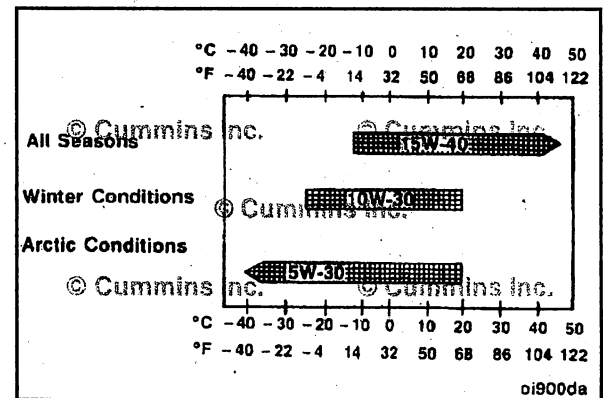


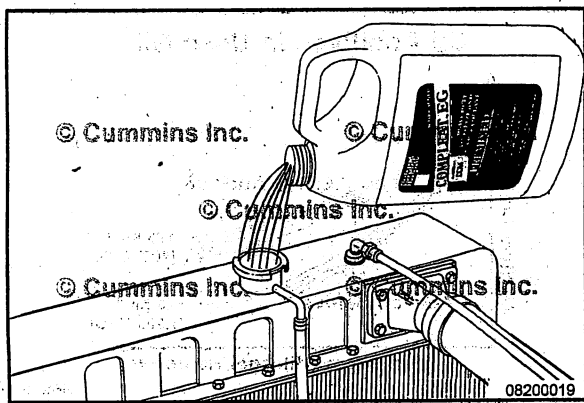
The use of a synthetic-base oil does not justify extended oil change intervals. Extended oil change intervals can decrease engine life due to factors such as corrosion, deposits, and wear.

The use of low-viscosity oils, such as 10W or 10W-30, can be used to aid in starting the engine and in providing sufficient oil flow at ambient temperatures below -5°C [23°F]. However, continuous use of low-viscosity oils can decrease engine life due to wear. Reference the illustration for conditions and temperatures.

If an engine is operated in ambient temperatures consistently below -23°C [9°F] and there are no provisions to keep the engine warm when it is not in operation, use a synthetic CH/SI or CH/SK or higher API classification engine oil with adequate low-temperature properties such as 5W-20 or 5W-30.

The oil supplier is responsible for meeting the performance service specifications represented with its product.





Coolant Recommendations and Specifications

Fully Formulated Coolant/Antifreeze

Use low-silicate antifreeze that meets ASTM4985 (GM6038M specification) criteria.

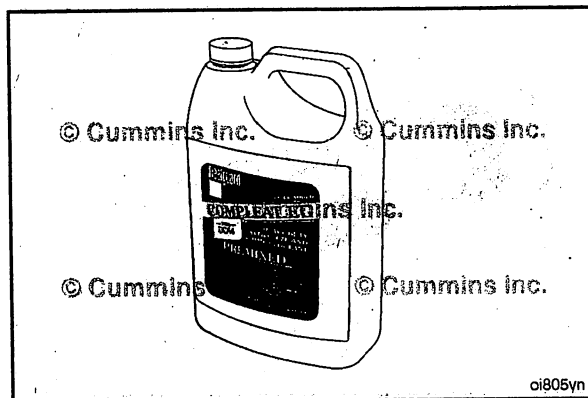
Fully formulated coolant must meet ASTM D-6210/ D-6211.

Cummins Inc. recommends using either a 50/50 mixture of good-quality water and fully formulated antifreeze, or fully formulated coolant when filling the cooling system.

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

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

Cummins Inc. recommends Fleetguard® antifreeze coolants including ES Compleat containing DCA4 Plus; Fleetcool EX containing DCA2 Plus, and ES Optimax Organic Acid Technology (OAT), which meet the requirements of Cummins Engineering Standard 14603. However, Cummins Inc., Chevron Texaco and Shell have agreed that Chevron Texaco, Shell Rotella® and their private label counterpart Extended Life OAT coolants, which do **not** meet the elastomer compatibility section of Cummins Engineering Standard 14603 are acceptable for extended service interval use, assuming the initial coolant fill requirements were met from the vehicles' original equipment manufacturer (OEM).



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Mid-Range, Heavy-Duty and High Horsepower engine overhauls, or repairs involving the replacement of the following components, using this Extended Life OAT coolant **must** discard the coolant and replace it with new coolant.

- Rocker lever housing gasket
- Lubricating oil cooler housing gasket
- Cylinder head gasket
- Thermostat housing gasket

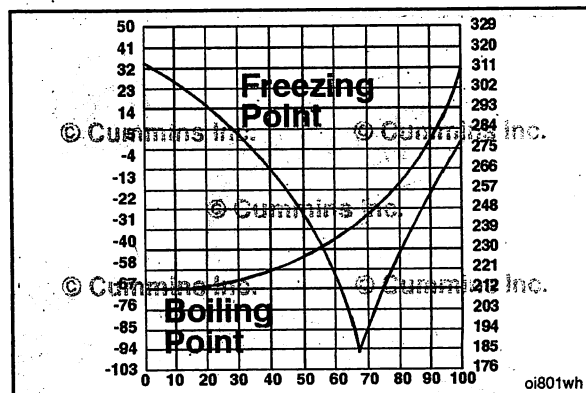
If the replacement coolant is Chevron Texaco, Shell Rotella® or their private label counterpart Extended Life OAT coolants, which do **not** meet the elastomer compatibility section of Cummins Engineering Standard 14603, then the coolant **must** be treated by adding 0.24 liters [8 oz] of liquid silicate fluid for every 45.5 liters [12 gal] of total coolant system volume. It is critical to **not** overtreat the coolant with silicate fluid.

To obtain order forms or ask questions relative to ordering the silicate fluid, contact:

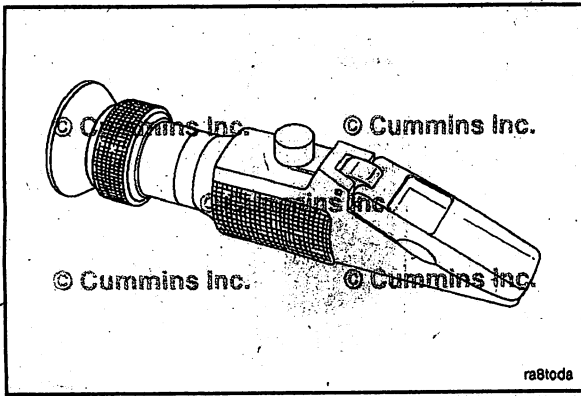
Silicate Fluid Order Program
P.O. Box 27388
Houston, TX
77277-7388
Phone: 800-346-9041
Fax: 800-876-5317

For further details and discussion of engine coolant for Cummins engines, refer to Cummins Coolant Requirements and Maintenance, Bulletin 3666132.

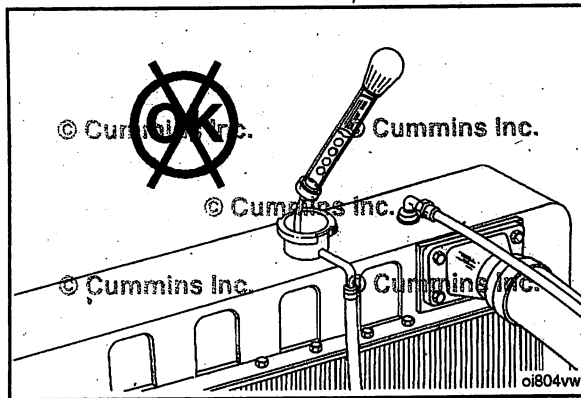
Fully formulated antifreeze **must** be mixed with good-quality water at a 50/50 ratio (40- to 60-percent working range). A 50/50 mixture of antifreeze and water gives a -36°C [-33°F] freezing point and a 108°C [226°F] boiling point, which is adequate for locations in North America. The actual lowest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



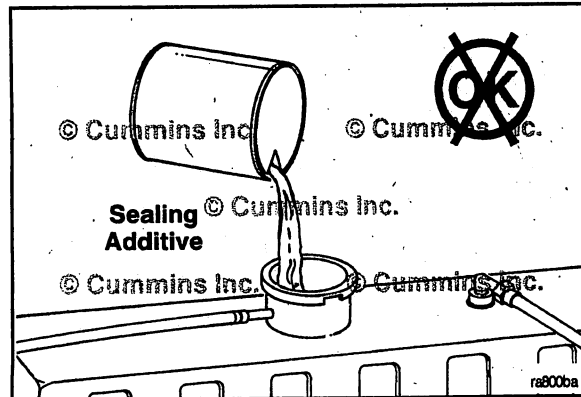
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A refractometer **must** be used to measure the freezing point of the coolant **accurately**. Use Fleetguard® refractometer, Part Number GC2800 or GC2806.



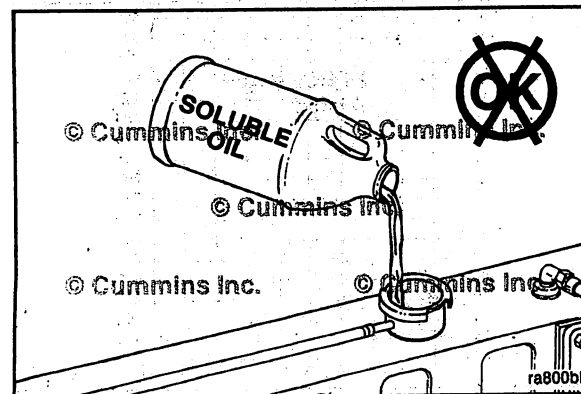
Do **not** use a floating ball hydrometer. Using floating ball hydrometers can give an incorrect reading.



Cooling System Sealing Additives

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

- Build up 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.

Drive Belt Tension

Tension Chart

SAE Belt Size	Belt Tension Gauge Part No.		Belt Tension New		Belt Tension Range Used*	
	Click-type	Burroughs	N	lbf	N	lbf
0.380 in	3822524		620	140	270 to 490	60 to 110
0.440 in	3822524		620	140	270 to 490	60 to 110
1/2 in	3822524	ST-1138	620	140	270 to 490	60 to 110
11/16 in	3822524	ST-1138	620	140	270 to 490	60 to 110
3/4 in	3822524	ST-1138	620	140	270 to 490	60 to 110
7/8 in	3822524	ST-1138	620	140	270 to 490	60 to 110
4 rib	3822524	ST-1138	620	140	270 to 490	60 to 110
5 rib	3822524	ST-1138	670	150	270 to 530	60 to 120
6 rib	3822525	ST-1293	710	160	290 to 580	65 to 130
8 rib	3822525	ST-1293	890	200	360 to 710	80 to 160
10 rib	3822525	3823138	1110	250	440 to 890	100 to 200
12 rib	3822525	3823138	1330	300	530 to 1070	120 to 240
12 rib K section	3822525	3823138	1330	300	890 to 1070	200 to 240

NOTE: This chart does not apply to automatic belt tensioners.

* A belt is considered used if it has been in service for ten minutes or longer.

* If used belt tension is less than the minimum value, tighten the belt to the maximum used belt value.

Engine Component Torque Values

Torque Table

Component	Wrench Size	N•m	[ft-lb]	[in-lb]
Alternator bracket	8 mm	31	23	
	10 mm	31	23	
Crankshaft Pulley (with PTO)	14 mm	176	130	
Crankshaft Pulley (without PTO)	14 mm	93	69	
Crankshaft Pulley (All)	18 mm	372	274	
Fan Pulley	8 mm	31	23	
Fuel Filter (Spin-on)	N/A	Tighten to manufacturer's instructions.		
Lubricating Oil Drain Plug	17 mm	51	38	
Lubricating Oil Filter (Spin-on)	N/A	Tighten to manufacturer's instructions.		
Rocker Lever Assembly	8 mm	25	18	
Rocker Lever Cover	10 mm	9		80
Starter Motor	12 mm	43	32	
Thermostat Housing	13 mm	19	14	
Water-in-Fuel Separator	N/A	Hand tighten.		

Sealants

General Information

Use the sealants listed below or sealants containing equivalent properties.

Item Description	Sealing Method
Pipe Plugs	Precoated teflon or pipe sealer
Cup Plugs	Loctite 277 or 11,264
O-Rings	Lubriplate™ 105
Rear Camshaft Expansion Plug	Precoated or Loctite 59,241 liquid teflon
Fuel Block Mounting Studs	Loctite 609
Turbocharger Drain in Block	Loctite 277 or 11,264
Front Seal in Gear Cover	Loctite 277 or 11,264
Rear Seal in Rear Cover	No sealant
Oil Pan at T-Joint	Three-Bond™ 1207C (Cummins Part Number 3823494)

Capscrew Markings and Torque Values

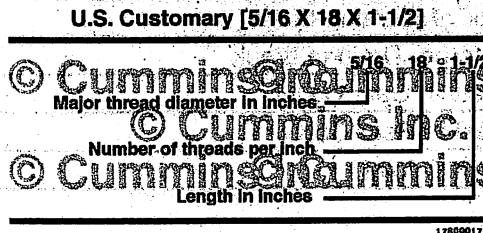
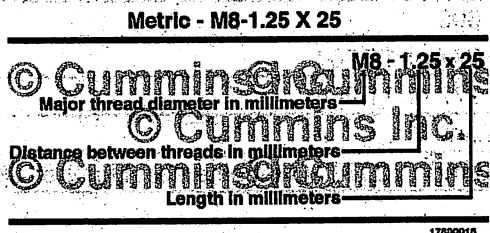
General Information



When replacing capscrews, always use a capscrew of the same measurement and strength as the capscrew being replaced. Using the wrong capscrews can result in engine damage.

Metric capscrews and nuts are identified by the grade number stamped on the head of the capscrew or on the surface of the nuts. U.S. Customary capscrews are identified by radial lines stamped on the head of the capscrew.

The following examples indicate how capscrews are identified:

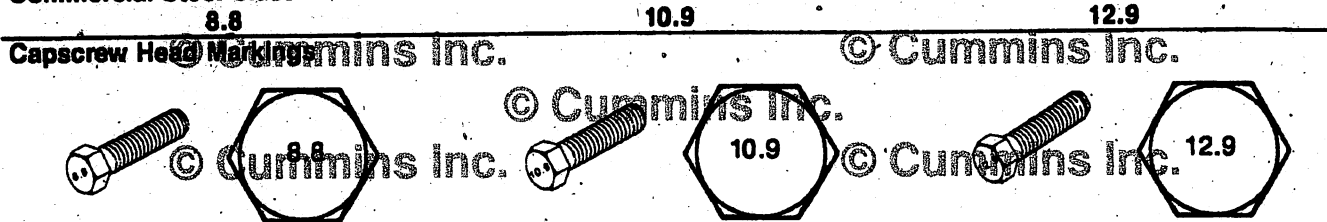


NOTES:

1. Always use the torque values listed in the following tables when specific torque values are not available.
2. Do not use the torque values in place of those specified in other sections of this manual.
3. The torque values in the table are based on the use of lubricated threads.
4. When the ft-lb value is less than 10, convert the ft-lb value to in-lb to obtain a better torque with an in-lb torque wrench. Example: 6 ft-lb equals 72 in-lb.

Capscrew Markings and Torque Values - Metric

Commercial Steel Class



Body Size Diameter mm	Torque				Torque				Torque			
	Cast Iron		Aluminum		Cast Iron		Aluminum		Cast Iron		Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
6	9	5	7	4	13	10	7	4	14	9	7	4
7	14	9	11	7	18	14	11	7	23	18	11	7
8	23	17	18	14	33	25	18	14	40	29	18	14
10	45	33	30	25	65	50	30	25	70	50	30	25
12	80	60	55	40	115	85	55	40	125	95	55	40
14	125	90	90	65	180	133	90	65	195	145	90	65
16	195	140	140	100	280	200	140	100	290	210	140	100
18	280	200	180	135	390	285	180	135	400	290	180	135
20	400	290	—	—	550	400	—	—	—	—	—	—

Capscrew Markings and Torque Values - U.S. Customary

SAE Grade Number

5

8

Capscrew Head Markings

These are all SAE Grade 5 (3 line)



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Capscrew Torque - Grade 5 Capscrew

Capscrew Torque - Grade 8 Capscrew

Capscrew Body Size	Cast Iron		Aluminum		Cast Iron		Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1/4 - 20	9	7	8	6	15	11	8	6
1/4 - 28	12	9	9	7	18	13	9	7
5/16 - 18	20	15	16	12	30	22	16	12
5/16 - 24	23	17	19	14	33	24	19	14
3/8 - 16	40	30	25	20	55	40	25	20
3/8 - 24	40	30	35	25	60	45	35	25
7/16 - 14	60	45	45	35	90	65	45	35
7/16 - 20	65	50	55	40	95	70	55	40
1/2 - 13	95	70	75	55	130	95	75	55
1/2 - 20	100	75	80	60	150	110	80	60
9/16 - 12	135	100	110	80	190	140	110	80
9/16 - 18	150	110	115	85	210	155	115	85
5/8 - 11	180	135	150	110	255	190	150	110
5/8 - 18	210	155	160	120	290	215	160	120
3/4 - 10	325	240	255	190	460	340	255	190
3/4 - 16	365	270	285	210	515	380	285	210
7/8 - 9	490	360	380	280	745	550	380	280
7/8 - 14	530	390	420	310	825	610	420	310
1 - 8	720	530	570	420	1100	820	570	420
1 - 14	800	590	650	480	1200	890	650	480

Section W - Warranty

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All Diesel Engines Worldwide Generator Drive

Engines Warranted

This warranty applies to new Engines sold by Cummins and delivered to the first user on or after April 1, 1999 that are used in generator drive application anywhere in the world where Cummins approved service is available. These Engines will have the following rating designations:

Standby Power Rating

Engines of this rating are applicable for supplying emergency power for the duration of the utility power outage. No overload capability is available for this rating. Under no condition is an Engine allowed to operate in parallel with the public utility at the Standby Power rating. This rating should be applied where reliable utility power is available. A standby rated engine is to be sized for a maximum of an 80 percent average load factor and 200 hours of operation per year. This includes less than 25 hours per year at the Standby Power rating. Standby rating should never be applied except in true emergency power outages. Negotiated power outages contracted with a utility company are not considered an emergency.

Unlimited Time Running Prime Power Rating

Engines with this rating are available for an unlimited number of hours per year in a variable load application. Variable load is not to exceed a 70 percent average of the Prime Power Rating during any operating period of 250 hours. Total operating time at 100 percent Prime Power shall not exceed 500 hours per year.

A 10 percent overload capability is available for a period of one hour within a twelve hour period of operation. Total operating time at the 10 percent overload power shall not exceed 25 hours per year.

Limited Time Running Prime Power Rating

Engines of this rating are available for a limited number of hours in a non-variable load application. It is intended for use in situations where power outages are contracted, such as in utility power curtailment. Engines may be operated in parallel to the public utility up to 750 hours per year at power levels never to exceed the Prime Power rating.

Limited Time Running Prime Power ratings differ from Unlimited Time Running in that even though the maximum power output of the engines are the same, the Limited Time Running allows the Engine to be parallel to Public Utility and run at the full Prime Power rating and must never exceed the Prime Power rating.

Continuous/Base Power Rating

Engines with this rating are available for supplying utility power at a constant 100 percent load for an unlimited number of hours per year. No overload capability is available for this rating.

Continuous/Base Power ratings differ from Unlimited Time Running Prime Power ratings in that the Continuous/Base Load ratings are significantly reduced from the Prime Power ratings. Continuous/Base Load ratings have no load factor or application restrictions.

Coverage

Base Engine Warranty

This warranty covers any failures of the Engine, under normal use and service, which result from a defect in material or factory workmanship (Warrantable Failure).

Coverage begins with the sale of the Engine by Cummins and continues for the Duration stated below. The Duration commences either on the date of delivery of the Engine to the first user, or on the date the Engine is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first.

Base Engine Warranty

Rating	Duration Whichever Occurs First	
	Months	Hours
Standby Power	24	400
Unlimited Prime Power	12	Unlimited
Limited Prime Power	12	750
Continuous/Base Power	12	Unlimited

Extended Major Components Warranty

The Extended Major Components Warranty applies to Engines other than B and C series 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 continues for the following stated Duration. The Duration commences either on the date of delivery of the Engine to the first user, or on the date the Engine is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first.

Extended Major Components Warranty

Rating	Duration Whichever Occurs First	
	Months	Hours
Standby Power	36	600
Unlimited Prime Power	36	10,000
Limited Prime Power	36	2,250
Continuous/Base Power	36	10,000

Consumer Products

This warranty on Consumer Products in the United States is a LIMITED warranty. **CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.** Any implied warranties applicable to Consumer Products terminate concurrently with the expiration of the express warranties applicable to the product. In the United States, some states do not allow the exclusion of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the limitations or exclusions herein may not apply to you.

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 Base Engine Warranty

Cummins will pay for all parts and labor needed to repair the damage to the Engine resulting from a Warrantable Failure when performed during normal business hours. All labor costs will be paid in accordance with Cummins published Standard Repair Time guidelines.

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

Cummins will pay reasonable travel expenses for mechanics to travel to and from the Engine site, including meals, mileage, and lodging when the repair is performed at the site of the failure.

Cummins will pay reasonable labor costs for Engine removal and reinstallation when necessary to repair a Warrantable 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's Responsibilities

During the Base Engine Warranty

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

During the Extended Major Components Warranty

Owner is responsible for the cost of all labor needed to repair the Engine, including the labor cost for Engine removal and reinstallation. When Cummins elects to repair a part instead of replacing it, the 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 repair of a Warrantable Failure.

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. Locations in the United States* and Canada are listed in the Cummins United States and Canada Sales and Service Directory; other locations are listed in the Cummins International Sales and Service Directory.

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

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

Owner is responsible for providing sufficient access to and reasonable ability to remove the Engine from the installation in the event of a Warrantable Failure.

Owner is responsible for maintaining an operating Engine hourmeter. If the hourmeter is not operational, engine usage will be estimated at 400 hours per month.

Limitations

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 to the Engine. Cummins is also not responsible for Engine performance problems or failures caused by incorrect oil or fuel, or by water, dirt or other contaminants in the fuel or oil.

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, air cleaners and safety shutdown switches.

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

Failure of belts and hoses supplied by Cummins are not covered beyond the first 500 hours or one year of operation, whichever occurs first after the warranty start date.

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 is not responsible for Engine performance problems or failures resulting from:

1. Use or application of the Engine inconsistent with its rating designation as set forth above.
2. Inadequate or incorrect installations deviating from Cummins Generator Drive Installation Guidelines.

CUMMINS IS NOT RESPONSIBLE FOR WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

THE WARRANTIES SET FORTH HEREIN 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.

In the United States* and Canada, this warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Outside the United States* and Canada, in case of consumer sales, in some countries, the Owner has statutory rights which cannot be affected or limited by the terms of this warranty.

Nothing in this warranty excludes or restricts any contractual rights the owner may have against third parties.

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

** Alternators, starters, and fans ARE covered for the duration of the base engine warranty on B3.3 engines.

All Engines United States and Canada Industrial (Off-Highway)

Coverage

Products Warranted

This warranty applies to new Engines sold by Cummins and delivered to the first user on or after April 1, 1999, that are used in industrial (off-highway) applications in the United States* and Canada, except for Engines used in marine, generator drive and certain defense applications, for which different warranty coverage is provided.

Base Engine Warranty

This warranty covers any failures of the Engine, under normal use and service, which result from a defect in material or factory workmanship (Warrantable Failures).

Coverage begins with the sale of the Engine by Cummins. Coverage continues for two years or 2,000 hours of operation, whichever occurs first, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first. If the 2,000 hour limit is exceeded during the first year, Coverage continues until the end of the first year.

Extended Major Components Warranty

The Extended Major Components Warranty 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 10,000* hours of operation from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or from when the Engine has been operated for 50 hours, whichever occurs first.

*3,000 hours for A series engines.

Consumer Products

The warranty on Consumer Products in the United States is a LIMITED warranty. **CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.** Any implied warranties applicable to Consumer Products in the United States terminate concurrently with the expiration of the express warranties applicable to the product. In the United States, some states do not allow the exclusion of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the limitations or exclusions herein may not apply to you.

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, and other maintenance items that are not reusable due to the Warrantable Failure.

Cummins will pay reasonable costs for mechanics to travel to and from the equipment site, including meals, mileage and lodging, when the repair is performed at the site of the failure.

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

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. Locations in the United States and Canada are listed in the Cummins Off Highway Authorized Dealer Directory:

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

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

Limitations

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

For power units and fire pumps (package units), this warranty applies to accessories, except for clutches and filters, supplied by Cummins which bear the name of another company.

Except for power units and fire pumps, this warranty does not apply to accessories which bear the name of another company. Such non-warranted accessories include, but are not limited to: alternators, starters, fans*, air conditioning compressors, clutches, filters, transmissions, torque converters, steering pumps, and non-Cummins fan drives, engine compression brakes and air compressors.

Cummins Compusave units are covered by a separate warranty.

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

Failures of belts and hoses supplied by Cummins are not covered beyond the first 500 hours or one year of operation, 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 DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

THESE WARRANTIES SET FORTH HEREIN 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* in vehicles designed for Industrial off-highway use. This warranty applies to Engines delivered to the ultimate purchaser on or after April 1, 1999 for engines up to 750 horsepower, on or after January 1, 2000 for engines 751 horsepower and over.

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 workmanship or material which would cause it not to meet these regulations within the longer of the following periods: (A) Five years or 3,000 hours 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

Failures, other than those resulting from defects in materials, or 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 coolant 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. Cummins is also not responsible for failures caused by incorrect fuel or by water, dirt or other contaminants in the fuel.

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

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

** Alternators, starters, and fans ARE covered for the duration of the base engine warranty on A series and B3.3 engines.

All Engines International Industrial (Off-Highway)

Coverage

PRODUCTS WARRANTED

This warranty applies to new Engines sold by Cummins and delivered to the first user on or after April 1, 1999, that are used in industrial (off-highway) applications anywhere in the world where Cummins-approved service is available, except the United States* and Canada. Different warranty coverage is provided for Engines used in marine, generator, drive and certain defense applications.

BASE ENGINE WARRANTY

This warranty covers any failures of the Engine, under normal use and service, which result from a defect in material or factory workmanship (Warrantable Failure).

Coverage begins with the sale of the Engine by Cummins. Coverage continues for two years or 2,000 hours of operation, whichever occurs first, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first. If the 2,000 hour limit is exceeded during the first year, coverage continues until the end of the first year.

EXTENDED MAJOR COMPONENTS WARRANTY

The Extended Major Components Warranty 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 10,000* hours of operation, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first.

*3,000 hours for A series engines.

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, and other maintenance items that are not reusable due to a Warrantable Failure.

Cummins will pay reasonable costs for mechanics to travel to and from the equipment site, including meals, mileage and lodging, when the repair is performed at the site of the failure.

Cummins will pay reasonable labor costs for Engine removal and reinstallation when necessary to repair a Warrantable 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's Responsibilities

DURING THE BASE ENGINE WARRANTY

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

DURING THE EXTENDED MAJOR COMPONENTS WARRANTY

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

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

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

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 product available for repair by such facility. Locations are listed in the Cummins International Sales and Service Directory.

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

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

Limitations

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

For power units and fire pumps (package units) the warranty applies to accessories, except for clutches and filters supplied by Cummins which bear the name of another company.

Non-Cummins starters, alternators, power steering pumps and air compressors supplied by Cummins that are not supplied as part of a package unit are covered for six months from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first. Cummins branded parts noted above supplied by Cummins are covered for the entire Base Warranty period.

Except for the accessories noted previously, Cummins does not warrant accessories which bear the name of another company. Such non-warranted accessories include, but are not limited to: alternators, starters, fans*, air conditioning compressors, clutches, filters, transmissions, torque converters, steering pumps, non-Cummins fan drives, and air cleaners.

Cummins Compusave units are covered by a separate warranty.

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

Failures of belts and hoses supplied by Cummins are not covered beyond the first 500 hours or one year of operation, 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 DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

THESE WARRANTIES SET FORTH HEREIN 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.

In case of consumer sales, in some countries, the Owner has statutory rights which cannot be affected or limited by the terms of this warranty.

Nothing in this warranty excludes or restricts any contractual rights the Owner may have against third parties.

* Alternators, starters, and fans ARE covered for the duration of the base engine warranty on A series and B3.3 engines.

B3.3 Worldwide Industrial/Welder

Coverage

PRODUCTS WARRANTED

This warranty applies to new B3.3 engines (hereinafter "Engine") sold by Cummins Inc. (hereinafter "Cummins"), and delivered to the first user on or after January 1, 2001, that are used in welder applications anywhere in the world where Cummins-approved service is available.

BASE ENGINE WARRANTY

This warranty covers any failures of the Engine, under normal use and service, which result from a defect in material or factory workmanship (Warrantable Failure).

Coverage begins with the sale of the Engine by Cummins and ends at three years or 3,000 hours of operation, whichever occurs first, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first. If the 3,000 hour limit is exceeded during the first year, coverage continues until the end of the first year. Starters, alternators, and fans are covered during Base Engine Warranty.

EXTENDED MAJOR COMPONENTS WARRANTY

The Extended Major Components Warranty covers Warrantable Failures of the Engine cylinder block, camshaft, crankshaft and connecting rods only (Covered Parts).

Bushing and bearing failures are not covered.

The Extended Major Components Warranty begins with the expiration of the Base Engine Warranty and ends three years or 10,000 hours of operation after the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or from when the engine has been operated for 50 hours, whichever comes first.

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. Travel is not covered during Base Engine Warranty.

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

Cummins will pay reasonable labor costs for Engine removal and reinstallation when necessary to repair a warrantable 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's 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 all travel costs associated with the repair.

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 repair of a Warrantable Failure.

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. Locations in the United States and Canada are listed in the Cummins Off Highway Authorized Dealer Directory. International locations are listed in the Cummins International Sales and Service Directory.

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

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

Limitations

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; over fuelling; over speeding; lack of maintenance of lubricating, cooling or air intake systems; improper storage starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine. Cummins is also not responsible for failures caused by incorrect oil or fuel or by water, dirt or other contaminants in the fuel or oil.

These warranties do not apply to accessories which bear the name of another company. Such non-warranted accessories include, but are not limited to: air conditioning compressors, clutches, filters, transmissions, torque converters, steering pumps, and non-Cummins fan drives, engine compression brakes and air compressors.

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 500 hours or one year of operation, whichever comes 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 SET FORTH HEREIN 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.

U.S./Canada Owners: These warranties, though limited, give you specific legal rights, and you may also have other rights which vary from state to state or province to province.

In case of consumer sales, in some countries, the Owner has statutory rights which cannot be affected or limited by the terms of this warranty.

Emission Warranty

(Applicable in the United States only)

PRODUCTS WARRANTED

This emission warranty applies to new Engines marketed by Cummins that are used in the United States* in vehicles designed for Industrial off-highway use.

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 3,000 hours of operation, whichever occurs first, as measured from the date of delivery of the Engine to the first user, or (B) The Base Engine Warranty.

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

LIMITATIONS

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

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

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

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

California Emission Control System Warranty, Off-Highway

Products Warranted

This Emission Control System Warranty applies to off-road diesel engines certified with the California Air Resources Board beginning with the year 1996 for engines up to 750 horsepower, beginning with the year 2000 for 751 horsepower and over, marketed by Cummins, and registered in California for use in industrial off-highway applications.

Your Warranty Rights and Obligations

The California Air Resources Board and Cummins Engine Company, Inc., are pleased to explain the emission control system warranty on your engine. In California, new off-road diesel engines must be designed, built and equipped to meet the State's stringent anti-smog standards. Cummins 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 the air induction system. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, Cummins will repair your off-road diesel engine at no cost to you including diagnosis, parts and labor.

Manufacturer's Warranty Coverage

This warranty coverage is provided for 5 years or 3,000 hours of engine operation, whichever first occurs from the date of delivery of the engine to the first user. If any emission-related part on your engine is defective, the part will be repaired or replaced by Cummins.

Coverage

This emission control system warranty applies only to the following A series; B3.3, B3.9, B4.5^s, B5.9, B6.7^s, QSB3.9-30, QSB4.5-30, QSB5.9-30, QSB5.9-44, C8.3, QSC8.3, and QSL9 emission control parts:

Fuel Pump

Static Timing

Delivery Valve

Injection Control Valve Module

Injectors

Calibration

Needle

Nozzle

Spring

Turbocharger

Compressor Wheel

Turbine Wheel

Turbine Oil Seal

Wastegate Valve

Intake Manifold

Charge Air Cooler

Aftercooler

Exhaust Manifold

Oxidation Catalyst

Electronic Control System

Control Module

Boost Pressure Sensor

Coolant Temperature Sensor

Fuel Pressure Sensor

Owner's Warranty Responsibilities

As the off-road diesel engine owner, you are responsible for the performance of the required maintenance listed in your Cummins Operation and Maintenance Manual. Cummins recommends that you retain all receipts covering maintenance on your off-road diesel engine, but Cummins cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

You are responsible for presenting your off-road diesel 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 the off-road diesel engine owner, you should also be aware that Cummins may deny you warranty coverage if your off-road diesel engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

Your engine is designed to operate on diesel fuel only. Use of any other fuel may result in your engine no longer operating in compliance with California's emissions requirements.

If you have any questions regarding your warranty rights and responsibilities, you should contact Cummins Customer Assistance Department at 1-800-343-7357 (1-800-DIESELS) or the California Air Resources Board at 9528 Telstar Avenue, El Monte, CA 91731.

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 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 failure.

Owner is responsible for business costs and losses, "downtime" expenses, and cargo damage resulting from a warrantable failure. CUMMINS IS NOT RESPONSIBLE FOR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDE BUT ARE NOT LIMITED TO FINES, THEFT, VANDALISM OR COLLISIONS.

Replacement Parts

Cummins 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. 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, 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 will not be covered under this emission control system warranty.

Cummins Responsibilities

Repairs and service will be performed by any Cummins distributor, authorized dealer or other repair location approved by Cummins using new, genuine Cummins or Cummins approved rebuilt parts and assemblies. Cummins will repair any of the emission control parts found by Cummins 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 is not available, repairs may be performed by any available repair location using any replacement parts. Cummins will reimburse the Owner for expenses (including diagnosis), not to exceed the manufacturer's suggested retail price for all warranted parts replaced and labor charges based on the manufacturer's recommended time allowance for the warranty repair and the geographically appropriate hourly labor rate. A part not being available within 30 days or a repair not being complete within 30 days constitutes an emergency. 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.

Warranty Limitations

Cummins is not responsible for failures resulting from Owner or operator abuse or neglect, such as: operation without adequate coolant, fuel or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or air intake systems; improper storage, starting, warm-up, run-in or shutdown practices.

The manufacturer warrants to the ultimate purchaser and each subsequent purchaser that the engine is designed, built, and equipped so as to conform with all applicable regulations adopted by the Air Resources Board, and that it is free from defects in materials and workmanship which cause the failure of a warranted part.

Any warranted part which is not scheduled for replacement as required maintenance, or which is scheduled only for regular inspection to the effect of "repair or replace as necessary" is warranted for the warranty period.

Any warranted part which is scheduled for replacement as required maintenance is warranted for the period of time prior to the first scheduled replacement point for that part.

The owner will not be charged for diagnostic labor which leads to the determination that a warranted part is defective, if the diagnostic work is performed at a warranty station.

The manufacturer is liable for damages to other engine components caused by the failure under warranty of any warranted part.

Cummins is not responsible for failures resulting from improper repair or the use of parts which are not genuine Cummins or Cummins approved parts.

These warranties, together with the express commercial warranties and emission warranty are the sole warranties of Cummins. 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.

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