Operation and Maintenance Manual
Automotive, Recreational Vehicle, and Bus B Series Engines

237944

THIS PRINTED CUMMINS MANUAL INCLUDES A COMPANION CD-ROM VERSION



REFERENCE ONLY

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

REFERENCE ONLY

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 15, COLUMBUS INDIANA

–POSTAGE WILL BE PAID BY ADDRESSEE–

Cummins Inc.
Product Registration Dept.
P O Box 3005 M/C 60610
Columbus, IN 47202-3005

REFERENCE ONLY

In order to serve you better it is very important that you fill out and return this card **within** 30 days of purchase.

Customer Name _____

Address _____

City / State _____

Zip Code _____

Home Phone Number (____)_____

Truck Phone / Cell Phone (____)_____

E-mail Address _____

Engine Serial Number _____

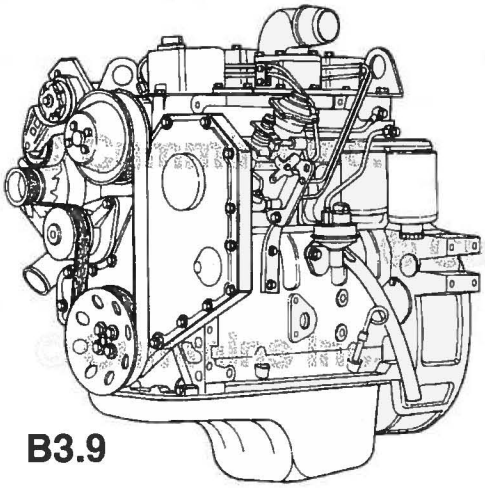
Date Purchased ____/____/____ VIN # _____

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

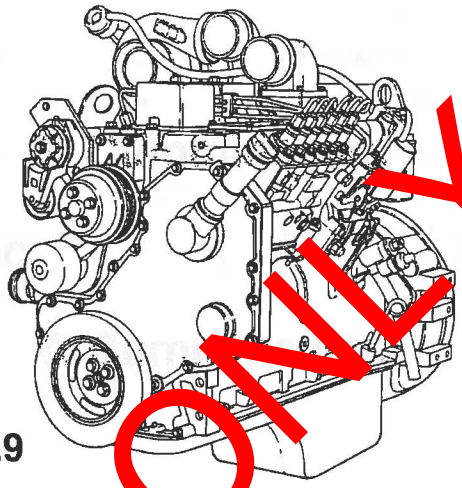
THANK YOU!!

REFERENCE ONLY

Operation and Maintenance Manual Automotive, Recreational Vehicle, and Bus B Series Engines



B3.9



B5.9

00900282

REFERENCE ONLY

Copyright© 2009
Cummins Inc.
All rights reserved

Bulletin 3810205
Printed 21-APRIL-2009

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.

REFERENCE ONLY

Table of Contents

	Section
Introduction	i
Engine Identification	E
Operating Instructions	1
Maintenance Guidelines	2
Maintenance Procedures at Daily Interval	3
Maintenance Procedures at 10,000 Kilometers [6000 Miles], 250 Hours, or 3 Months	4
Maintenance Procedures at 19,000 Kilometers [12,000 Miles], 500 Hours, or 6 Months	5
Maintenance Procedures at 38,000 Kilometers [24,000 Miles], 1000 Hours, or 1 Year	6
Maintenance Procedures at 77,000 Kilometers [48,000 Miles], 2000 Hours, or 2 Years	7
Adjustment, Repair, and Replacement	A
System Diagrams	D
Service Literature	L
Component Manufacturers	M
Service Assistance	S
Troubleshooting Symptoms	TS
Maintenance Specifications	V
Warranty	W

REFERENCE ONLY

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		

REFERENCE ONLY

Section i - Introduction

Section Contents

Page

About the Manual i-2
General Information i-2
Acronyms and Abbreviations i-14
General Information i-14
General Cleaning Instructions i-9
Abrasive Pads and Abrasive Paper i-9
Definition of Clean i-9
Fuel System i-12
Gasket Surfaces i-10
Plastic Bead Cleaning i-11
Solvent and Acid Cleaning i-10
Steam Cleaning i-11
General Repair Instructions i-8
General Information i-8
Welding on a Vehicle with an Electronic Controlled Fuel System i-8
General Safety Instructions i-6
Important Safety Notice i-6
How to Use the Manual i-3
General Information i-3
Illustrations i-5
General Information i-5
Symbols i-4
General Information i-4
To the Owner and Operator i-1
General Information i-1

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

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.

REFERENCE ONLY

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.

REFERENCE ONLY

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).

REFERENCE ONLY

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 or 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.

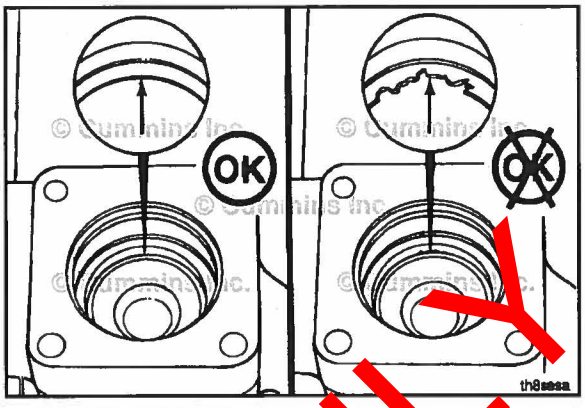
17800009

© Cummins Inc.
REFERENCE ONLY

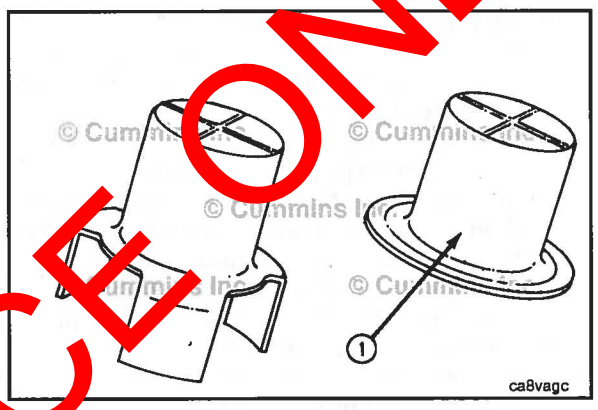
Illustrations

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.



REFERENCE ONLY

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. Place 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 SCR 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.
- Do **not** connect the jumper starting or battery charging cables to any ignition or governor control wiring. This can cause electrical damage to the ignition or governor.
- **Always** torque fasteners and fuel connections to the required specifications. Overtightening or undertightening can allow leakage. This is critical to the natural gas and liquefied petroleum gas fuel and air systems.
- **Always** test for fuel leaks as instructed, as odorant can fade.
- Close the manual fuel valves prior to performing maintenance and repairs, and when storing the vehicle inside.
- Coolant is toxic. If **not** reused, dispose of in accordance with local environmental regulations.
- The catalyst reagent contains urea. Do **not** get the substance in your eyes. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. Avoid prolonged contact with skin. In case of

REFERENCE ONLY

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.

REFERENCE ONLY

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.

⚠CAUTION⚠

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.

REFERENCE ONLY

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 cannot 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.

⚠WARNING⚠

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

REFERENCE ONLY

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

REFERENCE ONLY

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
- NOx Sensor.

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 bead 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 bead, 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** sure 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 psi) 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.

REFERENCE ONLY

⚠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 if 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.

Fuel System

When servicing any fuel system components, which can be exposed to potential contaminants, prior to disassembly, clean the fittings, mounting hardware, and the area around the component to be removed. If the surrounding areas are **not** cleaned, dirt or contaminants can be introduced into the fuel system.

The internal drillings of some injectors are extremely small and susceptible to plugging from contamination. Some fuel injection systems can operate at very high pressures. High pressure fuel can convert simple particles of dirt and rust into a highly abrasive contaminant that can damage the high pressure pumping components and fuel injectors.

Electrical contact cleaner can be used if steam cleaning tools are **not** available. Use electrical contact cleaner rather than compressed air, to wash dirt and debris away from fuel system fittings. Diesel fuel on exposed fuel system parts attracts airborne contaminants.

Choose lint free towels for fuel system work.

Cap and plug fuel lines, fittings, and ports whenever the fuel system is opened. Rust, dirt, and paint can enter the fuel system whenever a fuel line or other component is loosened or removed from the engine. In many instances, a good practice is to loosen a line or fitting to break the rust and paint loose, and then clean off the loosened material.

When removing fuel lines or fittings from a new or newly-painted engine, make sure to remove loose paint flakes/ chips that can be created when a wrench contacts painted line nuts or fittings, or when quick disconnect fittings are removed.

Fuel filters are rated in microns. The word micron is the abbreviation for a micrometer, or one millionth of a meter. The micron rating is the size of the smallest particles that will be captured by the filter media. As a reference, a human hair is 0.003 mm [3/1000 in] in diameter. One micron measures 0.00004 mm [4/100,000 in]. The contaminants being filtered out are smaller than can be seen with the human eye, a magnifying glass, or a low powered microscope.

The tools used for fuel system troubleshooting and repair are to be cleaned regularly to avoid contamination. Like fuel system parts, tools that are coated with oil or fuel attract airborne contaminants. Remember the following points regarding your fuel system tools:

REFERENCE ONLY

- Fuel system tools are to be kept as clean as possible.
- Clean and dry the tools before returning them to the tool box.
- If possible, store fuel system tools in sealed containers.
- Make sure fuel system tools are clean before use.

REFERENCE ONLY

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
BTU	British Thermal Unit
°C	Celsius
CARB	California Air Resources Board
C.I.D.	Cubic Inch Displacement
CNG	Compressed Natural Gas
CPL	Control Parts List
cSt	Centistokes
DEF	Diesel Exhaust Fluid
ECM	Electronic Control Module
EGR	Exhaust Gas Recirculation
EPA	Environmental Protection Agency
°F	Fahrenheit
FMI	Failure Mode Indentifier
GVW	Gross Vehicle Weight
LPG	Liquified Petroleum Gas
Hg	Mercury
hp	Horsepower
H_2O	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
RGT	Rear Gear Train
rpm	Revolutions Per Minute
SAE	Society of Automotive Engineers
SCA	Supplemental Coolant Additive
SCR	Selective Catalytic Reduction
STC	Step Timing Control
SID	Subsystem Identification Descriptions
VS	Variable Speed
VSS	Vehicle Speed Sensor

REFERENCE ONLY

Section E - Engine Identification

Section Contents

Page

Engine Diagrams E-5
Engine Views E-5
Engine Identification E-1
Cummins® Engine Nomenclature E-2
Engine Dataplate E-1
Fuel Injection Pump Dataplate E-2
Bosch® Rotary E-2
Bosch® In-line E-3
CAV Rotary E-3
Stanadyne Rotary E-3
Denso In-line E-3

REFERENCE ONLY

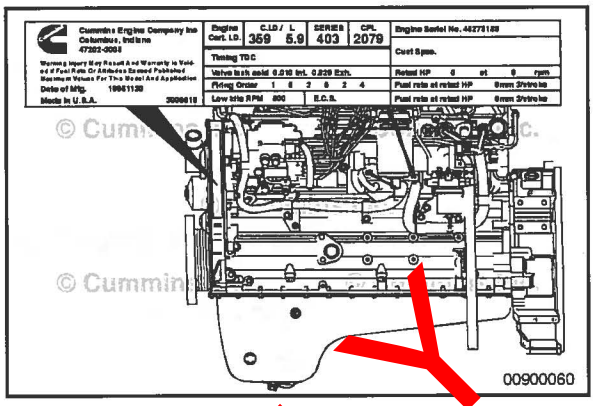
This Page Left Intentionally Blank

REFERENCE ONLY

Engine Identification

Engine Dataplate

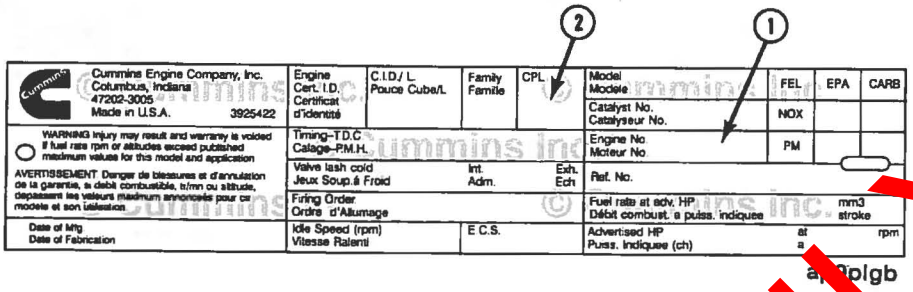
The engine dataplate shows specific facts about your engine. The engine serial number and Control Parts List provide information for ordering parts and for service. The engine dataplate **must not** be changed unless approved by Cummins Inc.

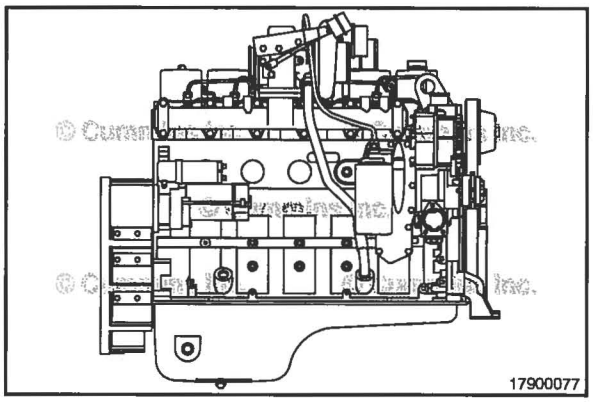


REFERENCE ONLY

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

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



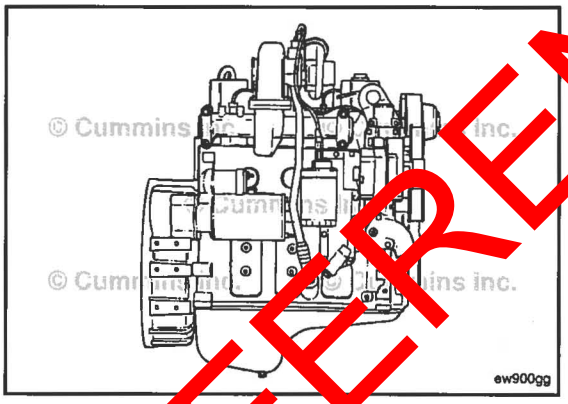


Cummins® Engine Nomenclature

B5.9

The model name provides the following engine data:

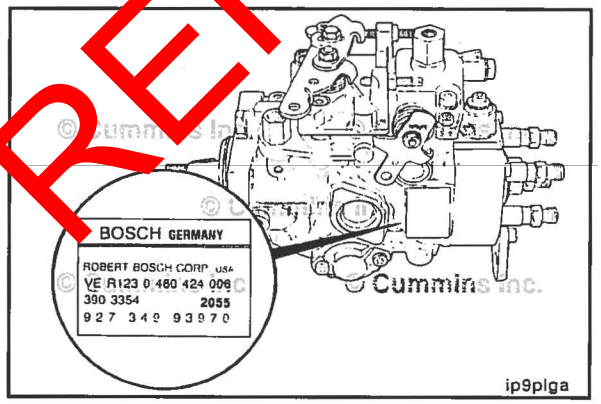
B = Engine series
5.9 = Displacement in liters.



B3.9

The model name provides the following engine data:

B = Engine series
3.9 = Displacement in liters.



Fuel Injection Pump Dataplate

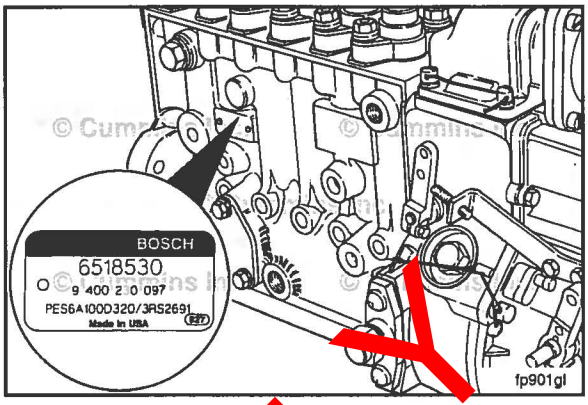
Bosch® Rotary

The injection pump dataplate for the Bosch® VE pump is located on the side of the injection pump. The dataplate provides information for fuel pump calibration.

REFERENCE ONLY

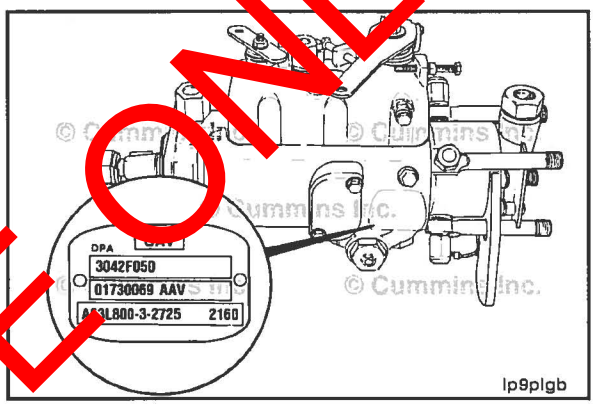
Bosch® In-line

The injection pump dataplate for the Bosch® in-line pump is located on the side of the injection pump. The data plate provides information for fuel pump calibration.



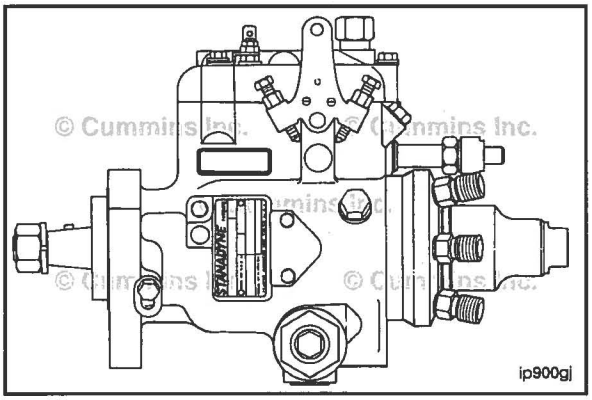
CAV Rotary

The injection pump dataplate for the Lucas DPA pump is located on the side of the injection pump. The dataplate provides information for fuel pump calibration.



Stanadyne Rotary

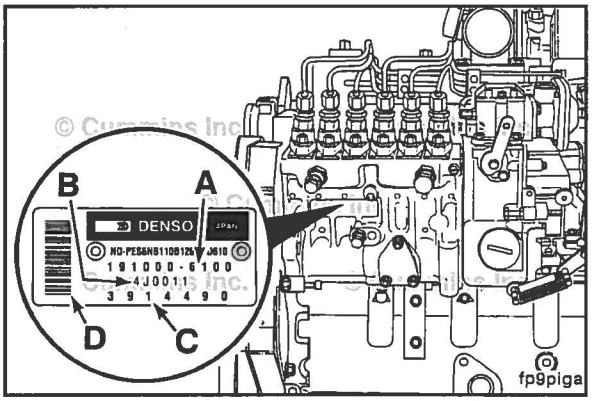
The injection pump dataplate for the Stanadyne DB4 is located on the side of the injection pump. The dataplate provides information for the fuel pump calibration.



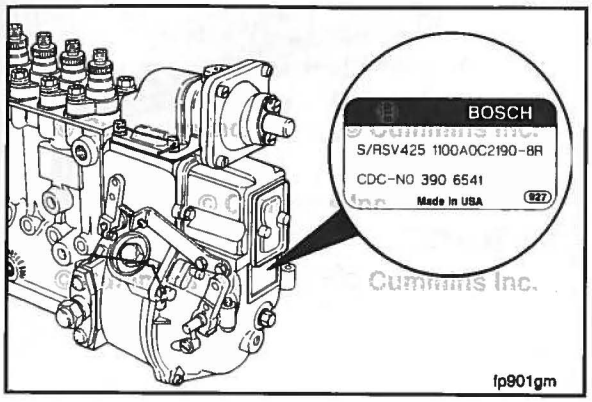
Denso In-line

The Denso fuel injection pump dataplate contains the following information:

(A) Fuel injection pump part number
(B) Denso serial number
(C) Cummins part number
(D) Fuel injection pump bar code.



REFERENCE ONLY



The Cummins part number for the fuel pump-governor combination is located on the governor dataplate.

REFERENCE ONLY

Engine Diagrams

Engine Views

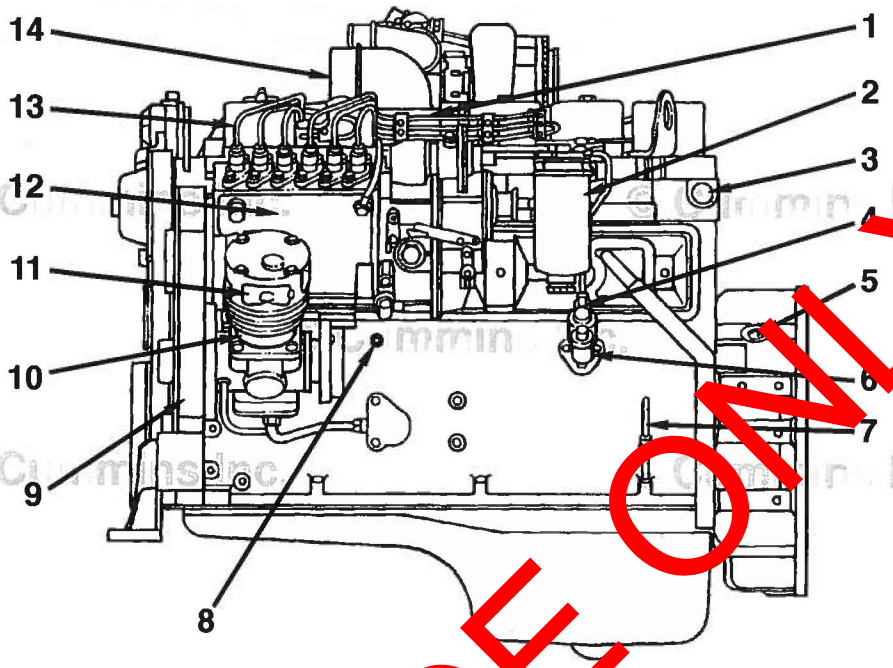
The following illustrations show the locations of the major external engine components, filters, and other service and maintenance points. Some external components will be at different locations for different engine models.

NOTE: The illustrations are **only** a reference to show a typical engine.

REFERENCE ONLY

Engine Diagrams

Engine Views



00900280

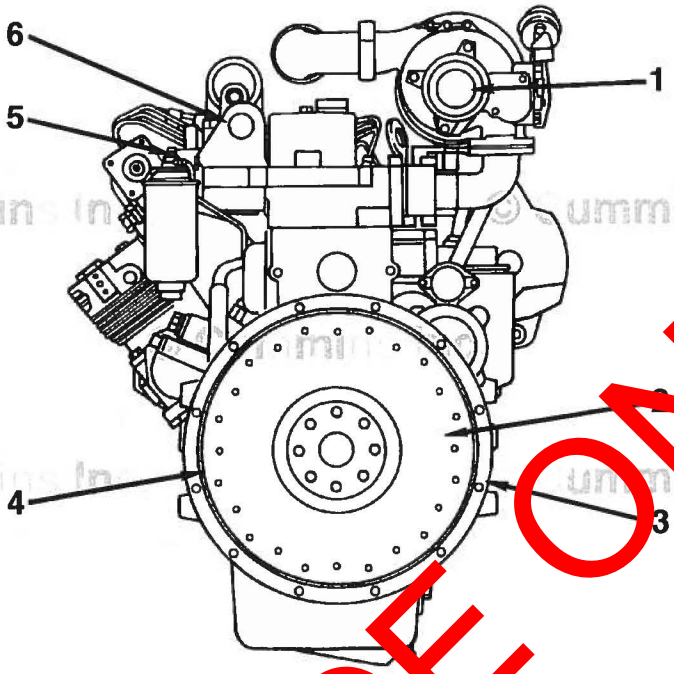
Automotive Fuel Pump Side View

1. Intake air preheater (optional)
2. Fuel filter/water separator
3. Water heater supply (3/4-inch NPTF)
4. Fuel inlet connection (1/4-inch NPTF)
5. Magnetic pickup location (3/4-16 UNF)
6. Fuel lift pump
7. Dipstick
8. Oil pressure (1/8-inch NPTF)
9. Engine dataplate
10. Air compressor
11. Air compressor intake
12. In-line fuel injection pump
13. High pressure fuel lines
14. Engine air inlet.

REFERENCE ONLY

Engine Diagrams

Engine Views



00900279

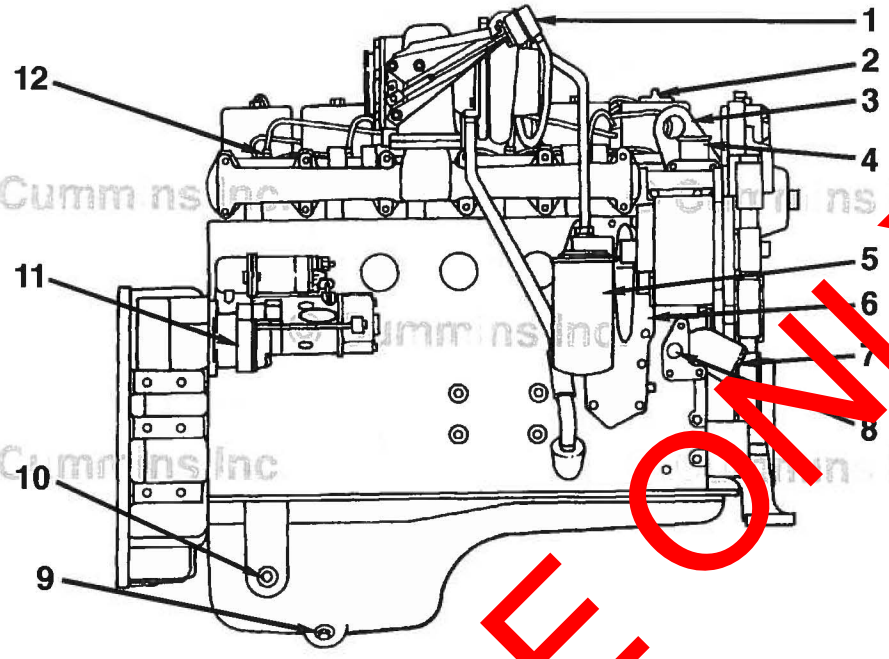
Automotive - Rear View

1. Turbocharger exhaust outlet
2. Clutch mounting plate
3. Flywheel housing
4. Flywheel flexplate
5. Fuel return connection
6. Rear engine lifting bracket.

REFERENCE ONLY

Engine Diagrams

Engine Views



00900278

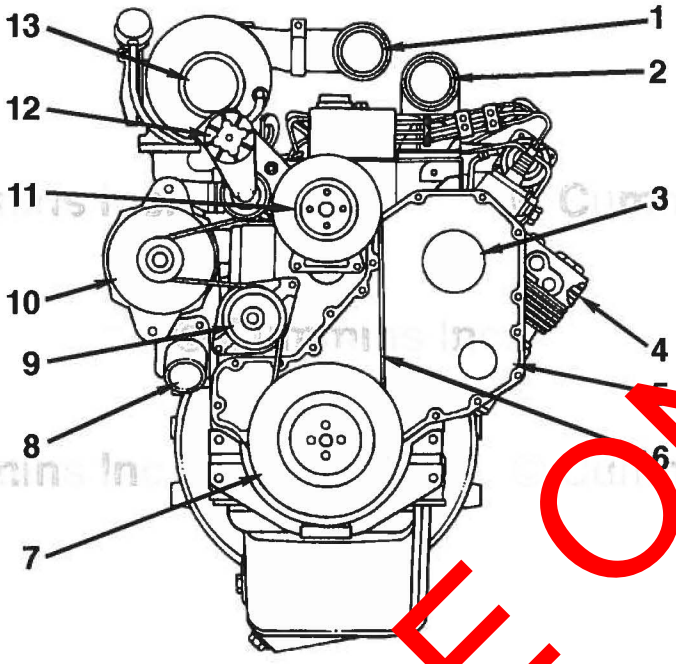
Automotive - Turbocharger Side View

1. Turbocharger wastegate actuator
2. Oil fill
3. Front engine lifting bracket
4. Water outlet
5. Lubricating oil filter
6. Lubricating oil cooler
7. Water inlet
8. Water heater return (1/2-inch NPTF)
9. Oil drain
10. Provision for oil immersion heater
11. Starter motor solenoid
12. Fuel injection nozzles.

REFERENCE ONLY

Engine Diagrams

Engine Views



00900277

Automotive - Front View

1. Turbocharger air outlet
2. Engine air inlet
3. Fuel pump drive cover
4. Air compressor air outlet
5. Front gear cover
6. Fan drive belt
7. Vibration damper
8. Water inlet
9. Water pump
10. Alternator
11. Fan pulley
12. Automatic belt tensioner
13. Turbocharger air inlet.

REFERENCE ONLY

Notes

REFERENCE ONLY

Section 1 - Operating Instructions

Section Contents

Page

Cold Weather Starting 1-5
Ether Starting Aids 1-5
General Information 1-5
Grid Heater 1-5
With Mechanical or Electrical Metering Equipment (Ether) 1-5
Engine Operating Range 1-9
General Information 1-9
Engine Shutdown 1-9
General Information 1-9
Normal Starting Procedure 1-2
General Information 1-2
Jump Starting 1-4
Operating Instructions - Overview 1-1
General Information 1-1
Operating the Engine 1-6
Ambient Temperature 1-7
0 to -32°C [32 to -25°F] 1-7
-32 to -54°C [-25 to -65°F] 1-7
Cold Weather 1-7
Normal 1-6
Winterfronts and Shutters 1-8
Starting Procedure After Extended Shutdown or Oil Change 1-6
General Information 1-6

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

Operating Instructions - Overview

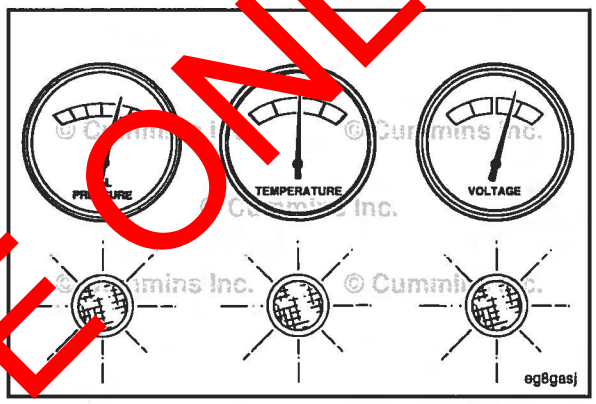
General Information

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).

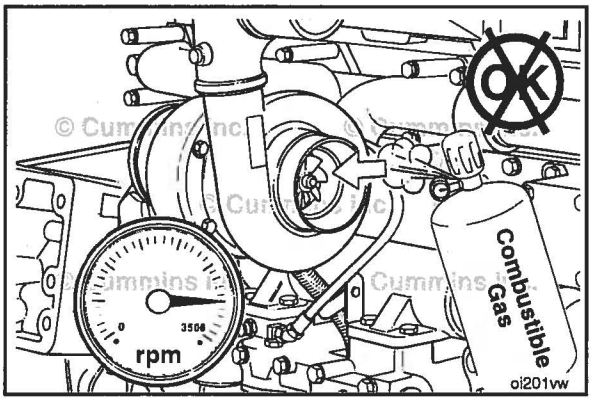
The **new** Cummins® engine associated with this manual does **not** require a "break-in" procedure. This section of the manual provides all of the necessary information required for proper engine operation.

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

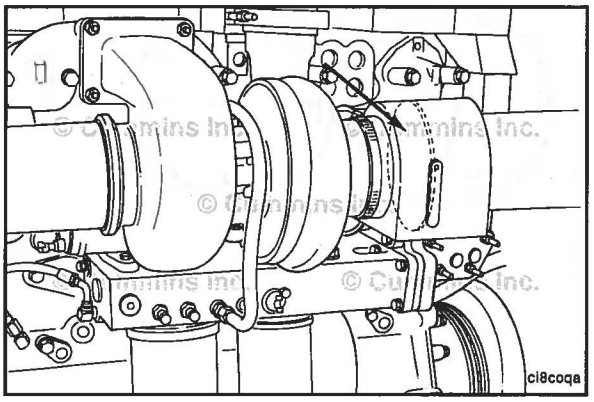


⚠ WARNING ⚠

DO NOT OPERATE A DIESEL ENGINE WHERE THERE ARE OR CAN BE COMBUSTIBLE VAPORS. These 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.

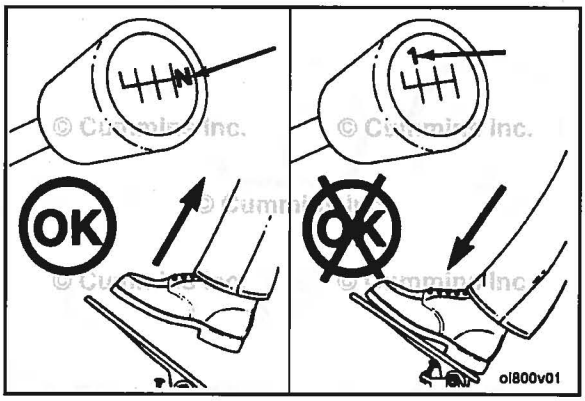


Cummins recommends the installation of an air intake shutoff device or a similar safety device to minimize the risk of overspeeding where an engine, due to the vehicle, vessel or equipment being operated in a combustible environment, such as due to a fuel spill or gas leak.



REFERENCE ONLY

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



Normal Starting Procedure

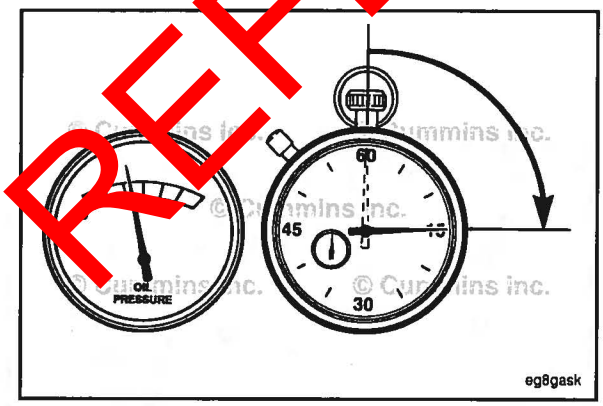
General Information

⚠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 reduce the possibility of 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]

1. Disengage the driven unit, or if equipped, put the transmission in neutral.
2. With the accelerator pedal or lever in the idle position, turn the keyswitch to the ON position, and wait for the WAIT-TO-START lamp to go out; then, turn the key to the START position.
3. 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.

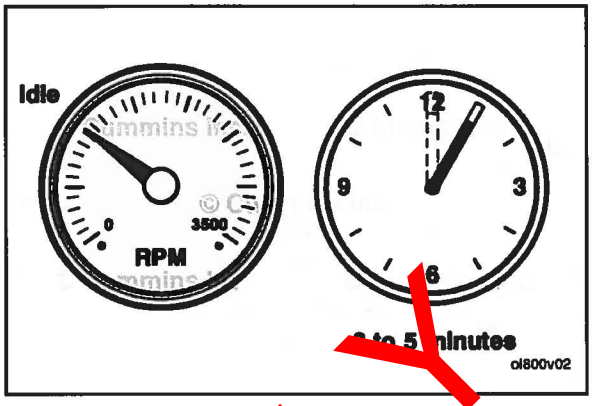


⚠CAUTION⚠
The engine must have adequate oil pressure within 15 seconds after starting. If the WARNING lamp indicating low oil pressure has not gone out or there is no oil pressure indicated on a gauge within 15 seconds, shut off the engine immediately to reduce the possibility of engine damage.

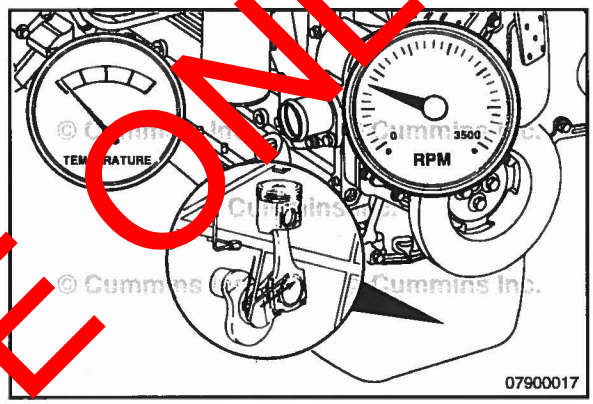
Refer to Lubricating Oil Pressure Low symptom tree in Section TS if no oil pressure is indicated.

REFERENCE ONLY

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



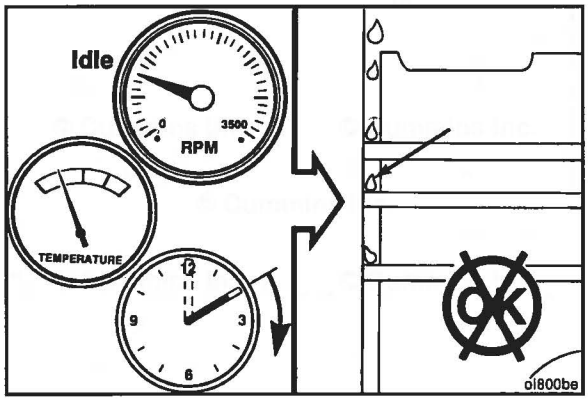
After starting a cold engine, increase the engine speed (rpm) slowly to provide adequate lubrication to the bearings and to allow the oil pressure to stabilize.



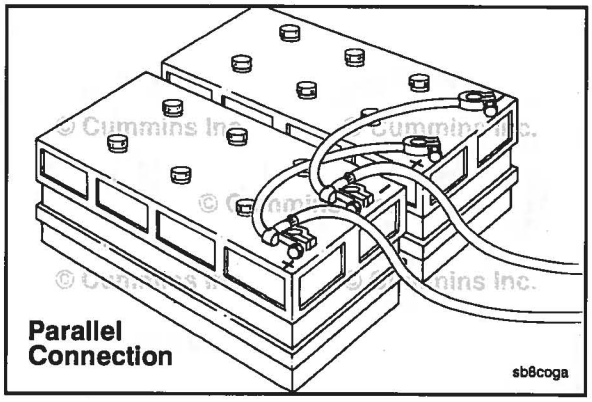
Do **not** operate the engine at low idle for long periods with the engine coolant temperature below the minimum specification. Refer to Engine Specifications in Section V.

This can result in the following:

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



REFERENCE ONLY



Jump Starting

⚠WARNING⚠

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

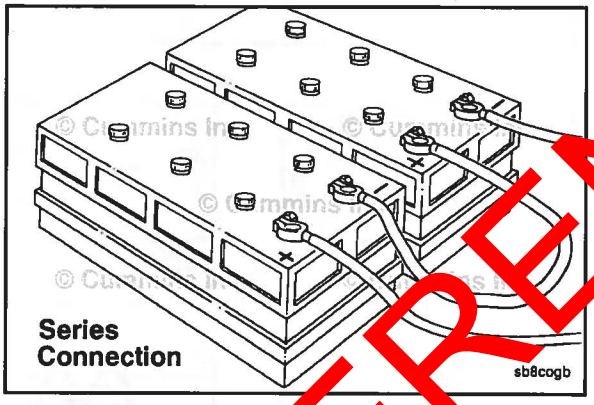
△CAUTION△

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

△CAUTION△

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

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.

REFERENCE ONLY

Starting Procedure Matrix	
Automotive and industrial	Idle throttle
All pumps above 16°C [60°F]	X (after 5 seconds, see note)
Automotive and industrial	Full throttle
All pumps below 16°C [60°F]	X (see note)
(1) Full throttle on the VE pump makes sure there is sufficient start-fuel delivery and helps keep the engine operating once started. The in-line pumps with RQV and RQV-K governors require full throttle to position and hold the rack in the start-fuel position.	

NOTE: Full throttle is applied after engaging the starter.

1. Disengage the driven unit, or if equipped, put the transmission in neutral.
2. Position the fuel shutoff, electrical switch, or mechanism control to the RUN position.

NOTE: Full throttle procedure **not** required on Tier II B3.9, B4.5, and B5.9 engines.

Cold Weather Starting

General Information

Follow the Normal Starting Procedures in this section in cold weather. The Wait-To-Start lamp will stay on longer.

With Mechanical or Electrical Metering Equipment (Ether)

- Set the throttle at **half** speed
- Disengage the driven unit, or if equipped, put the transmission in neutral
- While cranking the engine, inject metered amounts of starting fluid
- Engine oil pressure **must** be indicated on the gauge within 15 seconds after starting.

Ether Starting Aids

⚠WARNING⚠

Because of the potential for an explosion, do not use volatile cold starting aids in underground mine or tunnel operations. Ask the local U.S. Bureau of Mines inspector for instructions.

⚠WARNING⚠

Starting fluid is highly flammable and explosive. Keep flames, sparks, and arcing switches away from starting fluid.

⚠WARNING⚠

Do not breathe starting fluid fumes. Starting fluid fumes can be hazardous to your health.

△CAUTION△

Do not use excessive amounts of starting fluid when starting an engine. The use of too much starting fluid will cause damage to the engine.

- Spray starting fluid into the air cleaner intake while another person cranks the engine.

Grid Heater

⚠WARNING⚠

To reduce the possibility of personal injury and property damage, never use starting fluid if the grid heater option is used. Starting fluid, which contains ether, can cause an explosion.

A grid heater is available that improves cold weather starting characteristics by heating the intake air. It can also serve to reduce white smoke if it is energized during cold ambient temperatures while the engine is at idle.

The electric grid heater operates in a preheat and postheat mode. The length of heater on-time is a function of the engine temperature.

If the intake manifold air temperature is greater than 19°C [66°F], the electric grid air heater system will **not** be activated. If the intake manifold air temperature is below 19°C [66°F], the system will operate as follows:

Engine Starting Cycle

1. Turn the ignition key to the RUN position. When the key is in this position, the WAIT-TO-START lamp will be illuminated for approximately 25 seconds. Do **not** crank the engine until the WAIT-TO-START lamp shuts off.

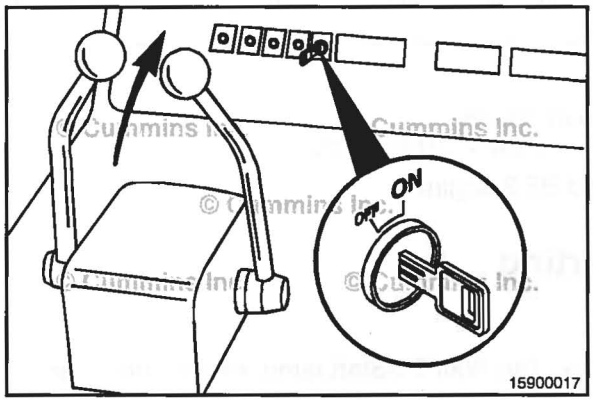
REFERENCE ONLY

NOTE: The controller is reset each time the ignition is turned off and the cycle will start over.

2. When the WAIT-TO-START lamp goes out, the preheat cycle is complete. Depress the accelerator pedal and crank the engine.

Postheat Cycle

3. Postheating occurs as the grid heater elements are cycled for a while with the engine running. Postheating helps warm the engine up faster and eliminates white smoke. Postheating is determined by the intake manifold air temperature upon start-up.

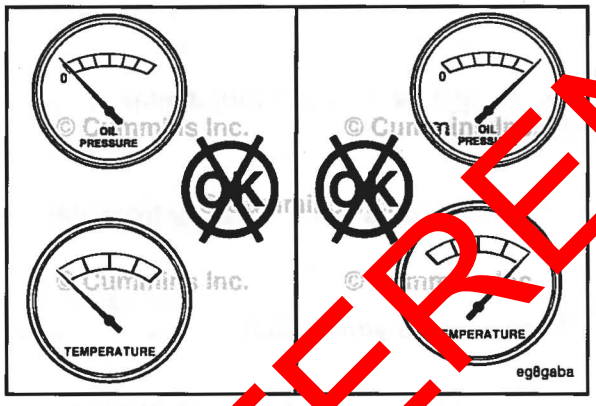


Starting Procedure After Extended Shutdown or Oil Change

General Information

Complete the following steps after each oil change, or after the engine has been shut down for more than 30 days to make sure the engine receives the correct oil flow through the lubricating system.

1. Disconnect the electrical wire from the fuel pump solenoid.
2. Rotate the crankshaft, using the starting motor, until oil pressure appears on the gauge or the warning lamp goes out.
3. Connect the electrical wire to the fuel pump solenoid valve.
4. Start the engine. Refer to 101-014 (Normal Starting Procedure).

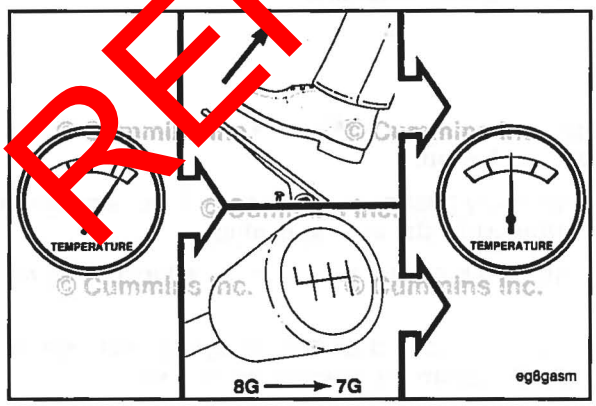


Operating the Engine

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.

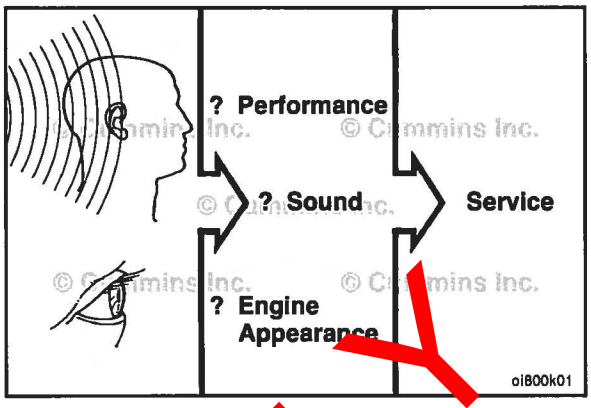


If an overheating condition starts to occur, reduce the power output of the engine by releasing the accelerator pedal or lever or shifting the transmission to a lower gear, or both, until the temperature returns to the normal operating range. If the engine temperature does **not** return to normal, shut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

REFERENCE ONLY

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.



⚠CAUTION⚠

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

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

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 fuel 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]

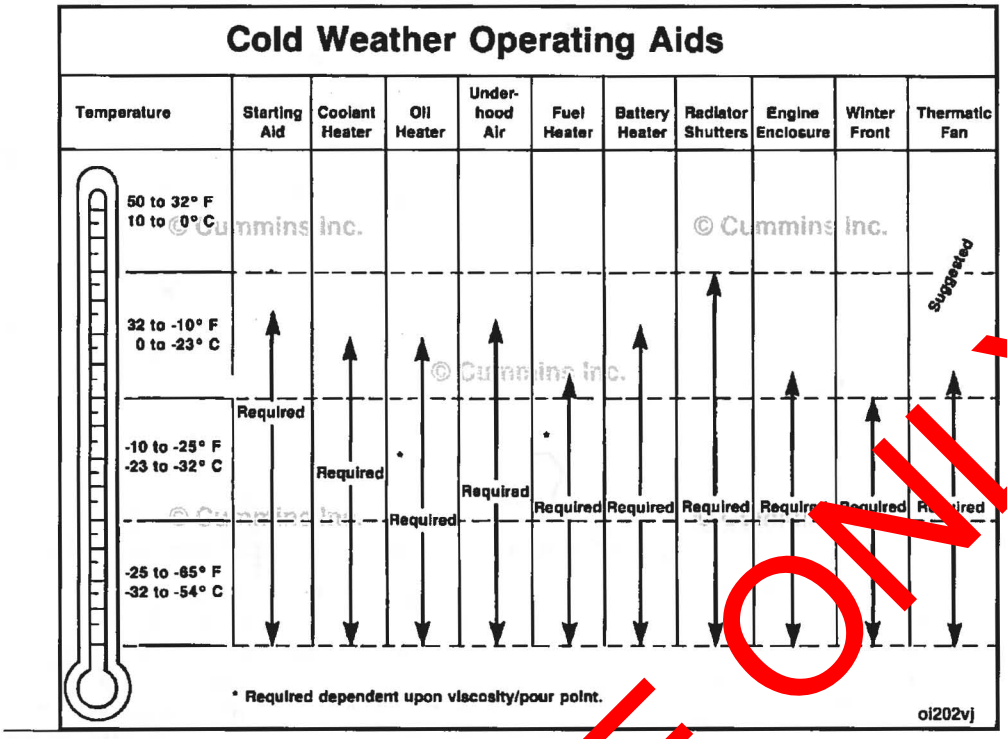
Use 60-percent ethylene glycol antifreeze and 40-percent water for the engine coolant mixture.

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:

REFERENCE ONLY



© Cummins Inc.

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).

REFERENCE ONLY

Engine Operating Range

General Information

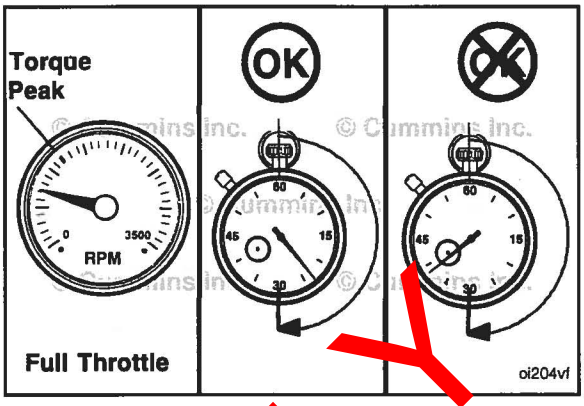
⚠CAUTION⚠

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).

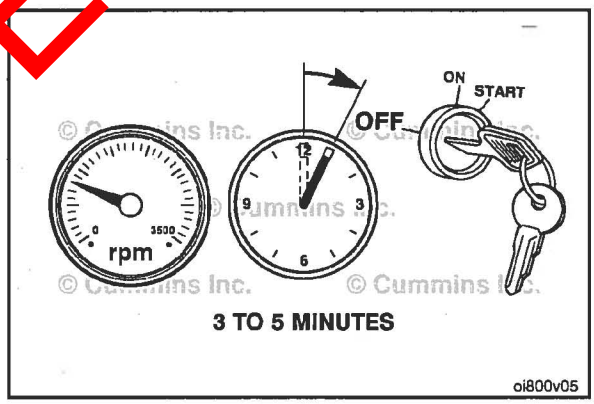


Engine Shutdown

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) in appropriate Operation and Maintenance manual.



REFERENCE ONLY

Notes

REFERENCE ONLY

Section 2 - Maintenance Guidelines

Section Contents

Page

Maintenance Guidelines - Overview 2-1
General Information 2-1
Maintenance Record Form 2-6
Maintenance Data 2-6
Maintenance Schedule 2-3
General Information 2-3
Oil Drain Intervals 2-3
Tool Requirements 2-2
General Information 2-2

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

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. For gas fueled generator sets, shorter maintenance intervals are also required, if operating at loads below 70% for prolonged periods. Contact your local Cummins® Authorized Repair Location for recommended maintenance intervals.

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

If your 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.

REFERENCE ONLY

Tool Requirements

General Information

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

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

Tool Part Number	Description
3375045	Torque wrench (0 to 175 ft-lb)
3375049	Oil filter wrench
3376807	Engine coolant and fuel filter wrench
3824556	Charge air cooler (CAC) pressure kit
3824591	Engine barring gear
3824783	Torque wrench (0 to 300 in-lb)
CC-2626	Cooling System DCA4 test kit
CC-2802	Coolant test kit

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

REFERENCE ONLY

Maintenance Schedule

General Information

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

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

Daily or Refueling - Maintenance Check.....Section 3
- Engine Lubricating Oil Level - Maintenance Check
- Engine Coolant Level - Maintenance Check
- Cooling Fan - Inspect
- Drive Belts - Inspect
- Fuel-Water Separator - Drain

Every 10,000 Kilometers [6000 Miles], 250 Hours, or 3 Months[1, 4] .....Section 4
- Lubricating Oil - Change[1]
- Lubricating Oil Filters - Replace
- Air Cleaner Restriction - Maintenance Check
- Air Intake Piping - Maintenance Check
- Charge-Air Cooler - Inspect[4]
- Air Compressor - Maintenance Check
- Batteries - Inspect

Every 19,000 Kilometers [12,000 Miles], 500 Hours, or 6 Months[3, 5] .....Section 5
- Fuel Filter (Spin-on-type) - Replace[5]
- Antifreeze - Maintenance Check[3]
- Cooling Fan Belt Tensioner - Inspect

Every 38,000 Kilometers [24,000 Miles], 1000 Hours, or 1 Year[2] .....Section 6
- Overhead Set - Adjust[2]
- Drive Belts - Test

Every 77,000 Kilometers [48,000 Miles], 2000 Hours, or 2 Years[3] .....Section 7
- Air Compressor Discharge Lines - Maintenance Check
- Cooling System - Inspect[3]
- Vibration Damper, Rubber - Inspect
- Vibration Damper, Viscous - Inspect

NOTE:
1. Refer to the oil change interval table provided in this section to find the specific oil change interval for individual applications.
2. Initial valve lash clearance adjustment, subsequent adjustments to be performed at 77,000 km [48,000 mi] intervals or every other oil change for automotive engines.
3. Heavy-duty year-around antifreeze that meets the critical composition of GM6038M **must** be used. The change interval is 2 years or 320,000 km [200,000 mi], whichever occurs first. Antifreeze is essential for freeze, overheat, and corrosion protection.
4. Service interval is 2 years or 320,000 km [200,000 mi], whichever comes first.
5. Service interval is every other oil change or 19,000 km [12,000 mi], 500 hours, or 6 months, whichever occurs first.

Oil Drain Intervals

Refer to the following flowchart to determine the maximum recommended oil change and filter change intervals in kilometers, miles, hours, or months, whichever comes first.

Is the vehicle one of those listed below?

Is the vehicle an on-highway application?

If Yes -

Refer to Table 1

If No -

Is the vehicle used in a construction, mining, or logging operation?

If Yes -

REFERENCE ONLY

Refer to Table 2

If No -

Is the vehicle in an agricultural or stationary power application?

If Yes -

Refer to Table 3

If No -

Use the following oil change interval, 10,000 kilometers [6000 miles], 250 hours, or 3 months, whichever occurs first.

Table 1: Use the following oil drain intervals for your application[1]

Vehicle/Equipment	Kilometers	Miles	Hours	Months
Refuse Truck	10,000	6000	250	3
Mixer/Dumper	10,000	6000	250	3
Delivery Truck	10,000	6000	250	6
Shuttle or Transit Bus	10,000	6000	250	3
School Bus	10,000	6000	250	6
Fire Truck	10,000	6000	250	3
Recreational Vehicle	10,000	6000	250	6
Regional Haul Truck	17,000	10,000	250	3
Coach Bus	17,000	10,000	250	3

[1]Or whichever occurs first. If your application accumulates high hours and low mileage, the change interval is determined by hours.

NOTE: If the vehicle accumulates 12,875 kilometer [8000 miles] in a month, the oil change interval will be 17,000 kilometer [10,000 miles] or 250 hours, whichever occurs first.

Table 2: Use the following oil drain intervals for your application[1]

Vehicle/Equipment	Kilometers	Miles	Hours	Months
Truck Crane	10,000	6000	250	3
Yard Spotter	10,000	6000	250	3
Paver	N/A	N/A	250	6
Cranes	N/A	N/A	250	6
Backhoe	N/A	N/A	250	6
Dozer	N/A	N/A	250	6
Scraper	N/A	N/A	250	6
Skidder	N/A	N/A	250	6

[1]Or whichever occurs first. If your application accumulates high hours and low mileage, the change interval is determined by hours.

Table 3: Use the following oil drain intervals for your application[1]

Vehicle/Equipment	Hours	Months
Farm Tractors	250	6
Combines	250	6
Irrigation Equipment	250	6
Generator Set	250	6
Air Compressor	250	6
Fire Pump	250	6
Pleasure Boat	250	6
Work Boat	250	3

REFERENCE ONLY

Table 3: Use the following oil drain intervals for your application[1]		
Vehicle/Equipment	**Hours**	**Months**
[1]Or whichever occurs first. If your application accumulates high hours and low mileage, the change interval is determined by hours.		

REFERENCE ONLY

Maintenance Record Form

Maintenance Data

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

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

A	B	C	D	E	F

REFERENCE ONLY

Section 3 - Maintenance Procedures at Daily Interval

Section Contents

Page

Coolant Level 3-5
Maintenance Check 3-5
Daily Maintenance Procedures - Overview 3-1
Engine Operation Report 3-1
General Information 3-1
Unusual Engine Noise 3-1
Drive Belts 3-3
Maintenance Check 3-3
Poly-Vee Belt 3-3
Cogged Belt 3-3
Fan, Cooling 3-4
Inspect for Reuse 3-4
Fuel-Water Separator 3-2
Drain 3-2
Canister Type 3-2
Spin-on Type 3-2
Lubricating Oil Level 3-4
Maintenance Check 3-4

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

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.

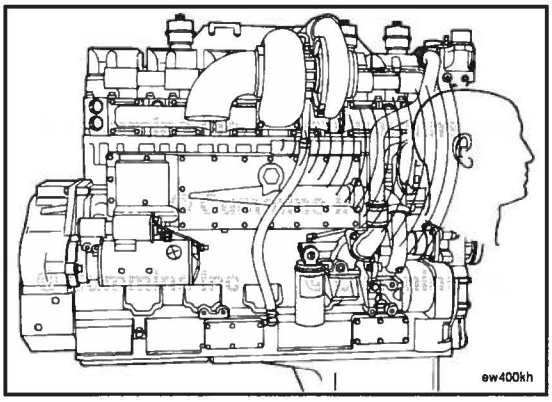
Comparison and intelligent interpretation of the daily report, along with a practical follow-up action, will eliminate most failures and emergency repairs.

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.



REFERENCE ONLY

Fuel-Water Separator

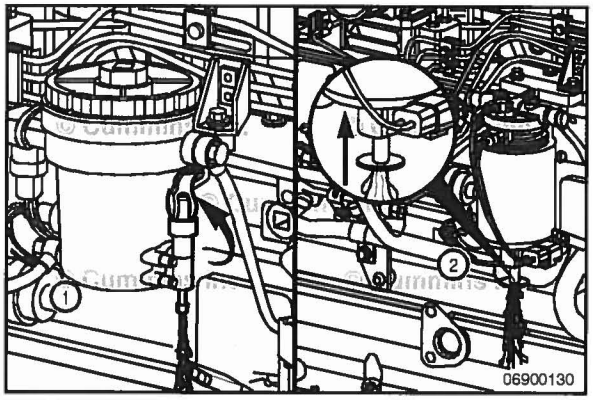
Drain

⚠WARNING⚠

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.

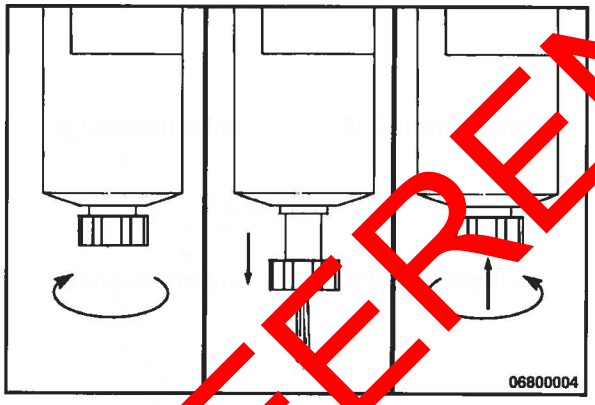


Canister Type

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 3½ turns until the valve drops down 25.4mm [1 in] and draining occurs.

Drain the filter sump until clear fuel is visible.

△CAUTION△

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

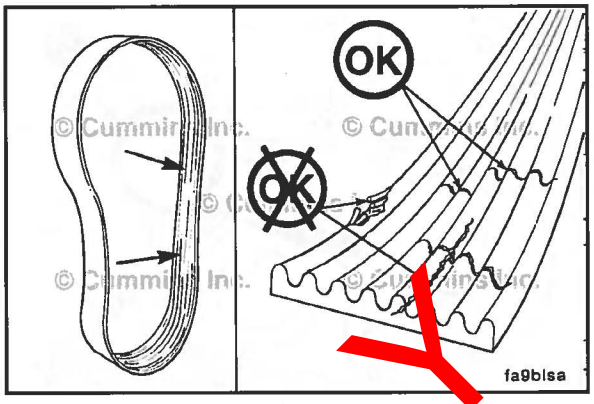
To close the valve, lift the valve and turn **clockwise** until it is hand-tight.

REFERENCE ONLY

Drive Belts

Maintenance Check

Poly-Vee Belt

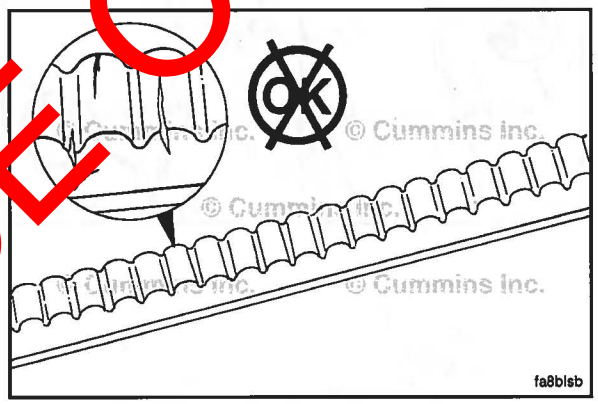


Inspect the belts daily. Check the belt for intersecting cracks. Traverse (across the belt width) cracks are acceptable. Longitudinal (direction of belt length) cracks that intersect with transverse cracks are **not** acceptable. Replace the belt if it is frayed or has pieces of material missing. Refer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

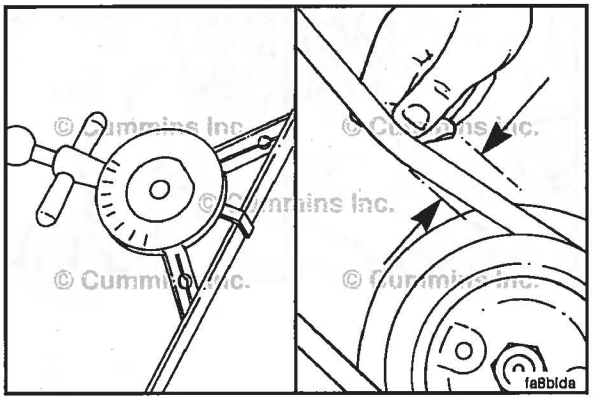


Inspect the belts daily. Replace the belts if they are cracked, frayed, or have chunks of material missing. Small cracks are acceptable.

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



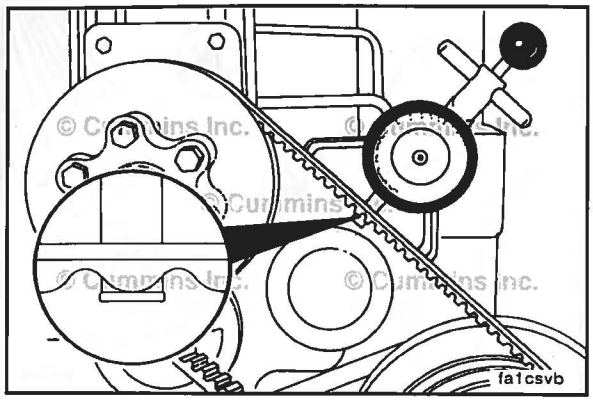
Measure the belt tension in the center span of the pulleys.

Refer to the Belt Tension Chart in Section V for the correct gauge and tension value for the belt width used.

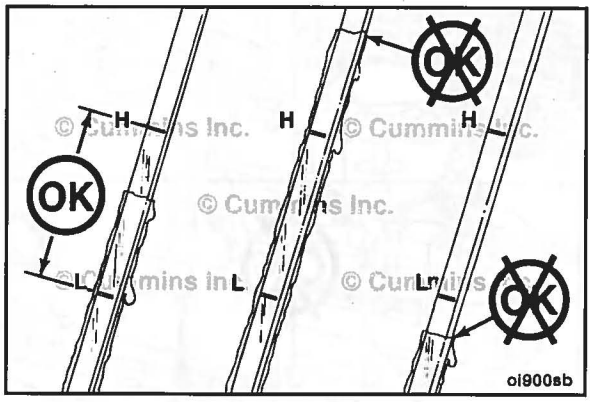
An alternate method (deflection method) can be used to check belt tension by applying 110 N [25 lbf] force between the pulleys on v-belts. If the deflection is more than one belt thickness per foot of pulley center distance, the belt tension **must** be adjusted.

Refer to Section A for adjustment procedures.

REFERENCE ONLY



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.



Lubricating Oil Level

Maintenance Check

⚠CAUTION⚠

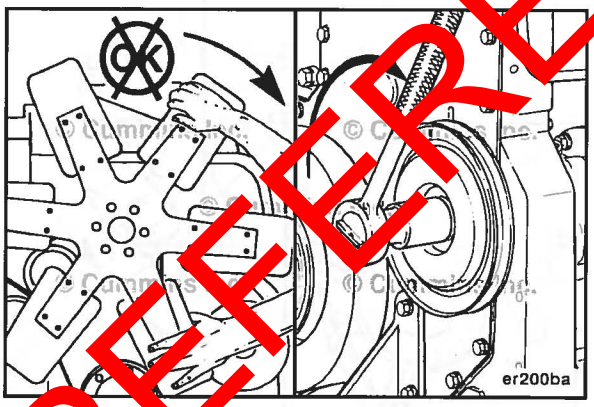
Never operate the engine with oil level below the L (low) mark or above the H (high) mark. Poor engine performance or engine damage can occur.

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

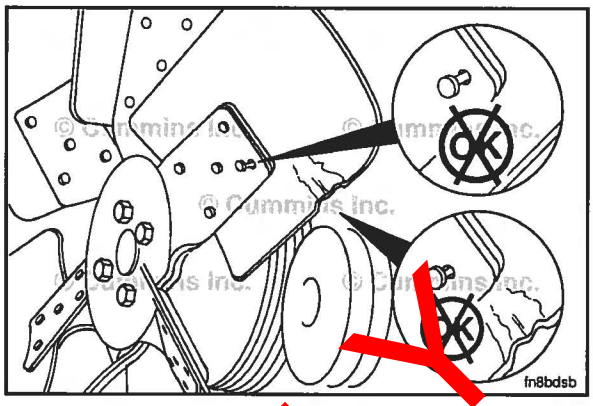
Inspect for Reuse

⚠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.

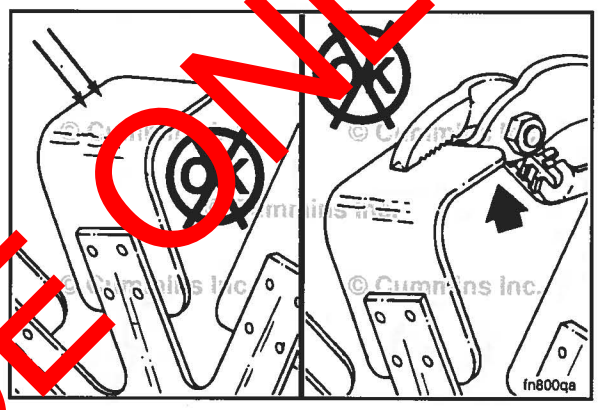
REFERENCE ONLY

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.



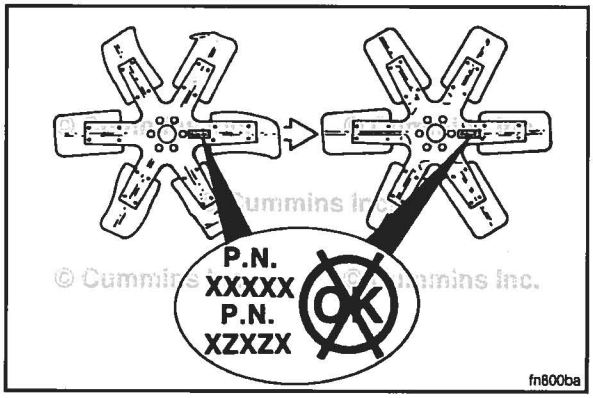
⚠WARNING⚠

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

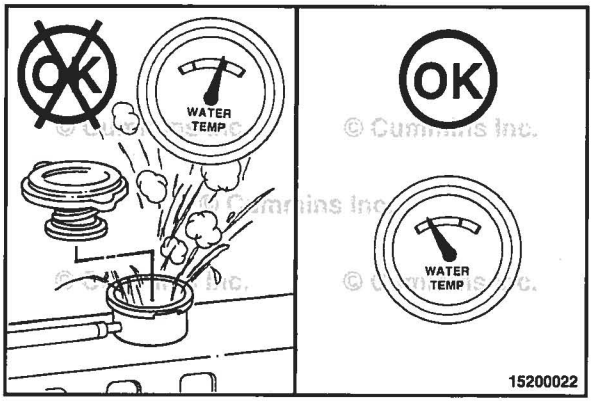
⚠WARNING⚠

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.

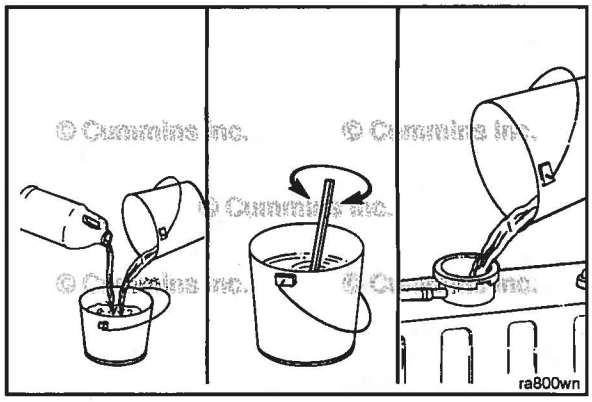
⚠CAUTION⚠

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.



REFERENCE ONLY

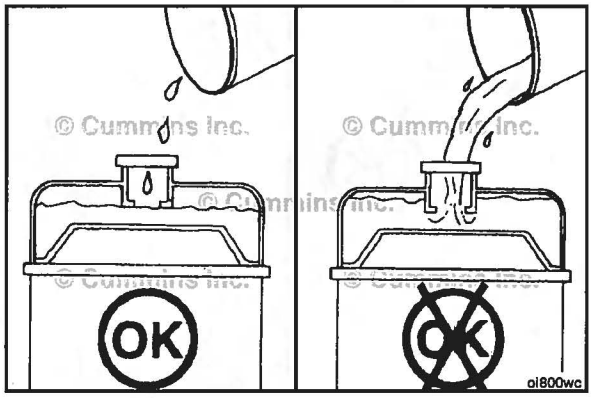


⚠CAUTION⚠

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.

REFERENCE ONLY

Section 4 - Maintenance Procedures at 10,000 Kilometers [6000 Miles], 250 Hours, or 3 Months

Section Contents

Page

Air Cleaner Restriction 4-4
Maintenance Check 4-4
Air Compressor 4-5
Finishing Steps 4-6
Maintenance Check 4-5
Preparatory Steps 4-6
Air Intake Piping 4-4
Maintenance Check 4-4
Batteries 4-7
Inspect 4-7
Charge-Air Cooler 4-4
Maintenance Check 4-4
Lubricating Oil and Filters 4-1
Drain 4-1
Fill 4-3
Install 4-2
Remove 4-2
Maintenance Procedures - Overview 4-1
General Information 4-1

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

Maintenance Procedures - Overview

General Information

All maintenance checks and inspections listed in previous maintenance intervals **must** also be performed at this time, in addition to those listed under this maintenance interval.

REFERENCE ONLY

Lubricating Oil and Filters

Drain

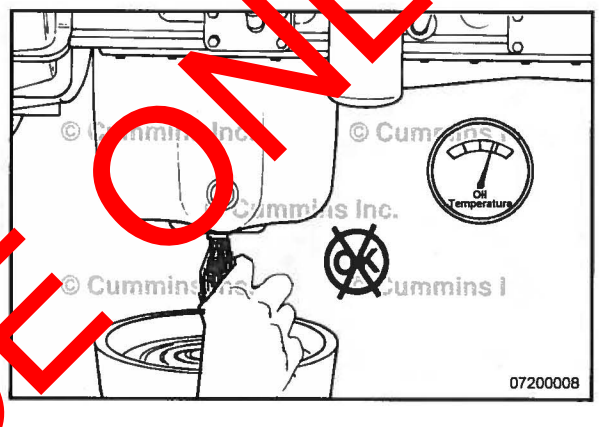
⚠WARNING⚠

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

⚠WARNING⚠

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

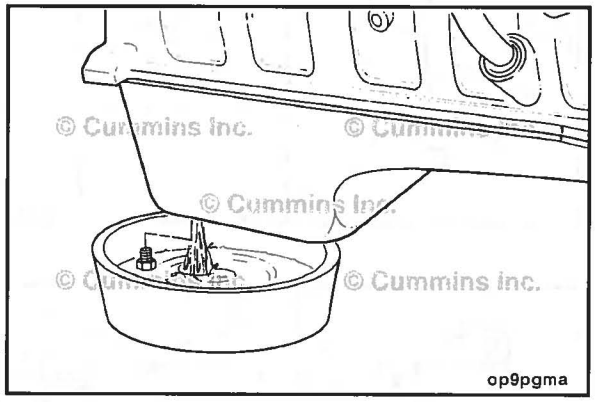
Change the lubricating oil and filter(s) at the specified oil change interval. Refer to Procedure [illegible] (Maintenance Schedule) in Section 2 to find the correct change interval for your application.

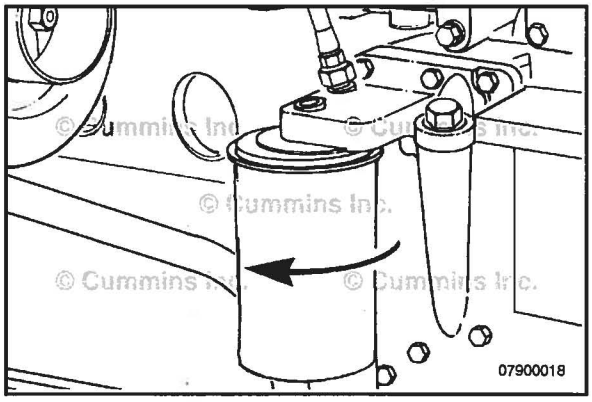


Operate the engine until the water temperature reaches 60°C [140°F]. Shut off the engine.

NOTE: Use a container that can hold at least 26 liters [27 qt] of lubricating oil.

Remove the oil drain plug from the bottom of the lubricating oil pan.





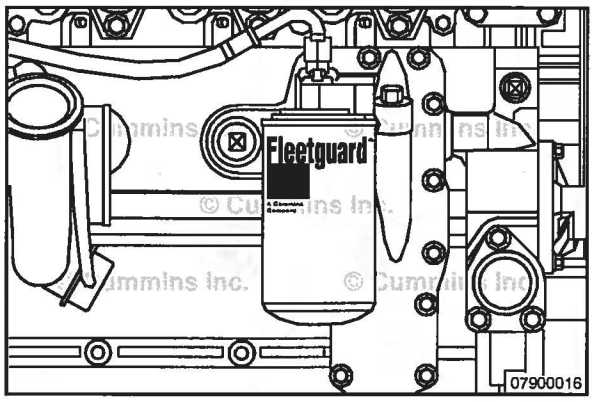
Remove

Clean the area around the lubricating oil filter head.

Remove the oil filter.

Clean the gasket surface of the filter head.

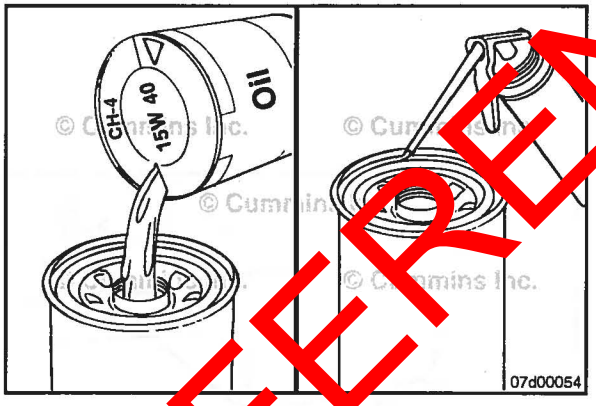
NOTE: The o-ring can stick on the filter head. Make sure it is removed before installing the new filter.



Install

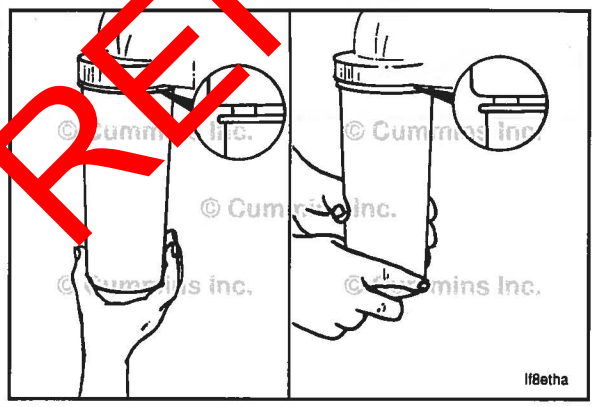
Use the correct oil filter.

Refer to Procedure 018-034 (Cummins/Fleetguard® Filter Specifications) in Section V for oil filter part number(s).



Fill the filter with clean lubricating oil before installation.

Apply a light film of lubricating oil to the gasket sealing surface before installing the filter.



⚠CAUTION⚠

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

Install the filter as specified by the filter manufacturer.

REFERENCE ONLY

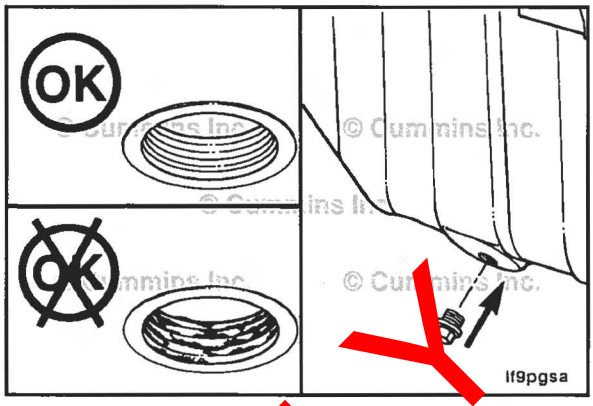
Clean the sealing surface.

Check the oil drain plug threads.

Install the drain plug.

Torque Value:

Steel Pan	60 N•m	[44 ft-lb]
Aluminum Pan	30 N•m	[22 ft-lb]



Fill

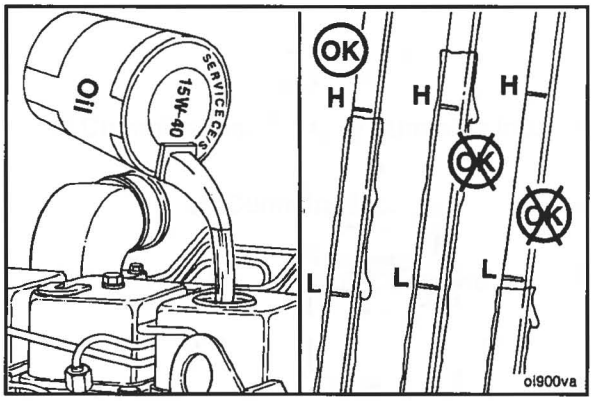
Use a high-quality 15W-40 multiviscosity lubricating oil, such as Valvoline® Premium Blue® or its equivalent, in Cummins engines. Choose the correct lubricating oil for your operating climate as outlined in Procedure 018-003 (Lubricating Oil Recommendations and Specifications) in Section V.



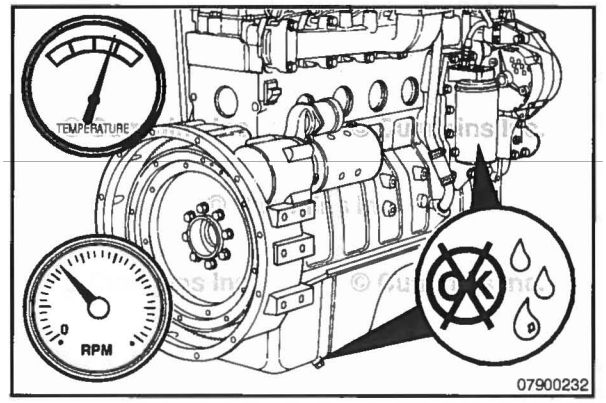
Fill the engine with clean lubricating oil to the proper level. Refer to Procedure 018-017 (Lubricating Oil System) in Section V for lubricating oil capacity.

NOTE: Total system capacity assumes lubricating oil pan plus lubricating oil filter.

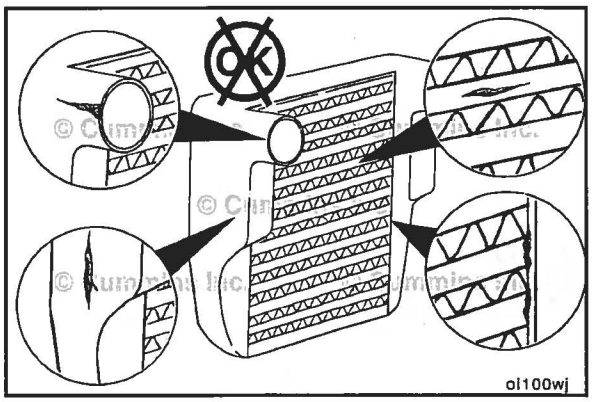
Some applications use a slightly different lubricating oil pan capacity. All lubricating oil quantities **must** be adjusted accordingly. Contact a local Cummins Distributor if you have any questions.



Operate the engine and check for leaks at the filters and oil drain plug.



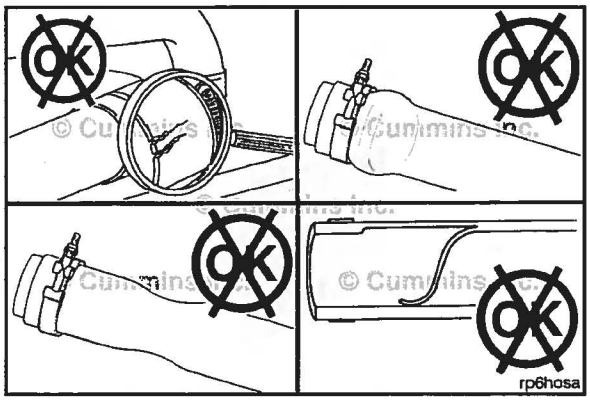
REFERENCE ONLY



Charge-Air Cooler

Maintenance Check

Inspect the charge-air cooler (CAC) for dirt and debris blocking the fins. Check for cracks, holes, or other damage. If damage is found, refer to the vehicle, vessel, or equipment manufacturer.



Air Intake Piping

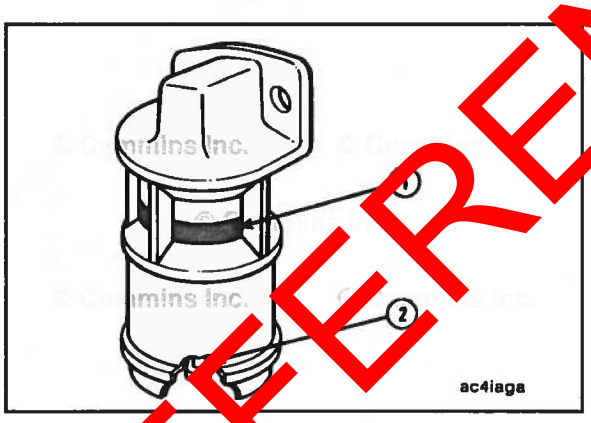
Maintenance Check

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.

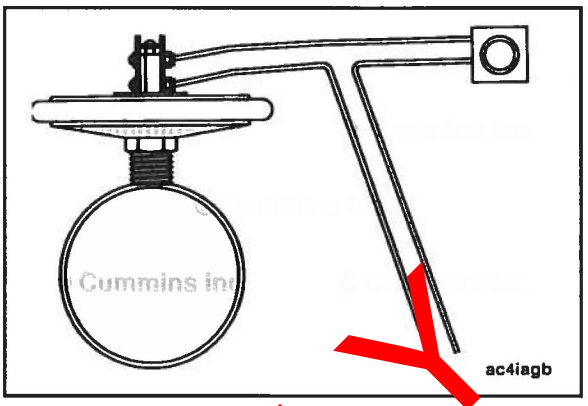
⚠CAUTION⚠

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.

REFERENCE ONLY

Vacuum Indicator

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



Air Compressor

Maintenance Check

NOTE: Depending on application, all engines will possibly **not** be equipped with an air compressor.

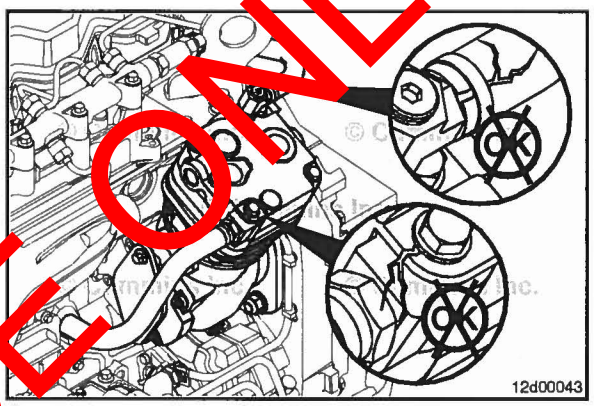
Inspect compressor housing for cracks and damage.

Inspect hydraulic pump couplings for cracks, wear, or damage (if equipped).

Inspect air plumbing for splits or cracks.

Inspect the air compressor mounting nuts, including support bracket, for loose or damaged hardware.

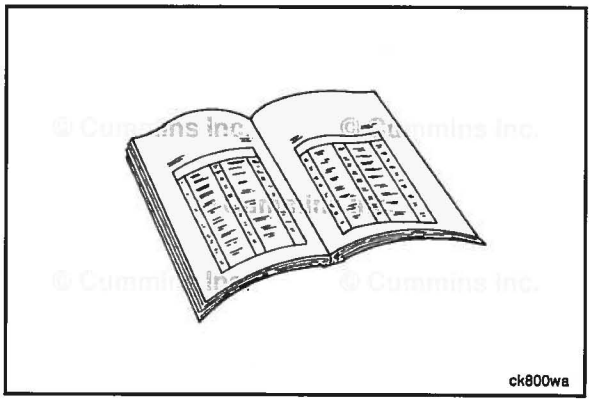
Operate the engine and check for correct compressor operation and air, oil, and coolant leaks.



Torque Value:
Mounting 18 mm 77 N•m [57 ft-lb]

Torque Value:
Bracket 10 mm 45 N•m [33 ft-lb]

REFERENCE ONLY



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⚠

Compressed air used for cleaning should not exceed 207 kPa [30 psi]. Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

⚠WARNING⚠

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

⚠WARNING⚠

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

NOTE: The illustrations shown will be of the QE model single-cylinder air compressor. Differences in procedures for QE and HD model Cummins air compressors will be shown where necessary.

Drain the engine coolant. Refer to Procedure 008-018.

Remove the coolant lines from the air compressor.

NOTE: If the air compressor does **not** have a liquid-cooled cylinder head, then this step is **not** necessary.

Use steam to clean the air compressor.

Dry with compressed air.

Remove the hydraulic pump, if equipped. Refer to Procedure 009-016.



Finishing Steps

Fill the engine cooling system (liquid-cooled air compressor **only**). Refer to Procedure 008-018.

Operate the engine and check for leaks.

Operate the engine to activate the air compressor.

With the air compressor pumping between 550 to 690 kPa [80 to 100 psi], use a solution of soapy water to check for air leaks.

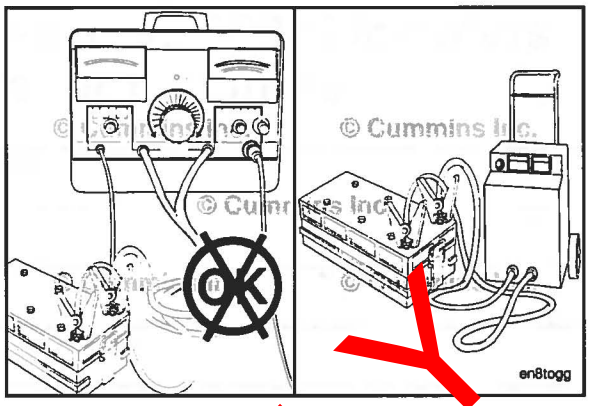
REFERENCE ONLY

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.



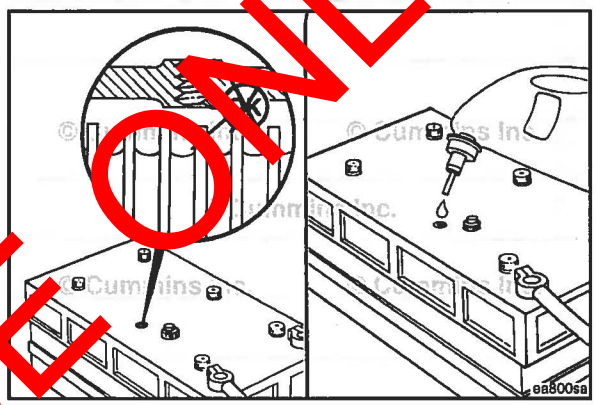
If conventional batteries are used, remove the cell caps or covers and check the electrolyte (water and sulfuric acid solution) level.

⚠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.



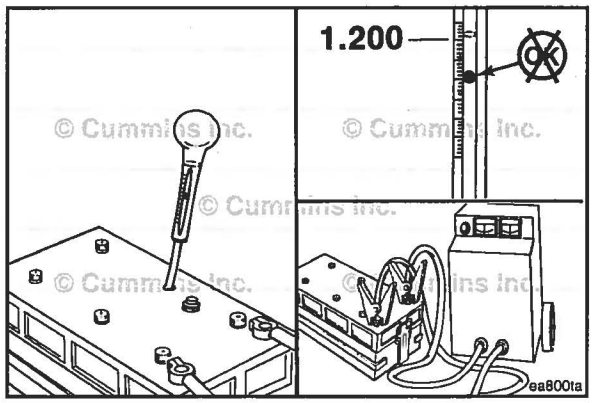
Refer to the accompanying table to determine the battery state of charge based on the specific-gravity reading.

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.



REFERENCE ONLY

Notes

REFERENCE ONLY

Section 5 - Maintenance Procedures at 19,000 Kilometers [12,000 Miles], 500 Hours, or 6 Months

Section Contents

Page

Cooling Fan Belt Tensioner 5-5
Maintenance Check 5-5
Engine Coolant Antifreeze 5-7
Maintenance Check 5-7
Fuel Filter (Spin-On Type) 5-1
Drain 5-1
Finishing Steps 5-5
Install 5-2
Preparatory Steps 5-1
Prime 5-3
General Information 5-3
Remove 5-1
Maintenance Procedures - Overview 5-1
General Information 5-1

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

Maintenance Procedures - Overview

General Information

All maintenance checks and inspections listed in previous maintenance intervals **must** also be performed at this time, in addition to those listed under this maintenance interval.

REFERENCE ONLY

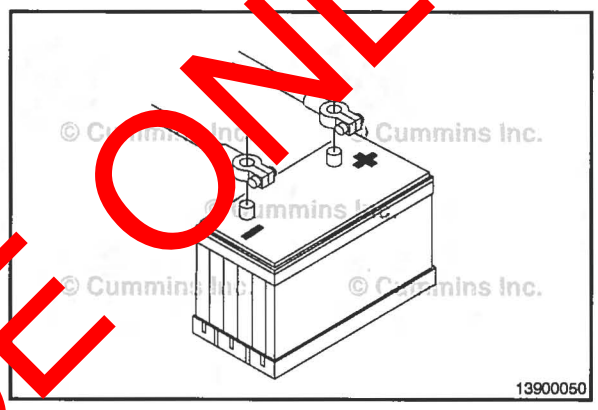
Fuel Filter (Spin-On Type)

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.

- Disconnect the batteries.

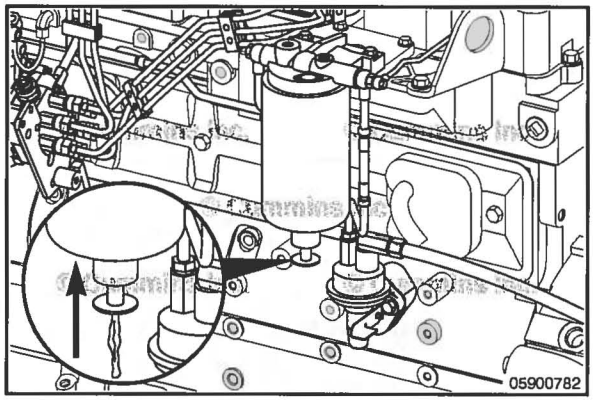


Drain

⚠WARNING⚠

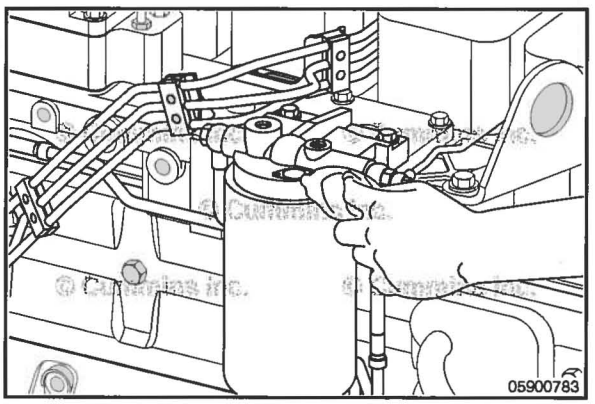
Drain the fuel-water separator into a container, and dispose of contents in accordance with local environmental regulations.

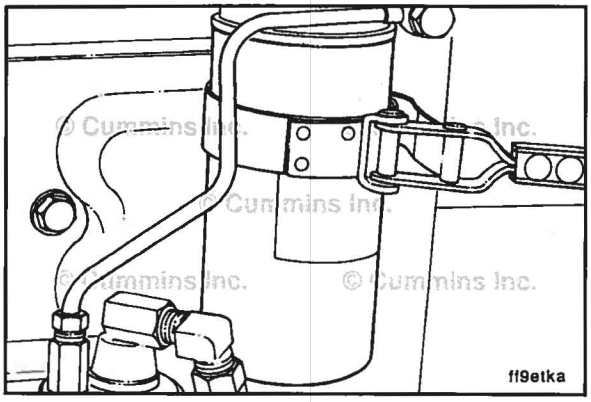
If equipped, use the filter drain valve to drain fuel out of the filter for approximately 5 seconds. This will eliminate fuel from running over the top of the filter upon removal.



Remove

Clean the area around the fuel filter head.

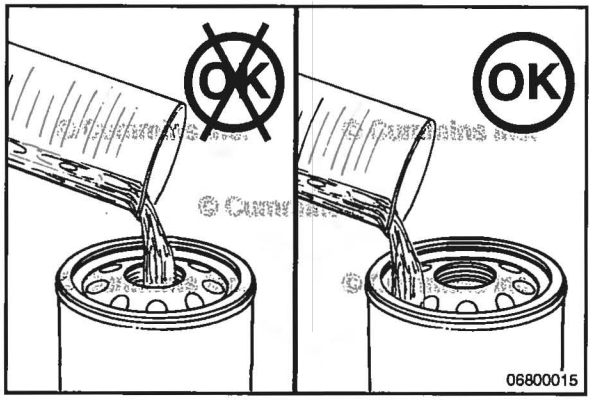




⚠WARNING⚠

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.

Remove the fuel filter.



Install

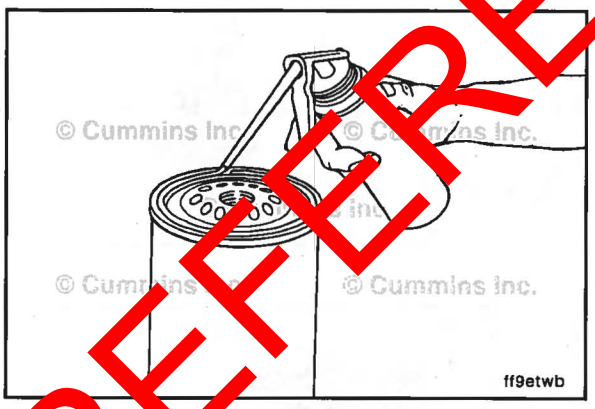
⚠WARNING⚠

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△

When pre-filling the filter do not pour fuel down the center (clean side) of the filter. Pour clean fuel into the outer openings (dirty side) of the filter. Use a clean side block off plug, if available, to prevent fuel from entering the clean side of the filter. Pre-filling on the clean side of the filter can result in debris entering the fuel system and damaging fuel system components.

Fill the new filter(s) with clean diesel fuel.



Lubricate the seal with clean lubricating engine oil.

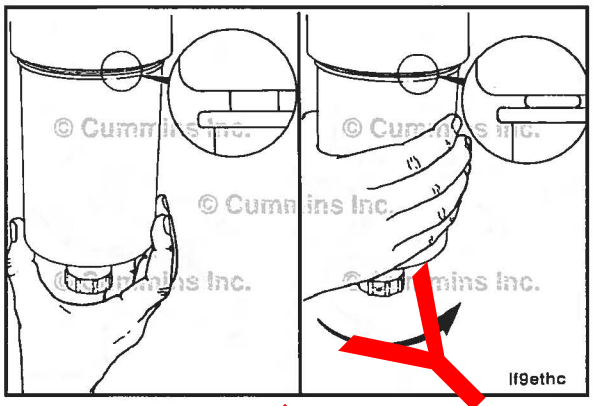
REFERENCE ONLY

⚠CAUTION⚠

Mechanical overtightening can distort the threads as well as damage the filter element seal or filter can.

Install the fuel filter on the fuel filter head. Turn the filter until the gasket contacts the filter head surface.

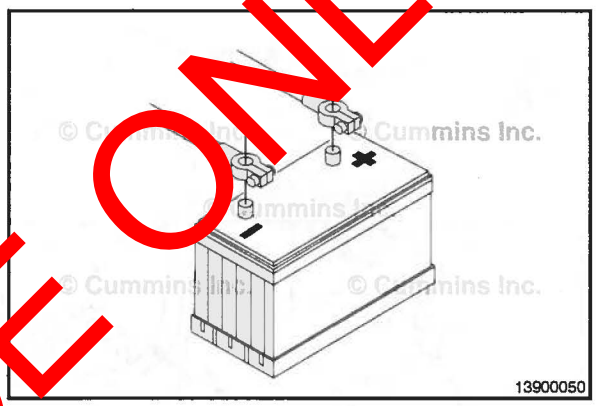
Tighten the fuel filter an additional ½ to ¾ of a turn after the gasket contacts the fuel filter head surface, or as specified by the fuel filter manufacturer.



⚠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.

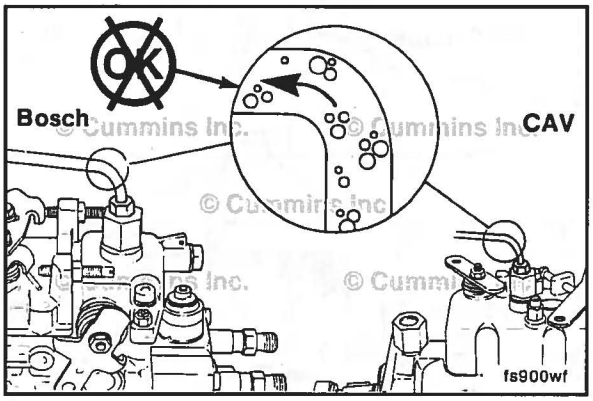
Connect the batteries.



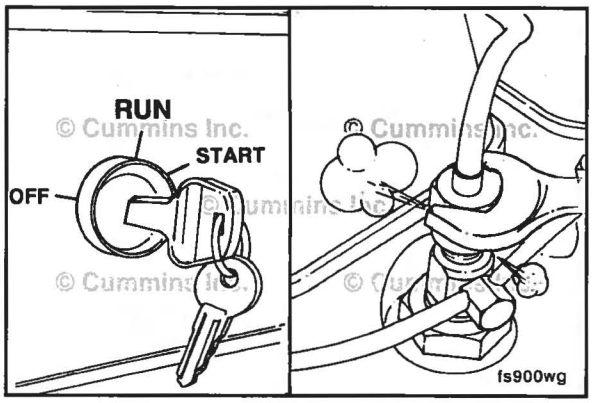
Prime

General Information

Controlled venting is provided at the injection pump through the fuel drain manifold. Small amounts of air introduced by changing the filters or injection pump supply line will be vented automatically if the fuel filter is changed in accordance with the instructions.



REFERENCE ONLY



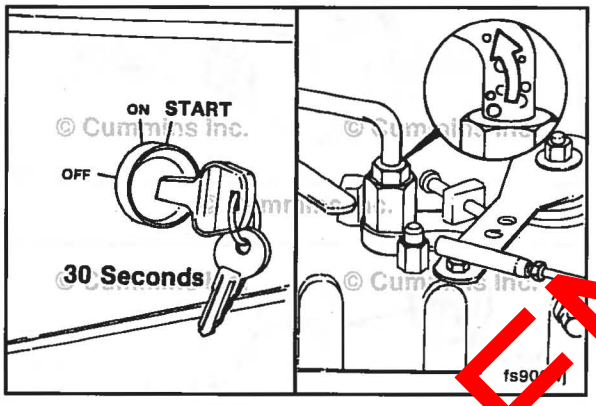
However, manual bleeding will be required if one of the following conditions exists:

- The fuel filter is **not** filled prior to installation
- The fuel injection pump is replaced
- The high-pressure fuel line connections are loosened, or the lines are replaced
- It is an initial engine start-up or start-up after an extended period of no engine operation.

Refer to Procedure 006-015 (Fuel Filter (Spin-On)) in Section 6 for proper venting of the low pressure side of the fuel system.

Refer to the Procedure 005-012 (Fuel Injection Pumps, In-Line) in Section 5 to determine if venting the fuel pump is necessary. Or, refer to Procedure 005-014 (Fuel Injection Pumps, Rotary) in Section 5 to determine if venting the fuel pump is necessary.

Refer to Procedure 006-051 (Injector Supply Lines (High Pressure) in Section 6 for venting of the high pressure side of the fuel system.



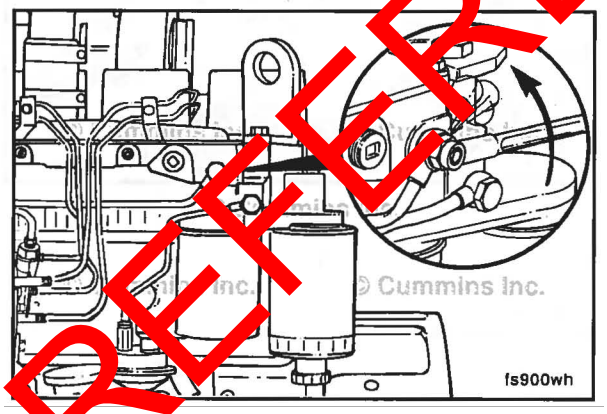
⚠CAUTION⚠

It is necessary to turn the keyswitch to the ON position. Because the engine can start, be sure to follow all safety precautions. Use the normal engine starting procedure.

⚠CAUTION⚠

When using the starting motor to vent the system, do not engage the starter for more than 30 seconds, or starter damage will occur. Wait 2 minutes before starting the engine again.

Air can also be vented through the fuel drain manifold line by operating the starting motor.



Low Pressure Fuel Line(s)

NOTE: For engines equipped with Distributor type pumps equipped with bleed screws.

Open the bleed screw.

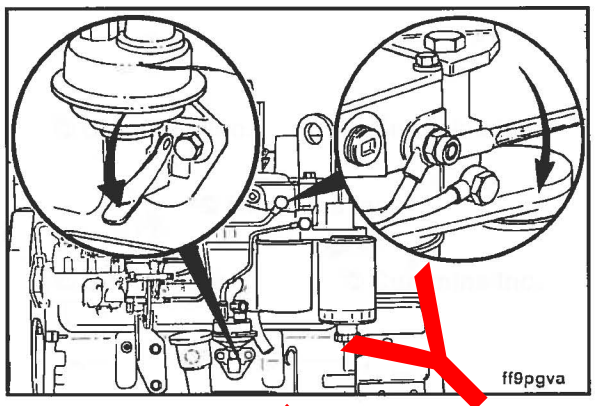
NOTE: If the engine is **not** equipped with a bleed screw, loosen the fitting on the low pressure supply line to the injection pump. Once priming has been completed, tighten the fitting to the specified torque.

REFERENCE ONLY

Operate the hand lever until the fuel flowing from the fitting is free of air.

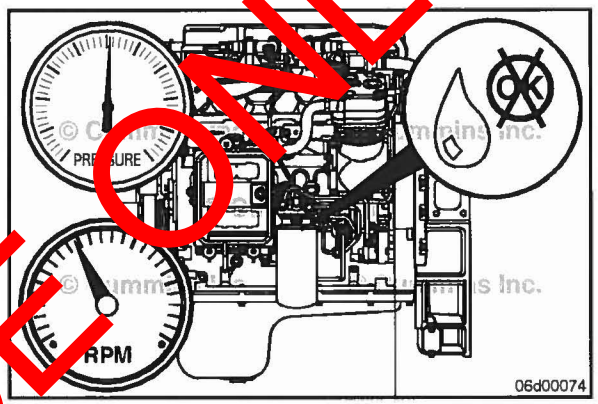
Tighten the bleed screw.

Torque Value: 9 N•m [80 in-lb]



Finishing Steps

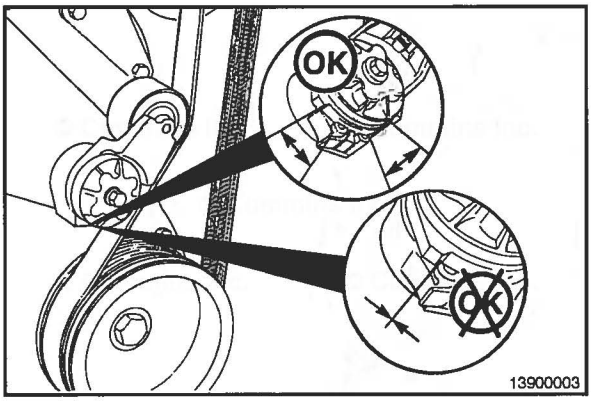
- Operate the engine and check for leaks.



Cooling Fan Belt Tensioner

Maintenance Check

With the engine turned off, check that neither the top nor bottom tensioner arm stop is touching the cast boss on the tensioner body. If either of the stops is touching a boss, the alternator belt **must** be replaced. Check to make certain the correct belt part number is being used if either condition exists.



⚠WARNING⚠

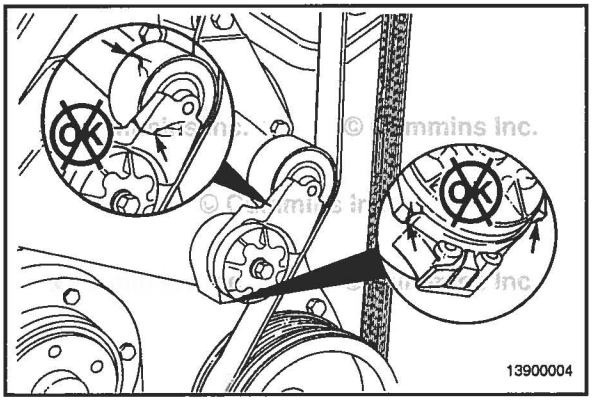
When using a steam cleaner, wear safety glasses or a face shield, as well as protective clothing. Hot steam can cause serious personal injury.

⚠WARNING⚠

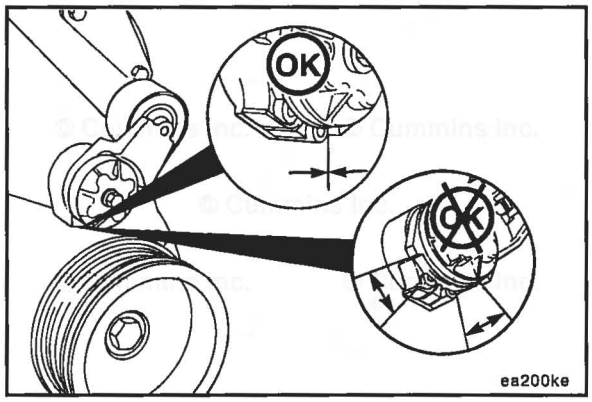
Wear safety glasses or a face shield, as well as protective clothing, to prevent personal injury when using a steam cleaner or high-pressure water.

Check the tensioner pulley and body for cracks. If any cracks are noticed, the tensioner **must** be replaced. Refer to a Cummins® Authorized Repair Facility.

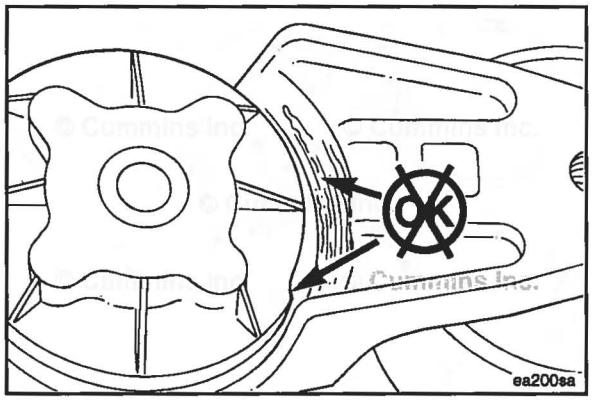
Check the tensioner for dirt buildup. If this condition exists, the tensioner **must** be removed and steam-cleaned.



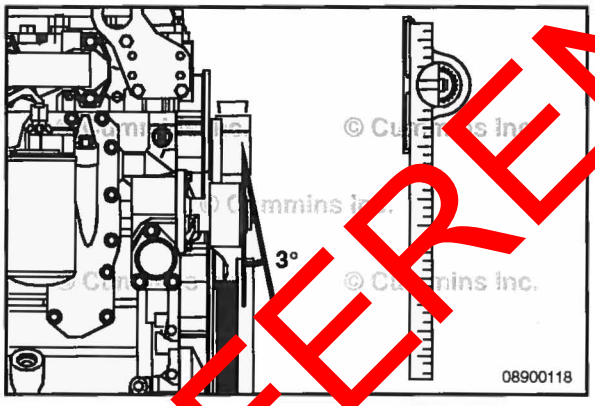
REFERENCE ONLY



With the cooling fan belt removed, check that the bottom tensioner arm stop is in contact with the bottom tensioner arm stop boss on the tensioner body. If these two are **not** touching, the tensioner **must** be replaced.



Inspect the tensioner for evidence of the pivoting tensioner arm contacting the stationary circular base. If there is evidence of these two areas touching, the pivot tube bushing has failed and the tensioner **must** be replaced.



The worn tensioner that has play in it or a belt that "walks" off its pulley possibly indicates pulley misalignment.

NOTE: Maximum pulley misalignment is 3 degrees.

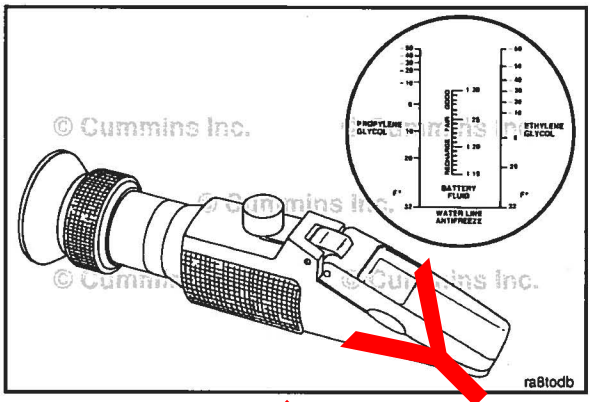
This measurement can be taken with a straightedge and an inclinometer.

Install the belt.

REFERENCE ONLY

Engine Coolant Antifreeze

Maintenance Check



⚠CAUTION⚠

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

Check the antifreeze concentration. Use a mixture of 50-percent water and 50-percent ethylene glycol or propylene glycol-base antifreeze to protect the engine to -32°C [-25° 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.

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

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

REFERENCE ONLY

Notes

REFERENCE ONLY

Section 6 - Maintenance Procedures at 38,000 Kilometers [24,000 Miles], 1000 Hours, or 1 Year

Section Contents

Page

Drive Belts 6-5
Test 6-5
Maintenance Procedures - Overview 6-1
General Information 6-1
Overhead Set 6-1
Adjust 6-2
B3.9, B5.9, and B4.5 Engines 6-2
Finishing Steps 6-4
Install 6-4
B3.9, B5.9, and B4.5 Engines 6-4
Preparatory Steps 6-1
Remove 6-2
B3.9, B5.9, and B4.5 Engines 6-2

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

Maintenance Procedures - Overview

General Information

All maintenance checks and inspections listed in previous maintenance intervals **must** also be performed at this time, in addition to those listed under this maintenance interval.

REFERENCE ONLY

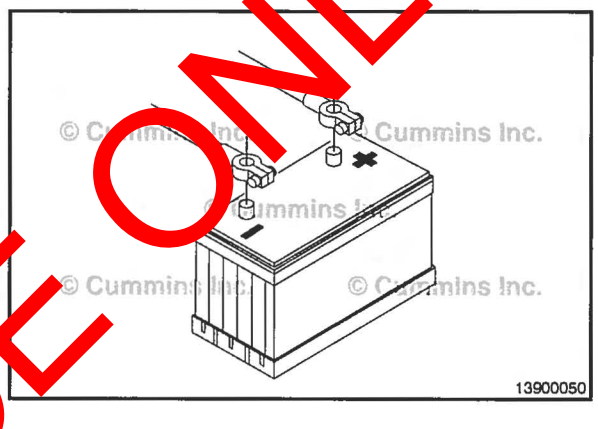
Overhead Set

Preparatory Steps

⚠WARNING⚠

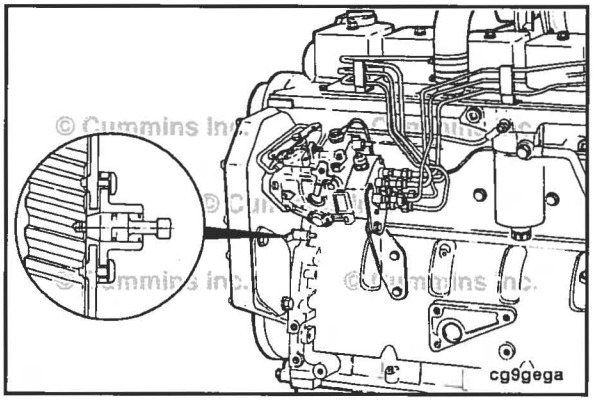
Batteries can emit explosive gases. To reduce the possibility of personal injury, always ventilate the compartment before servicing the batteries. To reduce the possibility of arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

- Disconnect the batteries.



NOTE: The timing pin is used to accurately locate TDC for setting the overhead. The timing pin is typically located below the fuel pump.

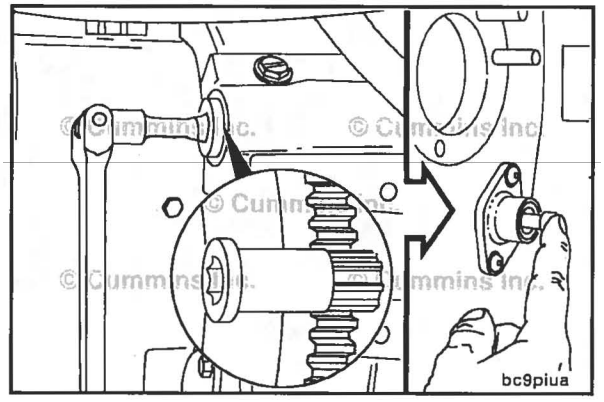
- for front gear train engines, in the front gear housing (shown)
- for rear gear train engines, in the rear gear housing (not shown)

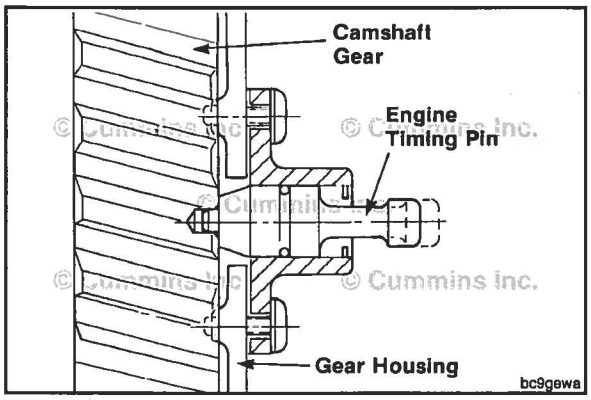


Locate top dead center (TDC) for cylinder number 1 by barring the crankshaft slowly while pressing on the engine timing pin. Barring the engine is recommended from the flywheel on the rear of the engine.

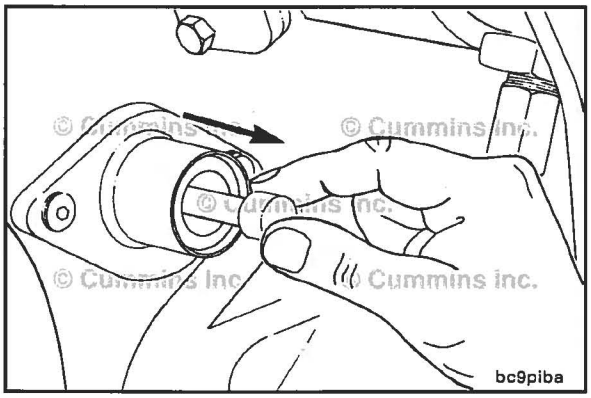
NOTE: Engine coolant temperature **must** be less than 60° C [140°F].

Using the barring tool Part Number 3824591, rotate the crankshaft slowly while pressing on the engine timing pin to locate TDC for cylinder number 1.



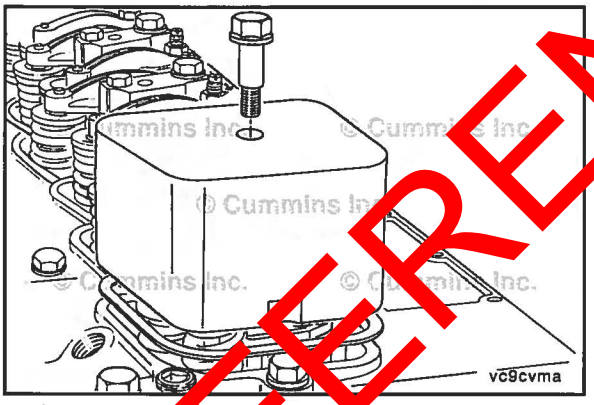


When the timing pin engages in the hole in the camshaft gear, cylinder number 1 is at TDC on the compression stroke.



⚠CAUTION⚠

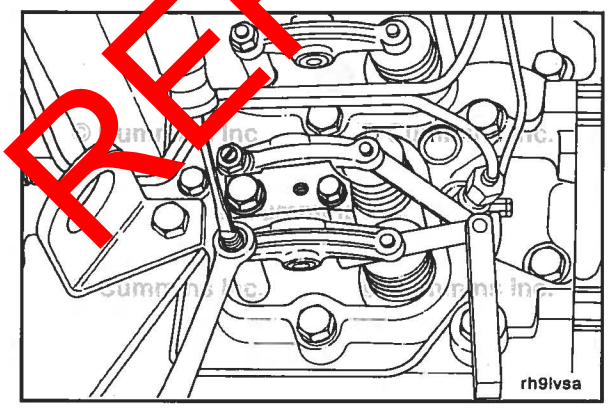
To reduce the possibility of engine or timing pin damage, you must disengage the timing pin after locating top dead center.



Remove

B3.9, B5.9, and B4.5 Engines

Remove the capscrews, capscrew seals, rocker lever covers, and rocker lever cover gaskets.



Adjust

B3.9, B5.9, and B4.5 Engines

NOTE: The clearance is correct when some resistance is "felt" when the feeler gauge is slipped between the valve stem and the rocker lever.

NOTE: Caution **must** be used when setting the exhaust valve lash on marine cylinder heads with rotators. The top of the valve stem is slightly recessed below the top of the valve rotator.

Intake Clearance: 0.254 mm [0.010 in]

Exhaust Clearance: 0.508 mm [0.020 in]

REFERENCE ONLY

Four-Cylinder Engine Adjustment

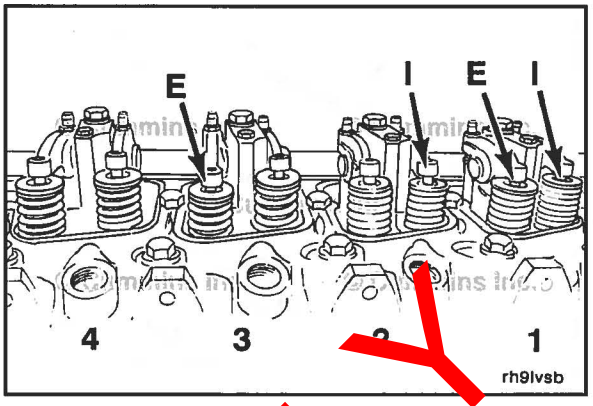
Make sure the engine is at top dead center (TDC) for cylinder number 1.

Set **only** valves indicated by the arrows (E = exhaust, I = intake). Do **not** set valves that are **not** indicated.

Holding the locknut steady with the wrench, adjust the valve clearance with the screwdriver or Allen wrench.

Tighten the locknut and measure the valve lash again.

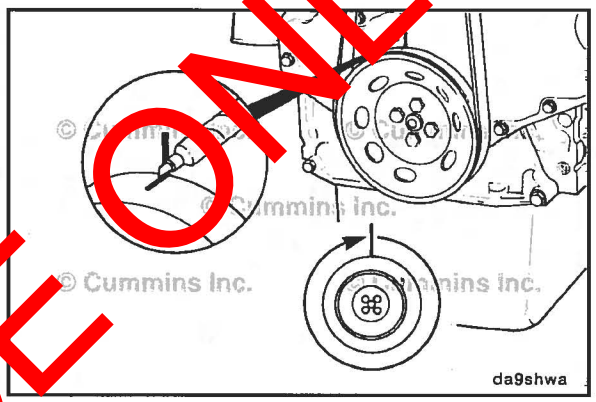
Torque Value: 24 N•m [18 ft-lb]



⚠CAUTION⚠

To reduce the possibility of engine or pin damage, be sure the timing pin is disengaged.

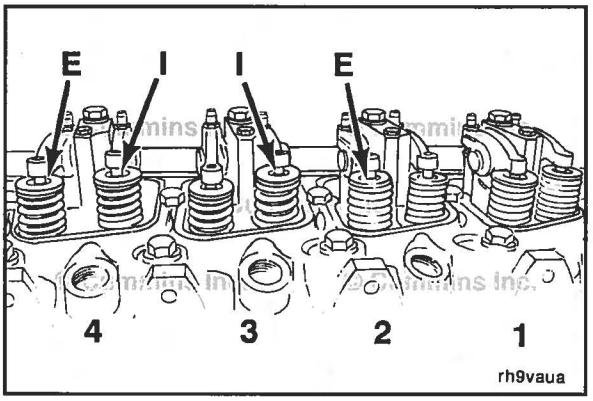
Mark the vibration damper and rotate the crankshaft 360 degrees.



Adjust the valves as indicated in the illustration.

Torque Value: 24 N•m [18 ft-lb]

Set **only** valves indicated by the arrows (E = exhaust, I = intake). Do **not** set valves that are not indicated.



Six-Cylinder Engine Valve Adjustment

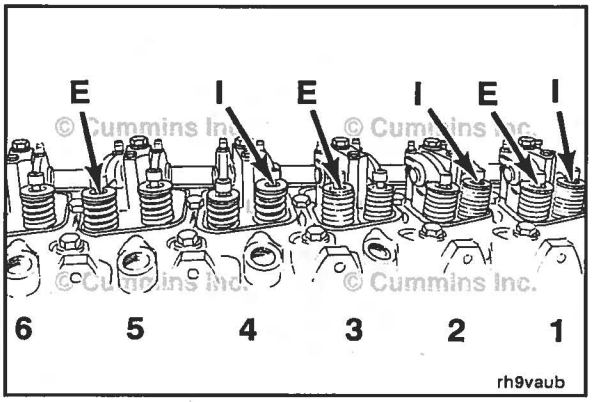
Make sure the engine is at top dead center (TDC) for cylinder number 1.

Set **only** the valves indicated by the arrows in the illustration (E = exhaust, I = intake).

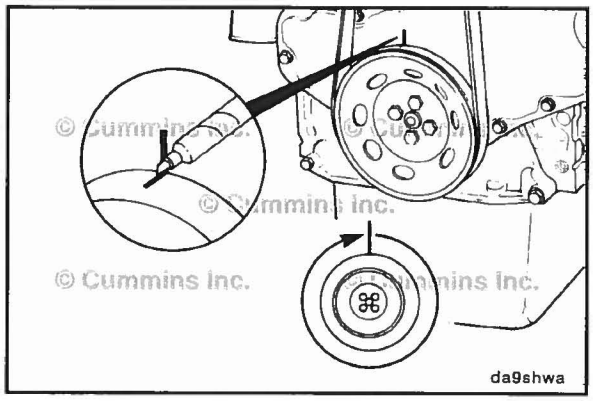
Holding the locknut steady with the wrench, adjust the valve clearance with the screwdriver or Allen wrench.

Tighten the locknut, and measure the valve lash again.

Torque Value: 24 N•m [18 ft-lb]



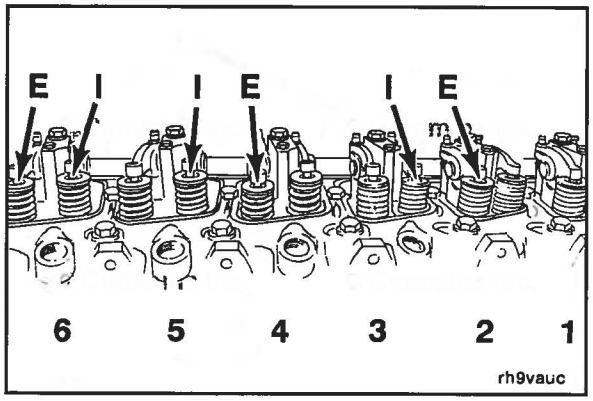
REFERENCE ONLY



⚠CAUTION⚠

To reduce the possibility of engine or pin damage, be sure timing pin is disengaged.

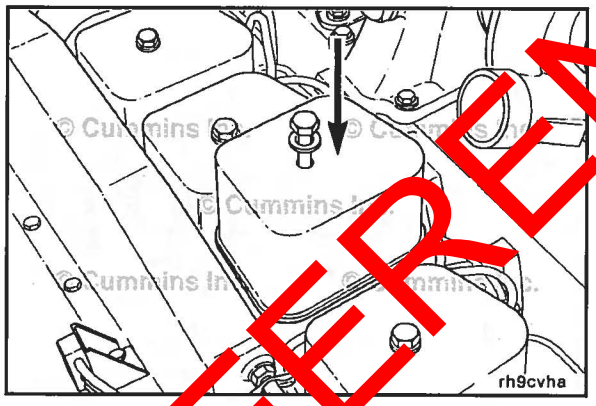
Mark the pulley, and rotate the crankshaft 360 degrees.



Adjust the valves as indicated in the illustration.

Set **only** the valves indicated by the arrows in the illustration (E = exhaust, I = intake). Do **not** set valves that are **not** indicated.

Torque Value: 24 N•m [18 ft-lb]



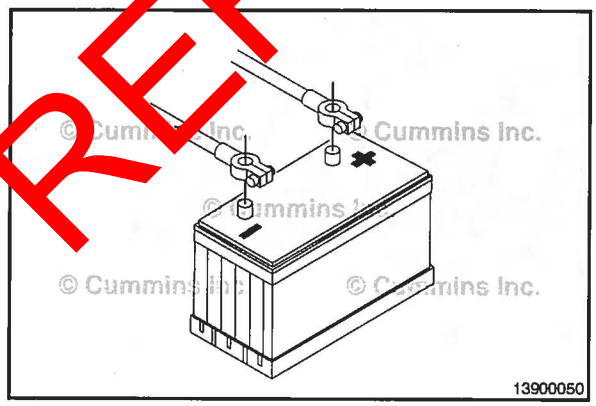
Install

B3.9, B5.9, and B4.5 Engines

Install rocker lever covers with new rocker lever cover gaskets. Next install the capscrews with new capscrew seals.

Tighten the rocker lever cover capscrews.

Torque Value: 24 mm [18 ft-lb]



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.

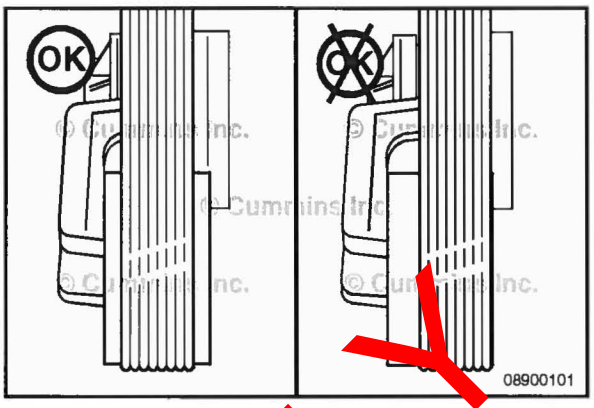
- Connect the batteries
- Operate the engine and check for leaks.

REFERENCE ONLY

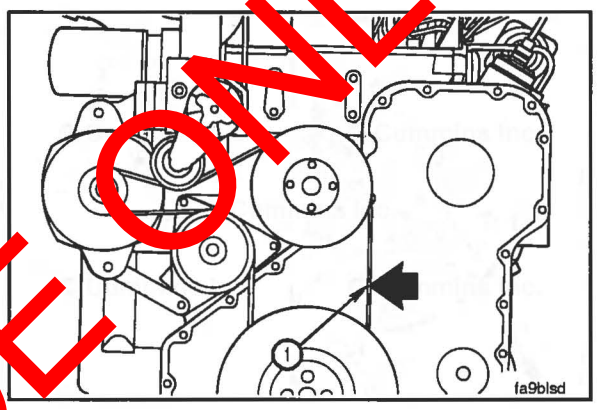
Drive Belts

Test

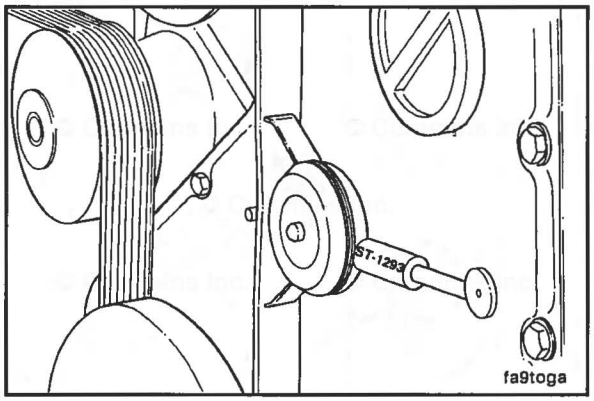
Check the location of the drive belt on the belt tensioner pulley. The belt **must** be centered on, or centered close to the middle of the pulley. Belts aligned either too far forward or backward can cause belt wear, belt roll-off, or increase uneven tensioner wear.



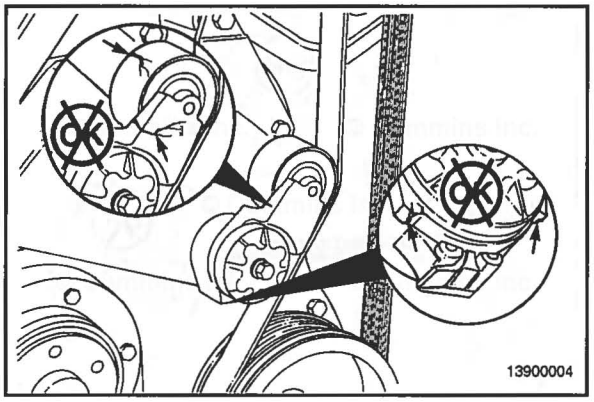
Check the belt deflection at the longest span of the belt. The deflection **must** be checked at the center of the span. See arrow. The maximum deflection allowed in the belt is 9.5 to 12.7 mm [0.375 to 0.5 in].



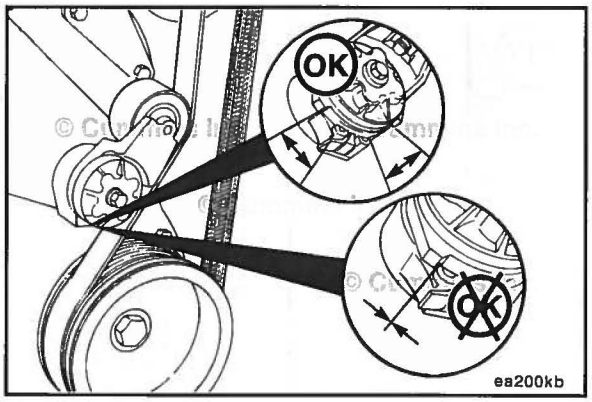
Use belt gauge, Part Number ST-1293, to measure the tension in the drive belt.



Check the tensioner arm, pulley, and stops for cracks. If any cracks are found, the tensioner **must** be replaced.

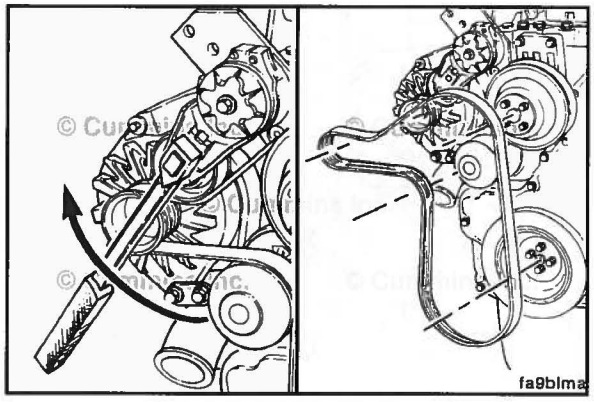


REFERENCE ONLY



With the belt on, verify that neither of the tensioner arm stops, are in contact with the spring case stops. If either stop is touching, the drive belt **must** be replaced.

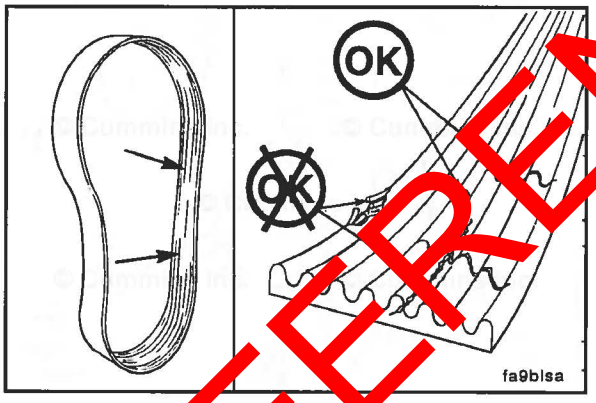
After replacing the belt, if the tensioner arm stops are still in contact with the spring case stops, replace the tensioner.



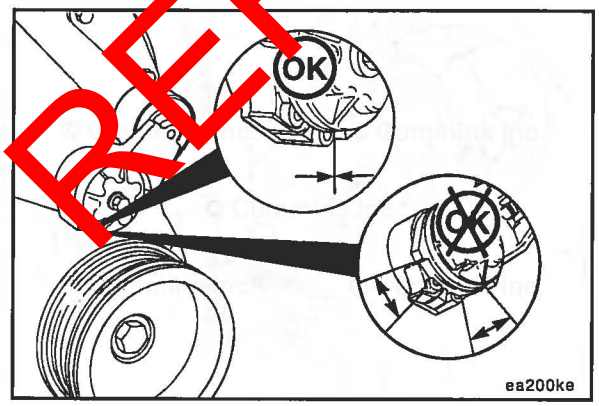
Remove the drive belt and check the tensioner capscrew torque.

Torque Value:
Tensioner Capscrew 43 N•m [32 ft-lb]

After checking the torque, use a 3/8-inch breaker bar with an extension to rotate the tensioner slowly away from the area of contact. If the arm rotates with any roughness or hesitancy, replace the tensioner.



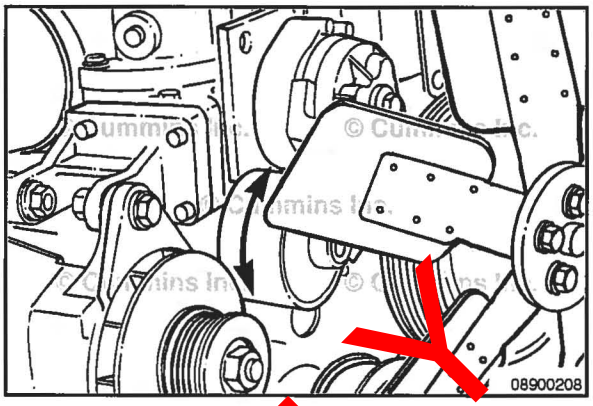
Check the belt for damage. Transverse cracks (across the belt width) are acceptable. Longitudinal cracks (along the length of the belt) that intersect with the transverse cracks are **not** acceptable. If the belt is frayed or has any piece of material missing, the belt **must** be replaced.



With the belt removed, verify that the tensioner arm stops are in contact with the spring case stops. If these two are **not** touching, the tensioner **must** be replaced.

REFERENCE ONLY

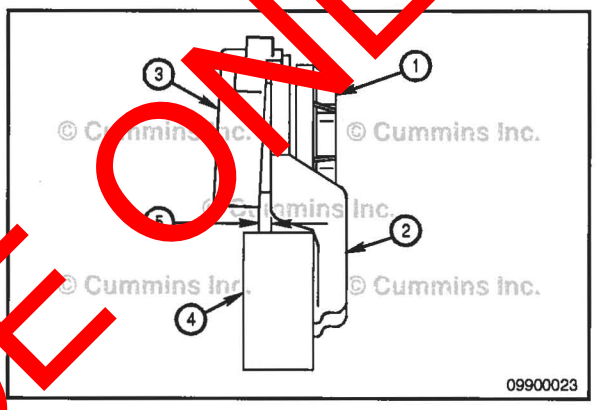
With the drive belt removed, check to be sure the tensioner pulley rotates freely.



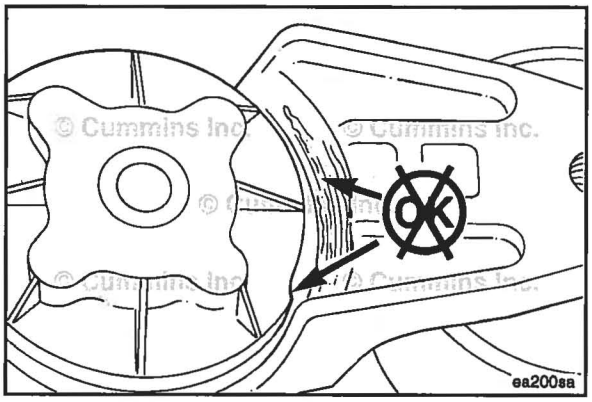
Measure the clearance between the tensioner spring case and the tensioner arm to verify wear-out and uneven bearing wear. If the clearance exceeds 3 mm [0.12 in] at any point, the tensioner **must** be replaced as a complete assembly. Experience has revealed that tensioners generally show a larger clearance gap near the lower portion of the spring case, resulting in the upper portion rubbing against the tensioner arm. **Always** replace the belt when the tensioner is replaced.

Tensioner parts list:

1. Tensioner cap
2. Tensioner arm
3. Spring case
4. Tensioner pulley
5. Clearance gap.



Inspect the tensioner for evidence of the tensioner arm touching the tensioner cap. If there is evidence of the two areas making contact, the pivot tube bushing and the tensioner **must** be replaced.



REFERENCE ONLY

Notes

REFERENCE ONLY

Section 7 - Maintenance Procedures at 77,000 Kilometers [48,000 Miles], 2000 Hours, or 2 Years

Section Contents

Page

Air Compressor Discharge Lines 7-6
General Information 7-6
Maintenance Check 7-6
Cooling System 7-2
Drain 7-2
Fill 7-5
Flush 7-3
Maintenance Procedures - Overview 7-1
General Information 7-1
Vibration Damper, Rubber 7-1
Inspect 7-1
Vibration Damper, Viscous 7-2
Inspect 7-2

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

Maintenance Procedures - Overview

General Information

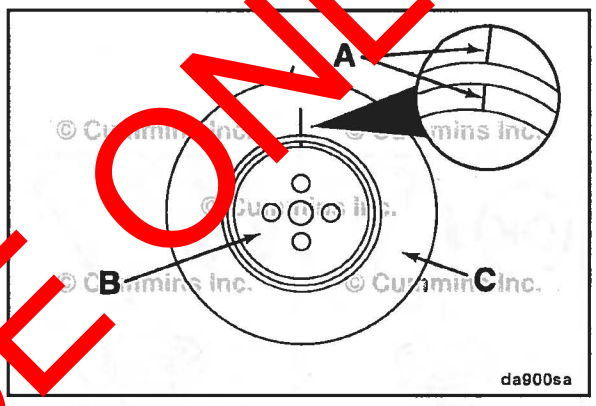
All maintenance checks and inspections listed in previous maintenance intervals **must** also be performed at this time, in addition to those listed under this maintenance interval.

REFERENCE ONLY

Vibration Damper, Rubber

Inspect

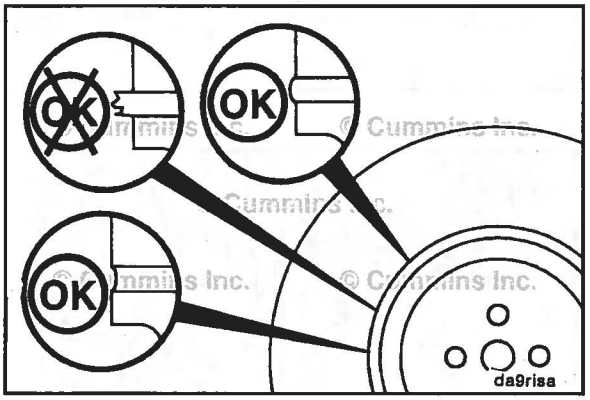
Check the index lines (A) in the vibration damper hub (B) and the inertia member (C). If the lines are more than 1.59 mm [1/16 in] out of alignment, replace the vibration damper.

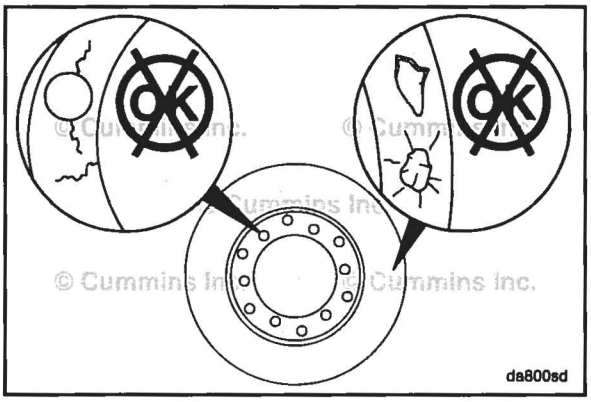


Inspect the rubber member for deterioration. If pieces of rubber are missing or if the elastic member is more than 3.18 mm [1/8 in] below the metal surface, replace the damper.

Look for forward movement on the damper ring on the hub. Replace the vibration damper if any movement is detected.

For vibration damper location, refer to Engine Diagrams in Engine Identification (Section E).





Vibration Damper, Viscous

Inspect

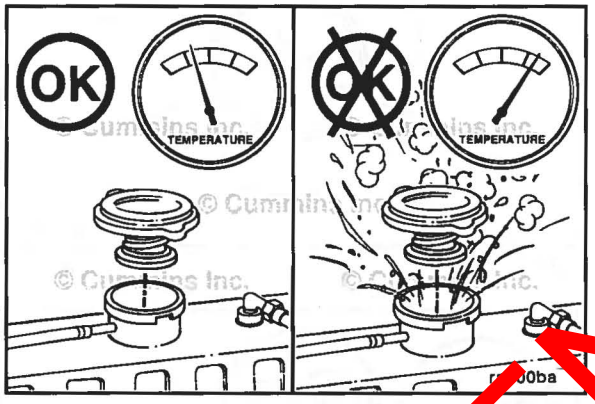
⚠CAUTION⚠

The silicone fluid in the vibration damper will become solid after extended service and will make the damper inoperative. An inoperative vibration damper can cause major engine or drivetrain failures.

Check the vibration damper for evidence of fluid loss, dents, and wobble. Inspect the vibration damper thickness for any deformation or raising of the damper cover plate.

If any of these conditions are identified, contact your local Cummins Authorized Repair Location to replace the vibration damper.

For vibration damper location, refer to Engine Diagrams in Engine Identification (Section E).

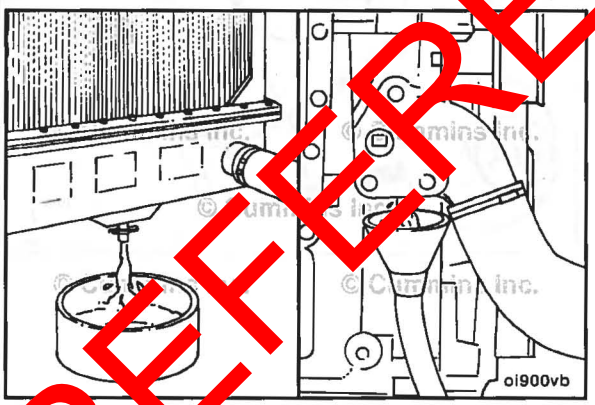


Cooling System

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⚠

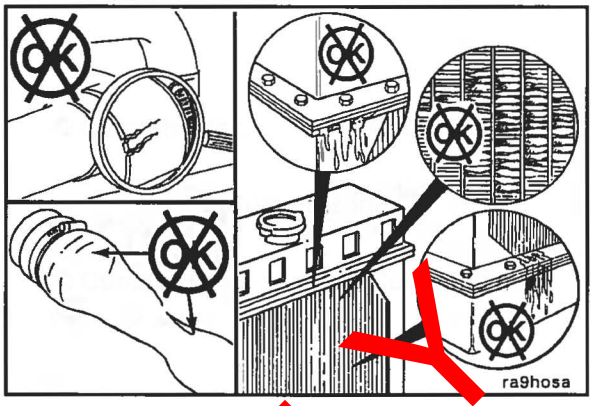
Coolant is toxic. Keep away from children and pets. If not reused, dispose of in accordance with local environmental regulations.

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 19 liters [5 gal] will be adequate in most applications.

REFERENCE ONLY

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

Check the radiator for leaks, damage, and buildup of dirt. Clean and replace as required.



Flush

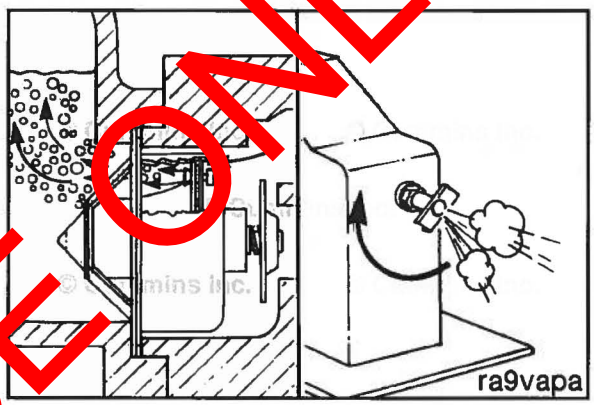
⚠CAUTION⚠

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 engines equipped with an aftercooler. Open the petcock during filling.

For front gear train engines with aftercoolers, open the petcock during filling for additional venting.

For front gear train engines without aftercoolers, the air vents through the jiggle pin openings in the thermostat to the top radiator hose and out the fill opening.

This provides adequate venting for a fill rate of 19 liters per minute [5 U.S. gallons per minute].

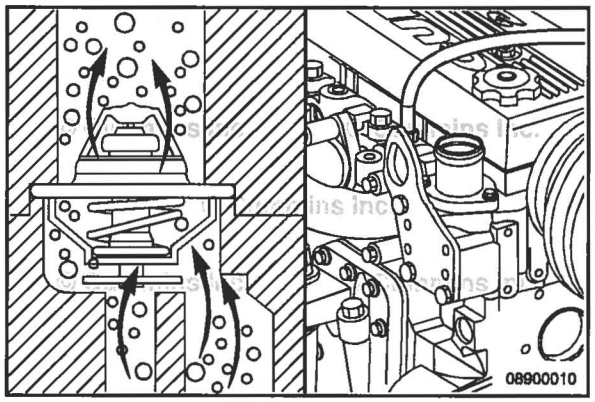


⚠CAUTION⚠

The system must be filled properly to prevent air locks. During filling, air must be vented from the engine coolant passages. Wait 2 to 5 minutes to allow air to be vented then add mixture to bring the level to the top.

For rear gear train engines a deaeration port next to the water outlet connection vents air to the top tank of the cooling system.

This provides adequate venting for a fill rate of 19 liters per minute [5 U.S. gallons per minute].

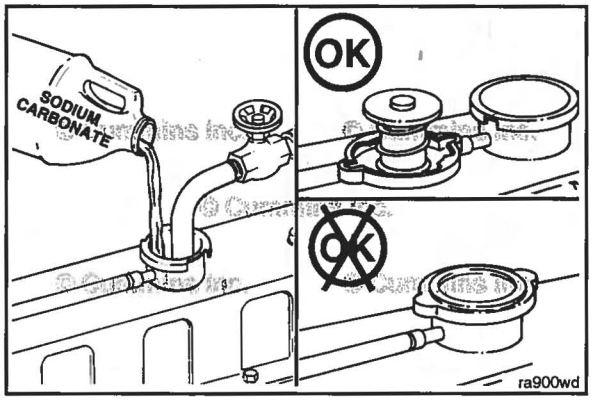


REFERENCE ONLY



NOTE: An alternative to using sodium carbonate, as outlined in this procedure, is to use RESTORE™.

RESTORE™ is a heavy-duty cooling system cleaner that removes corrosion products, silica gel, and other deposits. The performance of RESTORE™ is dependant on time, temperature, and concentration levels. An extremely scaled or flow-restricted system, for example, can require higher concentrations of cleaners, higher temperatures, or longer cleaning times or the use RESTORE Plus™. Up to twice the recommended concentration levels of RESTORE™ can be used safely. RESTORE Plus™ **must** be used only at its recommended concentration level. Extremely scaled or fouled systems can require more than one cleaning.

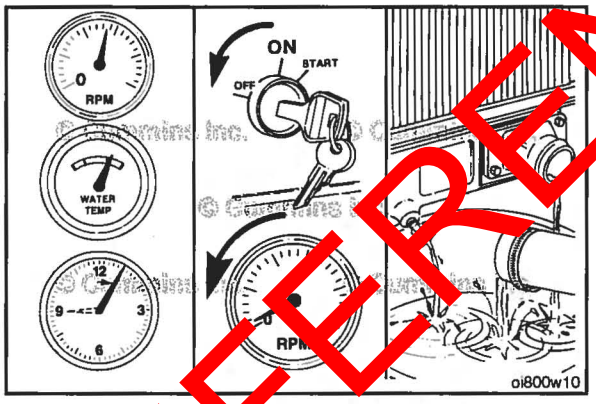


⚠CAUTION⚠

Do not install the radiator cap. The engine is to be operated without the cap for this process.

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

NOTE: Adequate venting is provided for a fill rate of 19 liters per minute [5 U.S. gallons per minute].

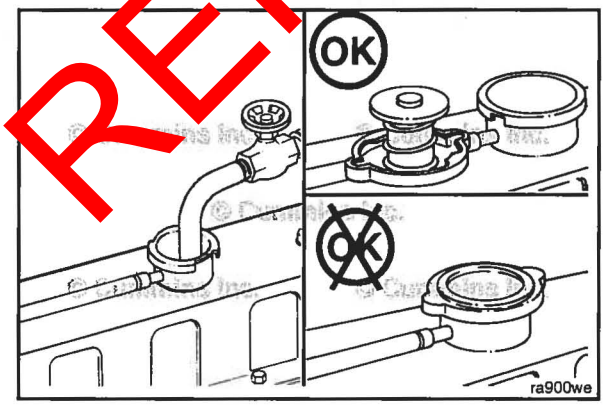


⚠WARNING⚠

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 80°C [176°F].

Shut the engine off, and drain the cooling system.



Fill the cooling system with clean water.

NOTE: Be sure to vent the engine and aftercooler, if equipped, for complete filling.

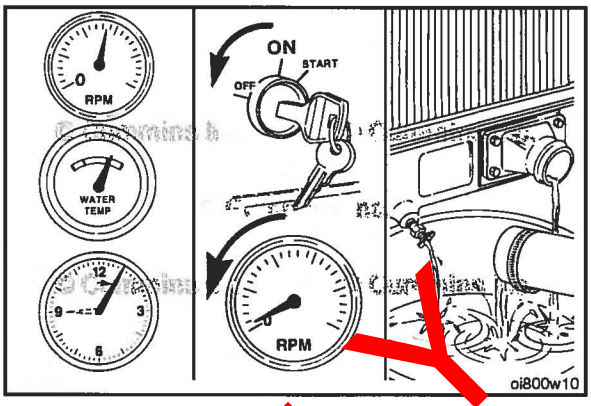
NOTE: Do **not** install the radiator cap.

REFERENCE ONLY

Operate the engine for 5 minutes with the coolant temperature above 80°C [176°F].

Shut the engine off, and drain the cooling system.

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



Fill

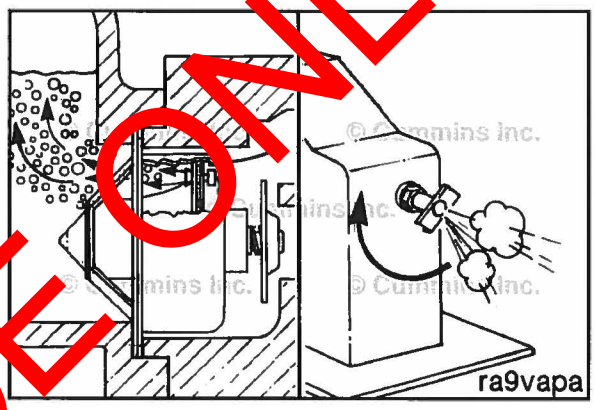
⚠CAUTION⚠

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 engines equipped with an aftercooler. Open the petcock during filling.

For front gear train engines with aftercoolers, open the petcock during filling for additional venting.

For front gear train engines without aftercoolers, the air vents through the jiggle pin openings in the thermostat to the top radiator hose and out the fill opening.

This provides adequate venting for a fill rate of 19 liters per minute [5 U.S. gallons per minute].

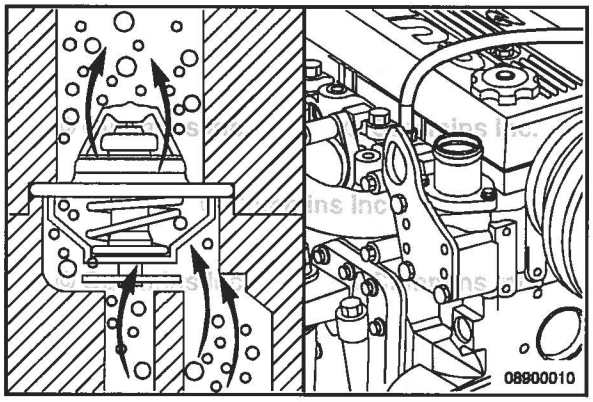


⚠CAUTION⚠

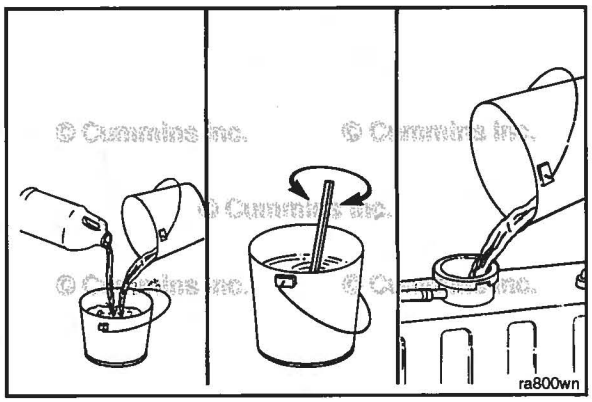
The system must be filled properly to prevent air locks. During filling, air must be vented from the engine coolant passages. Be sure to open the petcock on the aftercooler for aftercooled engines. Wait 2 to 3 minutes to allow air to be vented; then add mixture to bring the level to the top.

For rear gear train engines, a deaeration port next to the water outlet connection vents air to the top tank of the cooling system.

This provides adequate venting for a fill rate of 19 liters per minute [5 U.S. gallons per minute].



REFERENCE ONLY

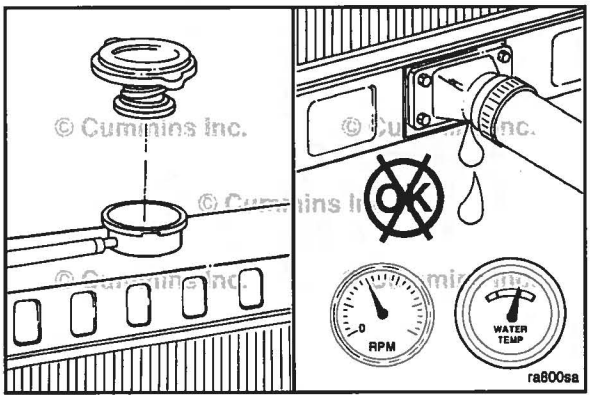


⚠CAUTION⚠

Never use water alone for coolant. Damage from corrosion can be the result of using water alone for coolant.

Use a mixture of 50-percent water and 50-percent ethylene glycol or propylene glycol antifreeze to fill the cooling system. Refer to the Cummins Coolant Requirements and Maintenance, Bulletin 3666132 for engine coolant specifications.

For system capacity, refer to Procedure 0[illegible]8-018 (Cooling System) in Section V.



⚠WARNING⚠

Do not remove the [illegible]ure [illegible]ap from a hot engine. Wait until the coolan[illegible] temperature is below 50°C [122°F]. Failure to [illegible]o s[illegible] can cause personal injury from heated [illegible]olant.

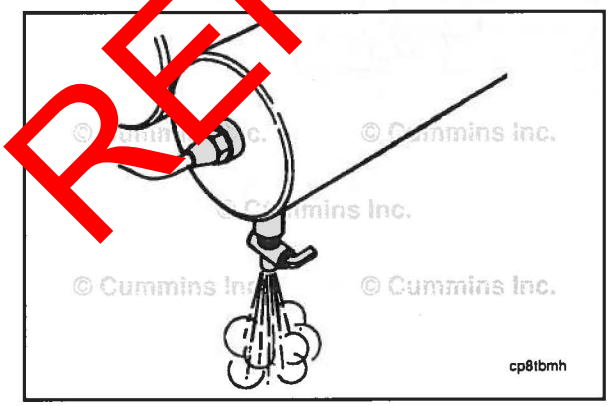
Install the pressure cap. Operate the engine until it reaches a temperature of 80°C [180°F], and check for coolant leaks.

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

Air Compressor Discharge Lines

General Information

All air compressors have a small amount of lubricating oil carryover that lubricates the piston rings and moving parts. When this lubricating oil is exposed to normal air compressor operating temperatures over time, the lubricating oil will form varnish or carbon deposits. If the following maintenance check are not performed, the air compressor piston rings will wear and not seal correctly.



Maintenance Check

⚠WARNING⚠

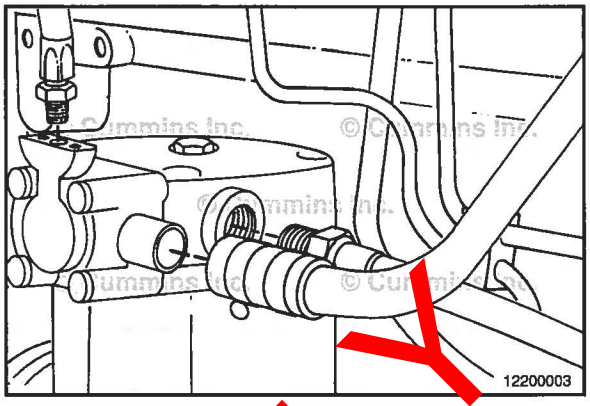
Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

Shut off the engine.

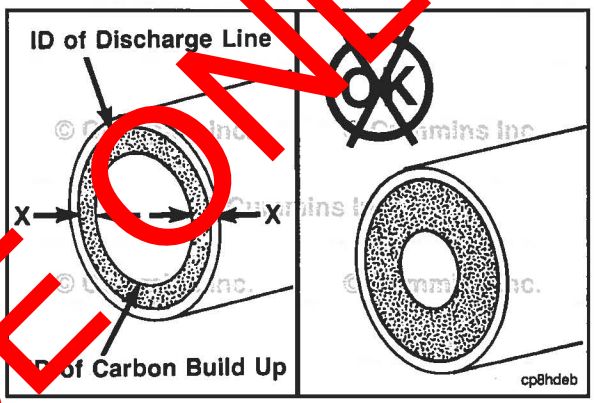
Open the drain valve on the wet tank to release the system air pressure.

REFERENCE ONLY

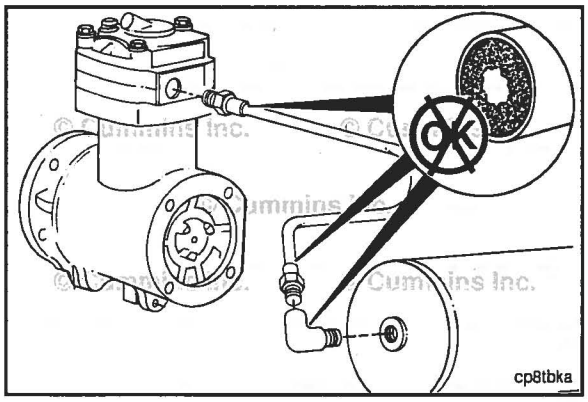
Remove the air compressor discharge line from the air compressor. Location of the air compressor discharge line can be found in Flow Diagram, Compressed Air System in System Diagrams (Section D).



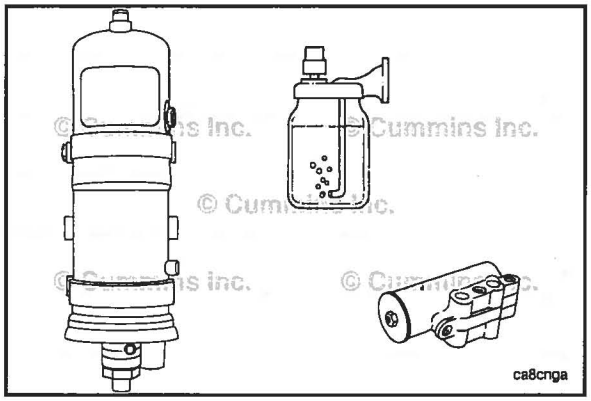
Measure the total carbon deposit thickness inside the air discharge line as shown. If the total carbon deposit (X + X) exceeds 2 mm [1/16 in], clean and inspect the cylinder head, the valve assembly, and the discharge line. Replace if necessary. Contact the Cummins Authorized Repair Location for procedures.



If the total carbon deposit exceeds specification, continue checking the air discharge line connections up to the first tank until total carbon deposit is less than 2 mm [1/16 in]. Clean or replace any lines or connections that exceed this specification.



Inspect air dryer, splitter valves, pressure relief valves, and alcohol injectors for carbon deposits or malfunctioning parts. Inspect for air leaks. Maintain and repair the parts according to the manufacturer's specifications.



REFERENCE ONLY

Notes

REFERENCE ONLY

Section A - Adjustment, Repair, and Replacement

Section Contents

Page

Air in Fuel A-1
General Information A-1
Alternator A-19
Initial Check A-19
Install A-21
Preparatory Steps A-20
Remove A-20
Test A-19
Belt Tensioner, Automatic (Alternator) A-23
Install A-23
Preparatory Steps A-23
Remove A-23
Charge-Air Cooler A-17
Clean A-18
General Information A-17
Initial Check A-17
Coolant Thermostat A-3
Finishing Steps A-9
Initial Check A-3
Inspect for Reuse A-6
Install A-7
Preparatory Steps A-5
Remove A-5
Cooling Fan Belt Tensioner A-16
Inspect for Reuse A-16
Install A-16
Remove A-16
Cooling System Hoses A-17
Maintenance Check A-17
Marine and Industrial Applications A-17
Drive Belt, Cooling Fan A-1
Inspect for Reuse A-2
Install A-2
Remove A-1
Engine Mounts A-24
Inspect for Reuse A-24
Fan Spacer and Pulley A-9
Inspect for Reuse A-10
Install A-10
Preparatory Steps A-9
Remove A-9
Starting Motor A-21
Finishing Steps A-22
Install A-22
Preparatory Steps A-21
Remove A-22
Water Pump A-10
Fill A-15
Inspect for Reuse A-11
Install A-14
Preparatory Steps A-10
Remove A-11

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

Air in Fuel

General Information

⚠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.

⚠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.

The low-pressure fuel system for a Cummins diesel installed in the vehicle consists of the fuel tank, lines between the tank and the engine, transfer pump and lines, and fuel filter and lines. Air or bubbles at the injection pump can cause the engine **not** to operate or erratic engine operation and/or subsequent malfunction of the fuel injection pump. Air can be introduced by leaks in the fuel system prior to the transfer pump since the fuel in the lines is under a vacuum and can draw air into the system. Bubbles can result from any number of restrictions in the system:

- Plugged fuel filter
- Crimped fuel line
- Stopped-up tank module
- Inoperative transfer pump.

If sufficient fuel reaches the injection pump from the low-pressure system then solutions to engine operational problems are elsewhere. The following steps will aid in evaluating low-pressure fuel system performance.

NOTE: For cold-start or performance problems, perform the following steps:

- Leave vehicle outside in cold environment for at least 12 hours
- Perform outlined test
- If the system fails to meet test criteria, replace the fuel lift pump.

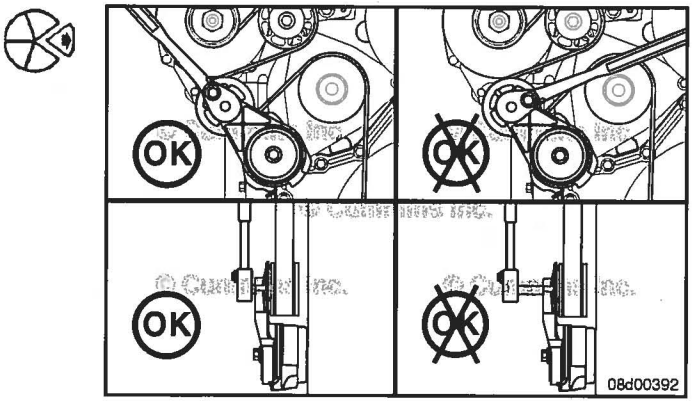
Drive Belt, Cooling Fan

Remove

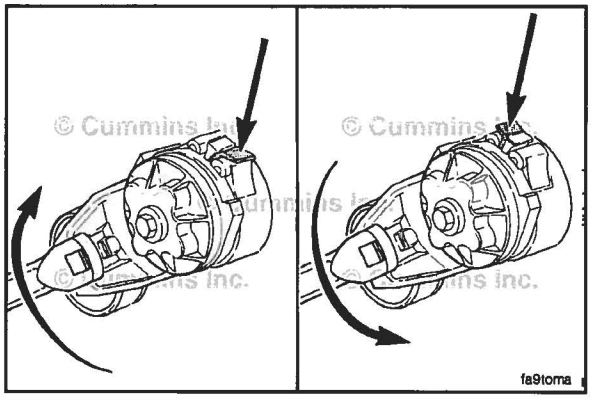
⚠CAUTION⚠

Using a socket extension is not recommended because it may cause axial twisting damage to the belt tensioner.

NOTE: If a socket extension is necessary, support the head of the ratchet with one hand to prevent the belt tensioner arm from being subjected to unintended loading.

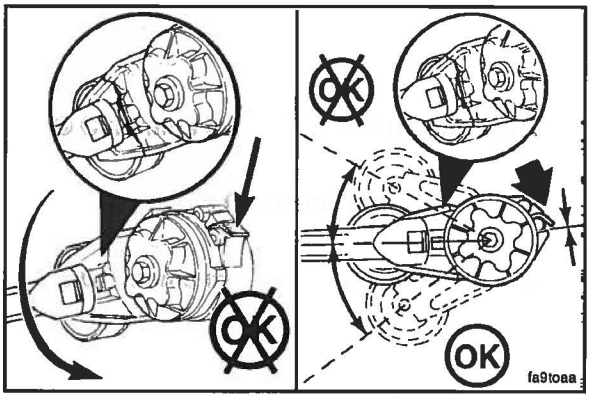


REFERENCE ONLY



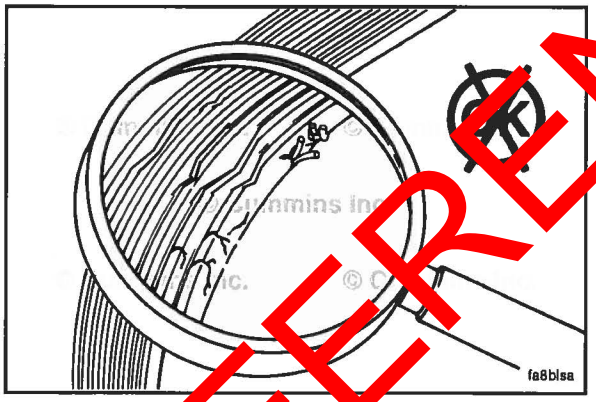
Lift the tensioner to remove the drive belt.

NOTE: The belt tensioner winds in the direction that the spring tang is bent over the tensioner body. To loosen the tension on the belt, rotate the tensioner to wind the spring tighter.



⚠CAUTION⚠

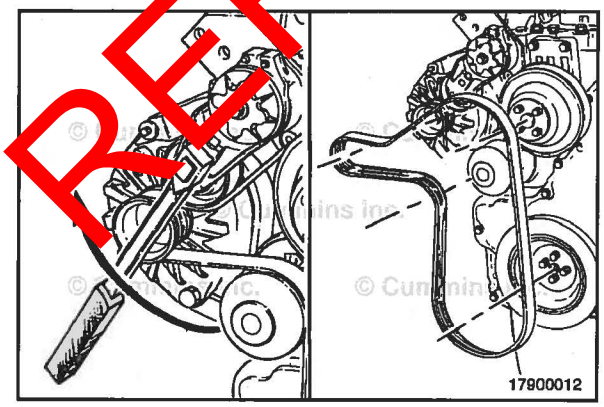
Applying excessive [illegible] in the opposite direction of windup or after the tensioner has been wound up to the positive stop can cause the tensioner arm to break.



Inspect for Reuse

Inspect the drive belt for:

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



Install

⚠CAUTION⚠

The belt tensioner is spring-loaded and must be pivoted away from the drive belt. Pivoting in the wrong direction can result in damage to the belt tensioner.

Lift the tensioner to install the drive belt.

REFERENCE ONLY

Coolant Thermostat

Initial Check

⚠WARNING⚠

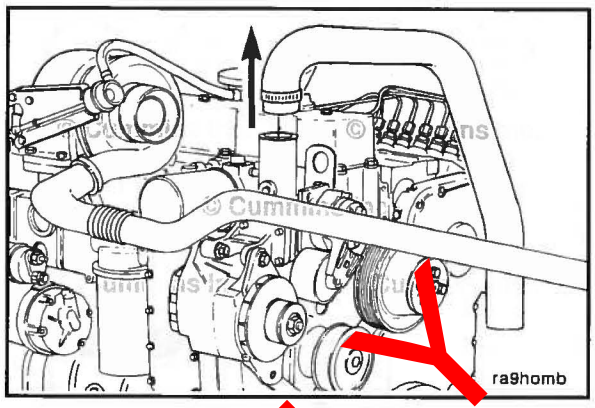
Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [120°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

⚠WARNING⚠

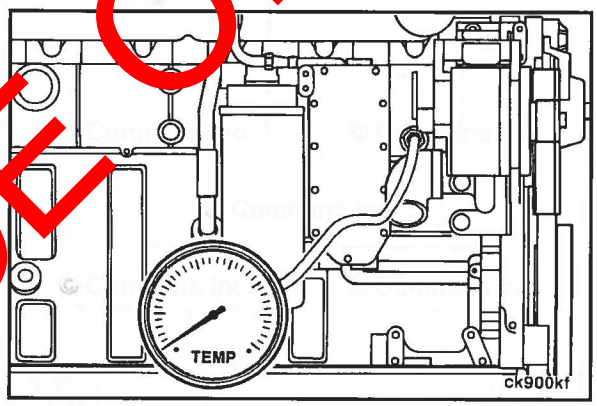
Complete this test with the engine coolant temperature below 49°C [120°F]. Hot steam can cause serious personal injury.

Drain 2 liters [2.1 qt] of coolant. Refer to Procedure 008-018.

Remove the cooling system hose from the thermostat housing.



Install a thermocouple or temperature gauge, which is known to be accurate, in the ¾-inch pipe plug located at the front of the cylinder block.

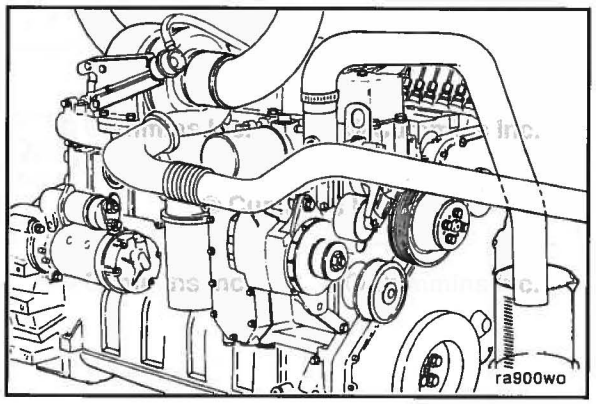


Install a hose of the same size on the thermostat housing outlet that is long enough to reach a remote, dry container used to collect coolant.

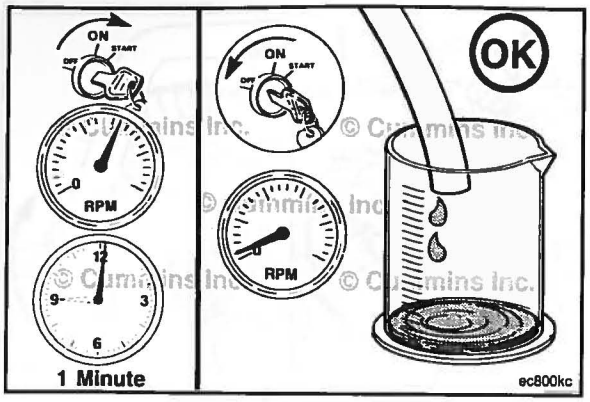
Install and tighten a hose clamp on the housing outlet.

Torque Value: 6 N•m [50 in-lb]

Insert the end of the hose in a dry container.



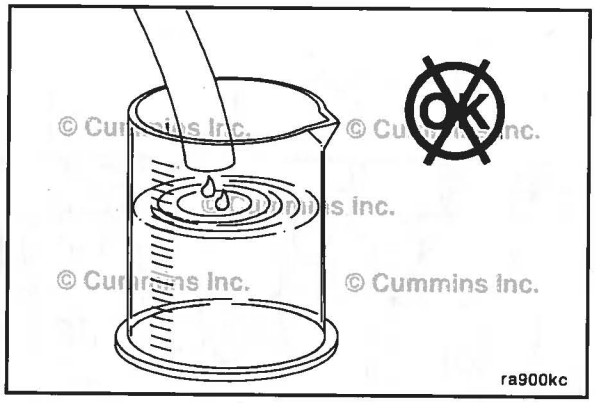
REFERENCE ONLY



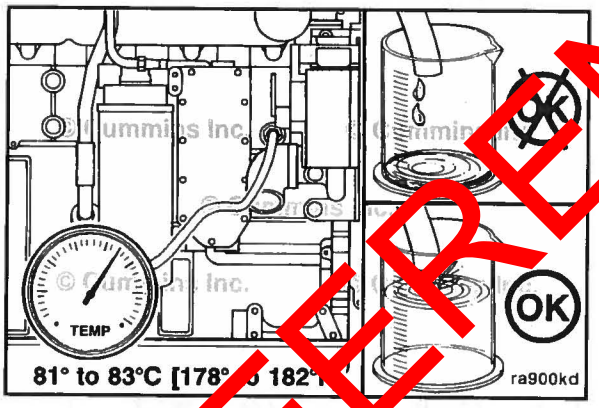
Operate the engine at rated speed for 1 minute.

Shut off the engine and measure the amount of coolant collected in the container.

Thermostat Leak Test - Allowable Leakage		
ml		fl-oz
150	MAX	5



If more than 150 ml [5 fl-oz] of coolant is collected, the thermostats are leaking and must be replaced.



Complete the following in-chassis test to determine the thermostat opening temperature.

Start the engine and monitor the water temperature gauge and the container. The thermostat initial opening temperature is:

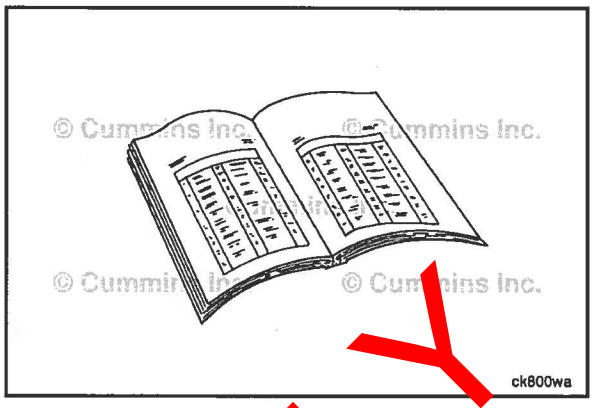
81 to 83°C [178 to 182°F]

Shut off the engine when the coolant starts to flow.

NOTE: If coolant does **not** start flowing into the container during the initial opening temperature range, the thermostat **must** be replaced.

REFERENCE ONLY

Preparatory Steps



⚠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.

⚠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.

Drain 2 liters [2.1 qt] of coolant. Refer to Procedure 008-018.

Remove the upper radiator hose from the outlet connection.

Remove the drive belt. Refer to Procedure 008-002.

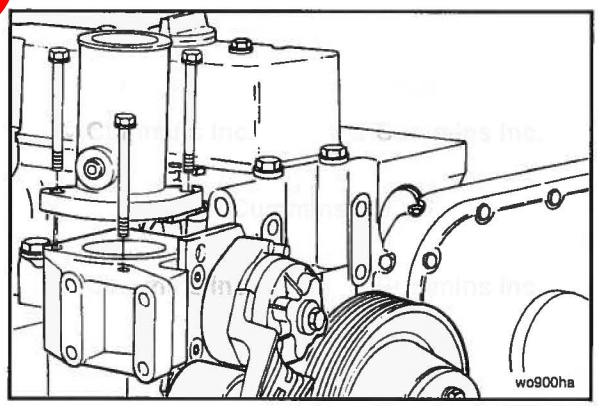
Disconnect the batteries.

Remove the alternator. Refer to Procedure 013-001.

Remove

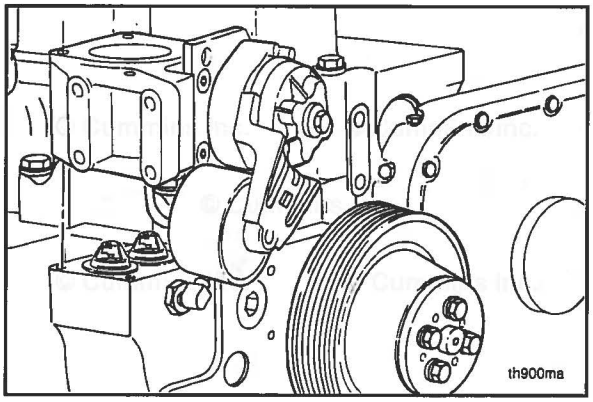
Remove the capscrews from the thermostat housing.

Remove the water outlet connection.

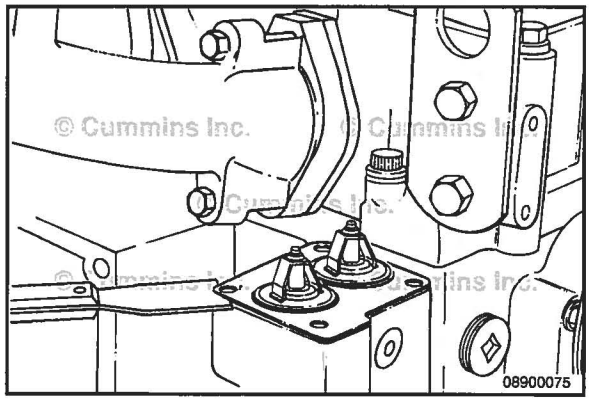


Remove the thermostat housing and belt tensioner assembly.

NOTE: If the vehicle is equipped with an external bypass system, the thermostat housing support (between the thermostat housing and cylinder block) **must** be removed.



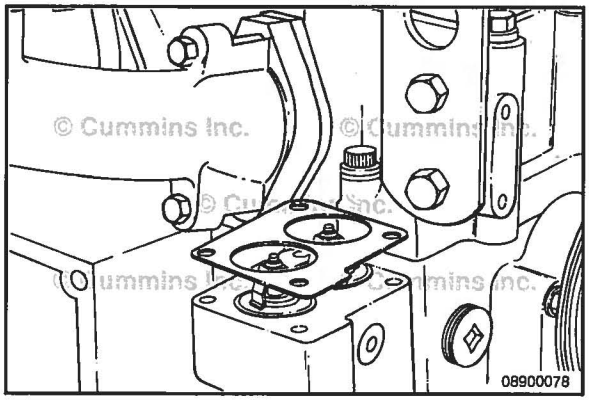
REFERENCE ONLY



⚠CAUTION⚠

Debris in the cooling system can cause damage to the engine.

Remove the thermostat gasket and clean the gasket surface.



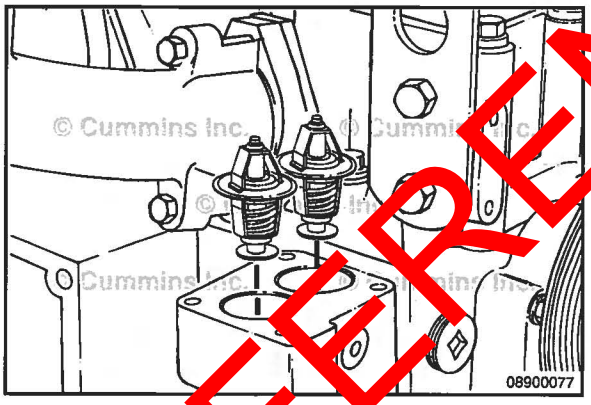
⚠CAUTION⚠

Do not shim the thermostats beyond the top of the block.

Measure the distance from the thermostat flange to the top of the block surface of each thermostat to determine the proper shim(s) to use.

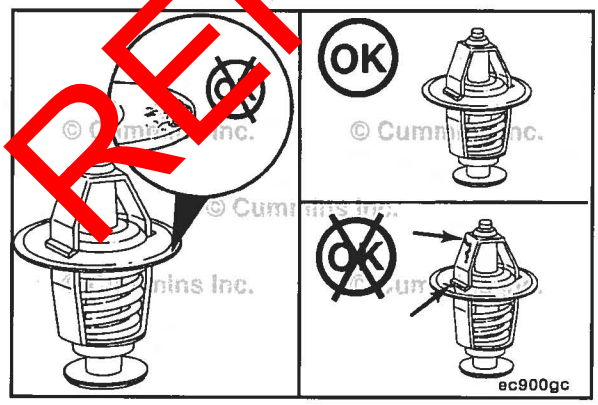
NOTE: The service shims included are 0.25 mm [0.010 in], 0.50 mm [0.020 in], 0.75 mm [0.030 in], and 1 mm [0.040 in].

Select the appropriate combination that will bring the thermostat height as close to the top of the block as possible.



NOTE: Any combination of shims can be used, but stacking is limited to a maximum of two shims per bore.

Remove each thermostat and insert the selected shims into each bore, making sure each shim is seated properly in the bore.



Inspect for Reuse

Inspect the thermostats for damage.

Make sure both thermostats are clean and free from corrosion.

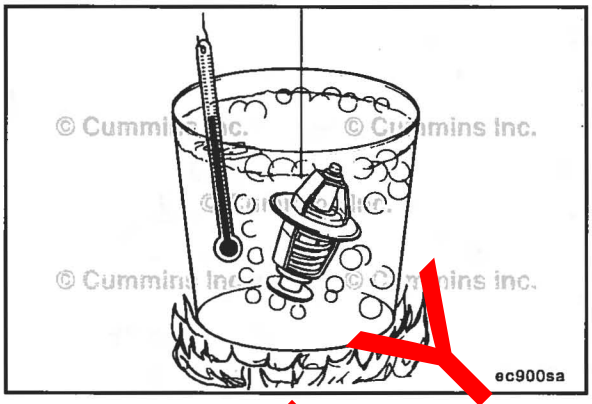
REFERENCE ONLY

Suspend the thermostats and a 100°C [212°F] thermometer in a container of water.

NOTE: Do **not** allow the thermostats or thermometer to touch the container.

Heat the water slowly so the wax element in the thermostats has sufficient time to react to the rising water temperature.

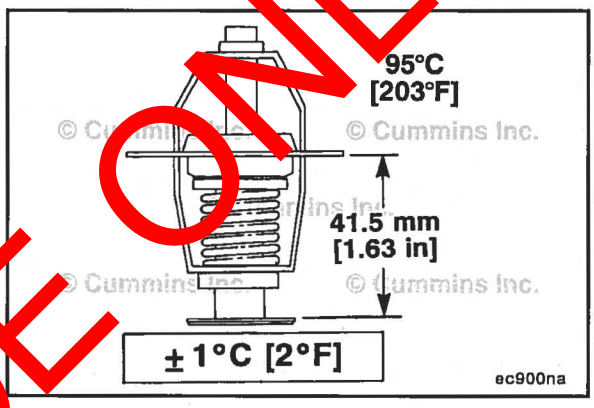
NOTE: The normal operating temperature is stamped on the thermostat.



Inspect the thermostats as follows:

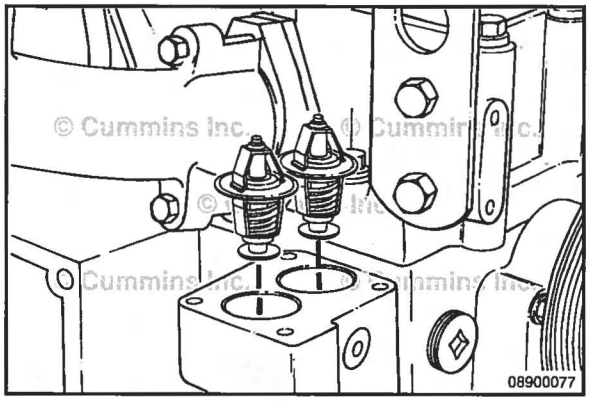
- Thermostat **must** begin to open within 1°C [2°F] of 82°C [180°F].
- Thermostat **must** be fully open within 1°C [2°F] of 95°C [203°F].

NOTE: The fully open clearance between the thermostat flow valve and flange **must** be 41.5 mm [1.63 in] minimum.

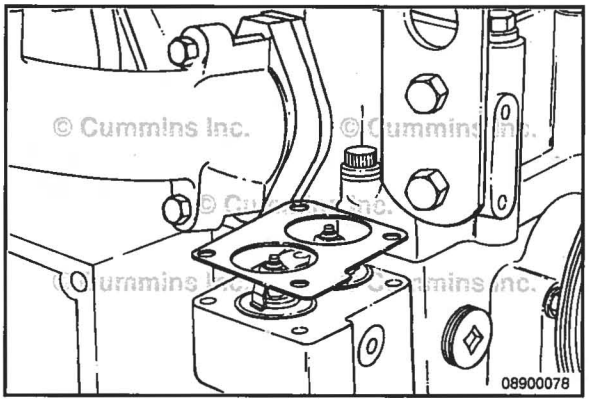


Install

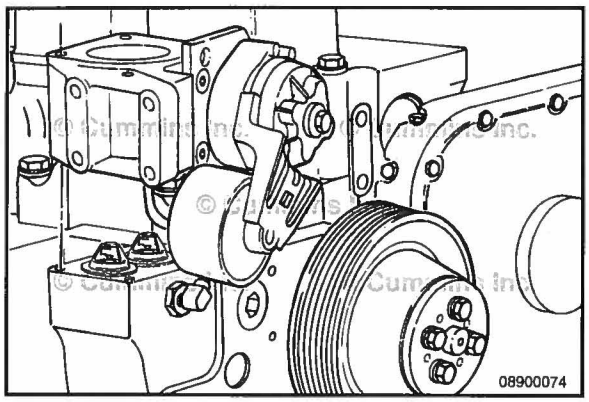
Install the thermostats on top of the service [illegible]im(s) in the thermostat flanges. They can be within 0.2[illegible] mm [0.00[illegible] in] of flush with the top of the block, without being above the top of the block.



Install a new thermostat gasket.

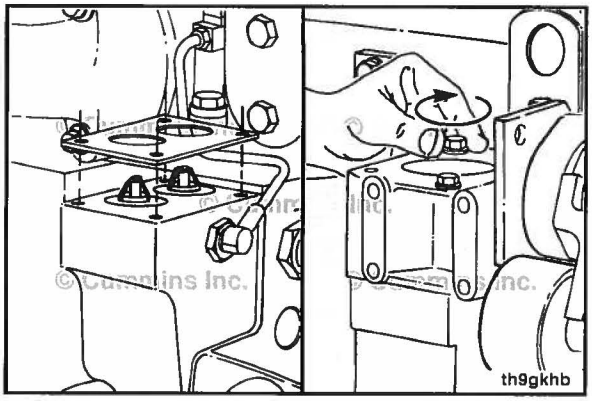


REFERENCE ONLY



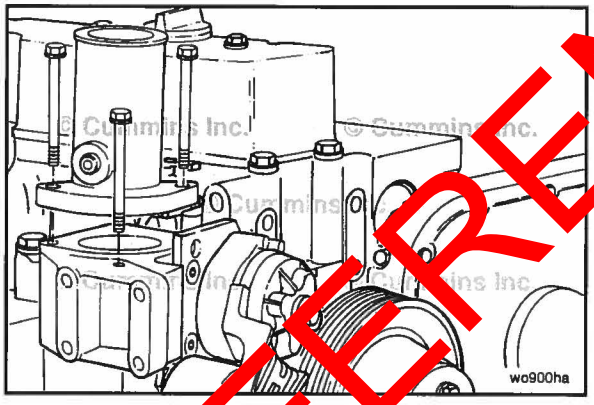
Position the thermostat housing and belt tensioner over the thermostats and gasket.

NOTE: If an external bypass system is used, the thermostat housing support (between the thermostat housing and cylinder block) **must** be installed.



Make sure the gasket is aligned with the capscrew holes.

Install the capscrews and finger-tighten.



Install the water outlet connection.

Tighten all capscrews.

Torque Value: 24 N•m [212 in-lb]

REFERENCE ONLY

Finishing Steps

⚠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.

Install the alternator. Refer to Procedure 013-001.

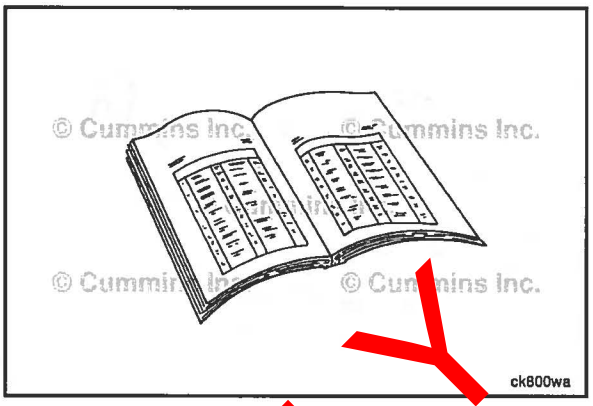
Install the drive belt. Refer to Procedure 008-002.

Install and tighten the battery's electrical connections.

NOTE: During filling, air **must** be vented from the engine's coolant passages. Open the engine vent petcock, if equipped. Make sure to open the petcock on the aftercooler for aftercooled engines. The system **must** be filled slowly to prevent air locks. Wait 2 to 3 minutes to allow air to be vented; then add coolant to bring the level to the bottom of the radiator filler neck.

Fill the cooling system. Refer to Procedure 008-018.

Operate the engine to normal operating temperature and check for leaks.

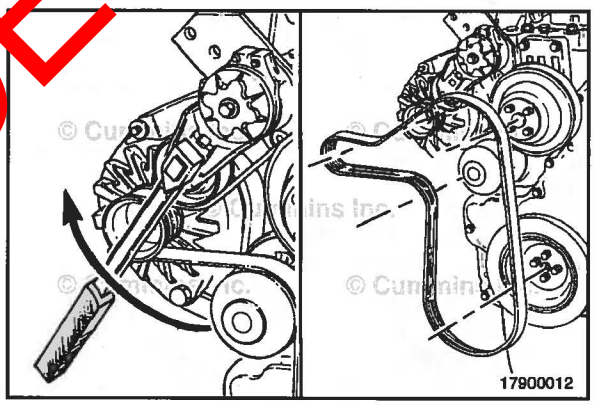


Fan Spacer and Pulley

Preparatory Steps

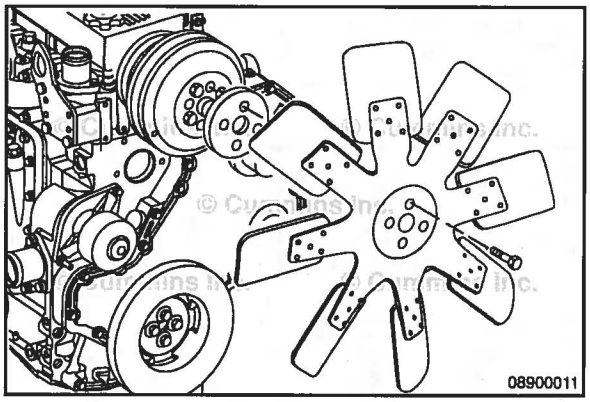
- Remove the drive belt.

NOTE: Loosen the capscrews before removing the bel and tighten the capscrews after the belt is insta

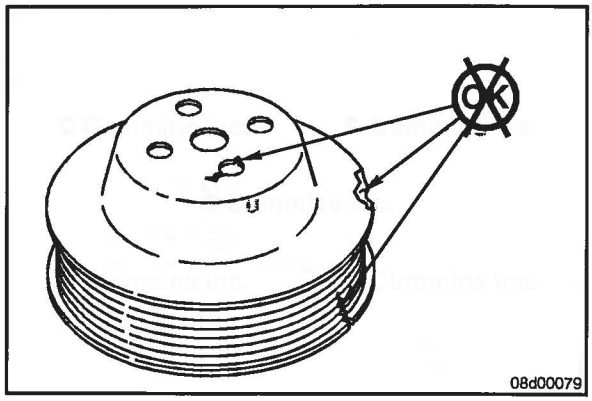


Remove

Remove the four capscrews, fan and spacer.



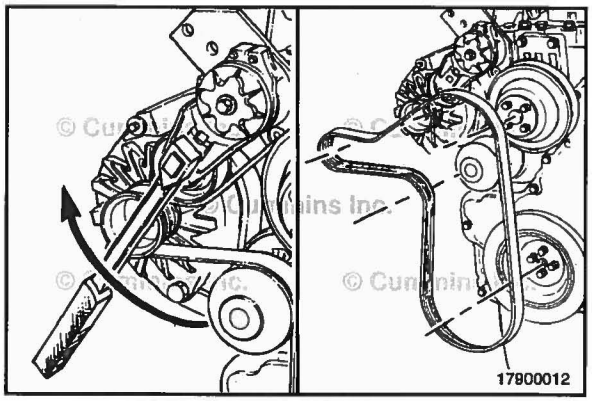
REFERENCE ONLY



Inspect for Reuse

Inspect the fan pulley for cracks near bolt holes.

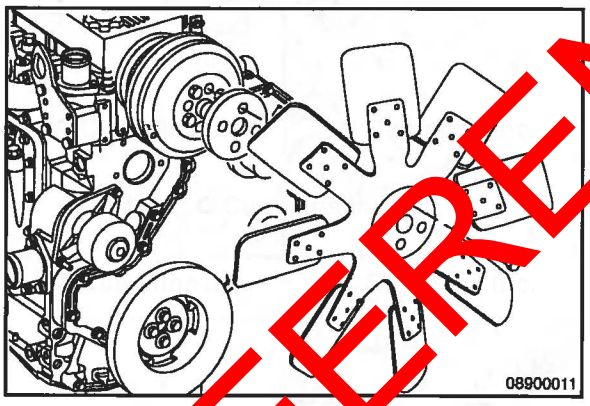
Check for cracks, loose rivets, and bent or loose blades.



Install

Lift the tensioner, and [illegible] belt.

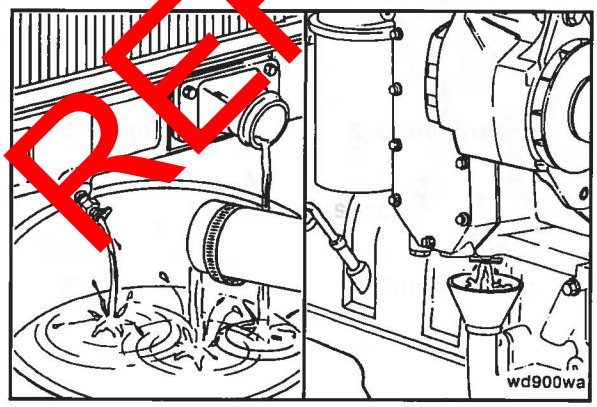
Service Tip: If difficulty is experienced installing the drive belt (the belt seems too short), position the belt over the grooved pulleys first; then, while holding the tensioner up, slide the belt over the water pump pulley.



Install the four capscrews, fan, and spacer.

Torque Value: 24 N•m [212 in-lb]

Torque Value: 43 N•m [32 ft-lb]



Water Pump

Preparatory Steps

⚠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.

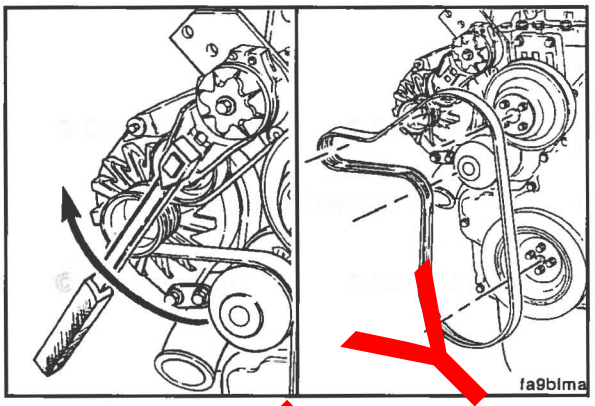
⚠WARNING⚠

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

Drain the coolant.

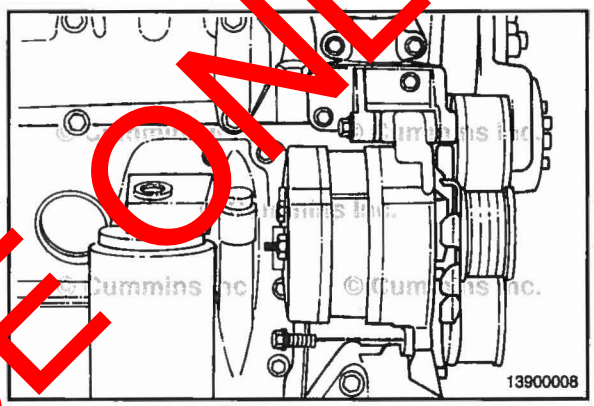
REFERENCE ONLY

Remove the drive belt.

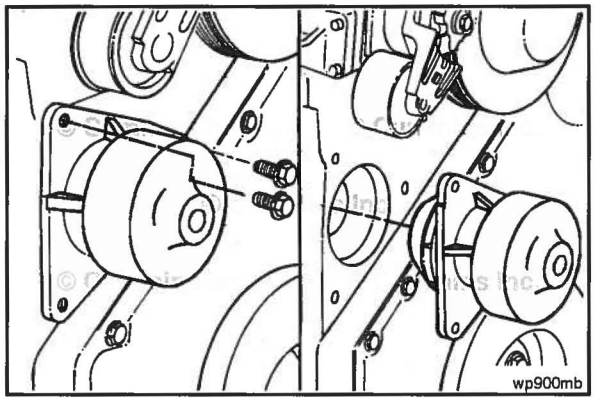


Remove

Remove the alternator link.



Remove the water pump mounting capscrews, and wate pump.

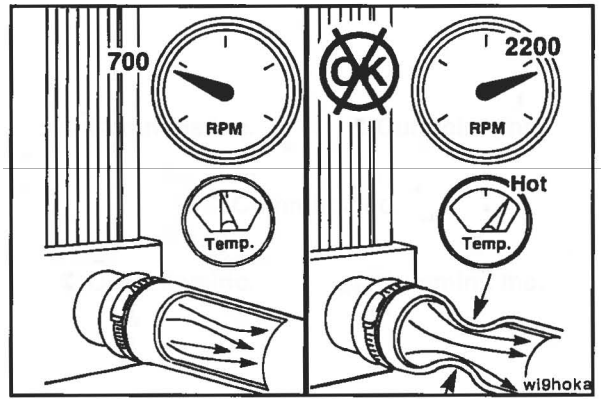


Inspect for Reuse

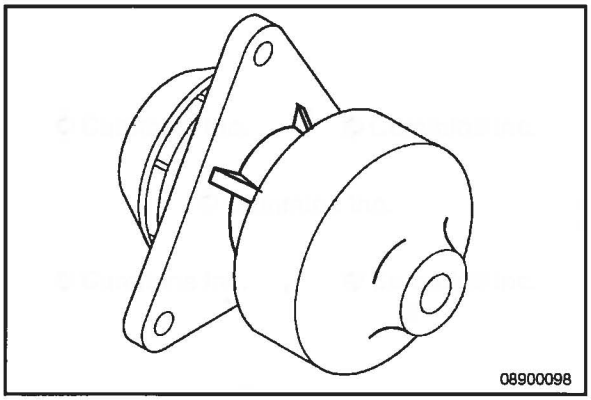
Inspect the coolant hose. The coolant flow can also be reduced if the inlet hose to the water pump collapses. A hose will usually **not** collapse while the engine is running at low speed. Inspect the hose while the engine is running at rated speed.

Make sure that the engine is warm, so the thermostat is open.

Engine Temperature 88 °C [190 °F]

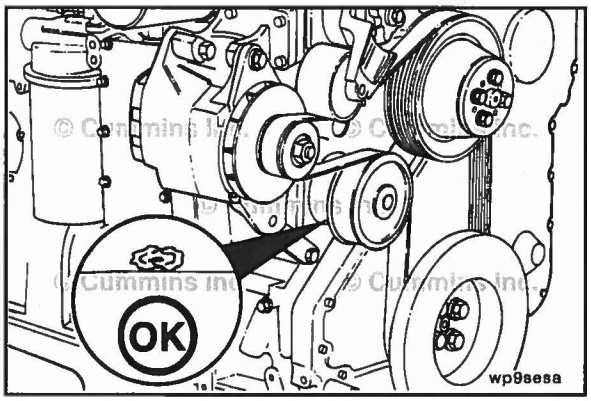


REFERENCE ONLY



The water pump pulls coolant from the bottom of the radiator and pumps it through the engine back to the top of the radiator for cooling.

A worn or malfunctioning water pump will **not** produce the flow required to prevent the engine from running hot. Make sure to inspect the other possibilities indicated in the Troubleshooting Logic Chart before inspecting the flow or replacing the water pump.

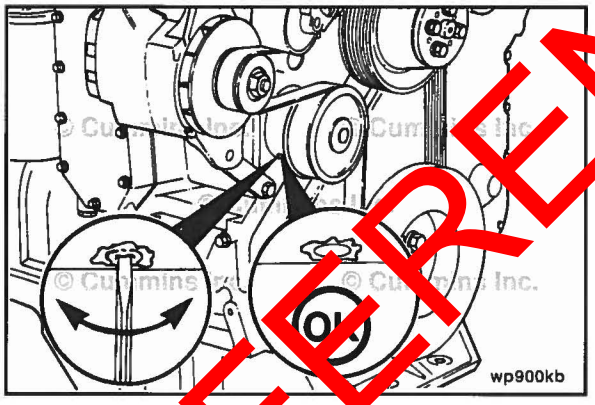


Check the water pump seal weep hole.

The water pump seal design requires a coolant film for lubrication and cooling. Therefore, it is normal to observe a minor chemical buildup or streaking at the weep hole.

NOTE: A streak or chemical buildup at the weep hole is **not** justification for water pump replacement.

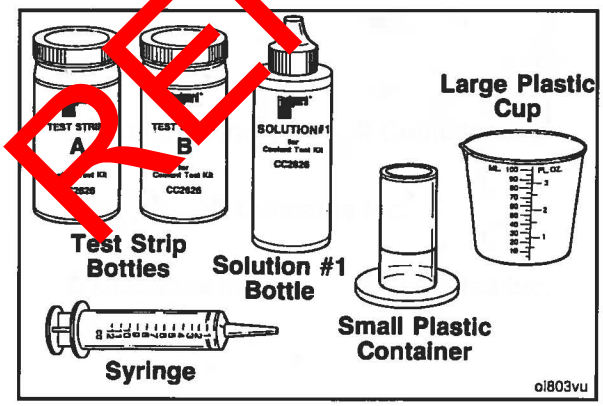
Use the following guidelines to determine if water pump replacement is necessary:



Make sure the weep hole is open.

NOTE: A small screwdriver or a similar tool can be used to remove any debris.

If no leakage is observed from the weep hole under operating conditions, do **not** replace the water pump.



If coolant is seen dripping from the weep hole:

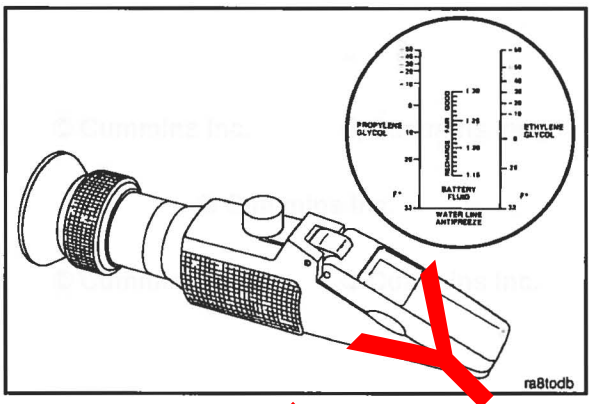
- Use Fleetguard® coolant test kit, Part Number CC-2626, to check the coolant inhibitor level, and adjust the inhibitor level according to the test kit chart.

NOTE: Supplemental coolant additive concentrations exceeding 2 units per gallon will cause water pump seal leakage.

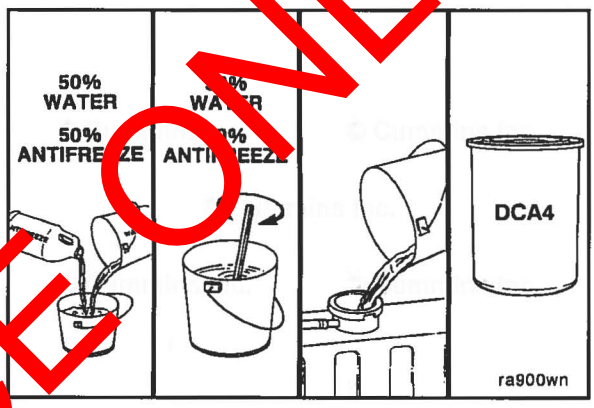
REFERENCE ONLY

- Use Fleetguard® refractometer, Part Number CC-2800, to check the antifreeze level of the coolant.

NOTE: Ethylene-glycol-type antifreeze concentration levels exceeding 70 percent will lessen the freezing point protection and will contribute to water pump seal leakage.



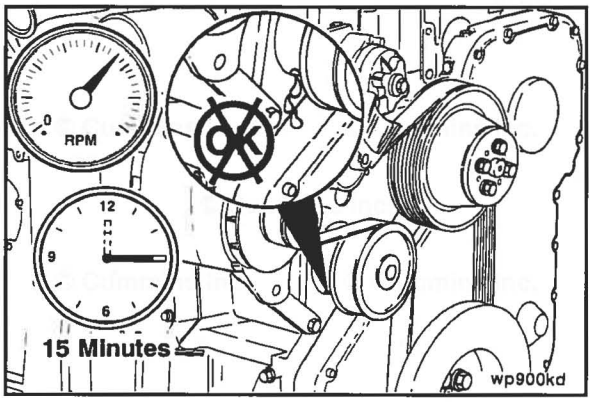
If the antifreeze concentration is above 60 percent, drain all the coolant and add makeup water to bring the antifreeze concentration between a minimum of 40 percent to a maximum of 60 percent. Replace the coolant filter and add new coolant inhibitor to the recommended levels as outlined in the Operation and Maintenance Manual, C Series Engines, Bulletin Number 3666183.



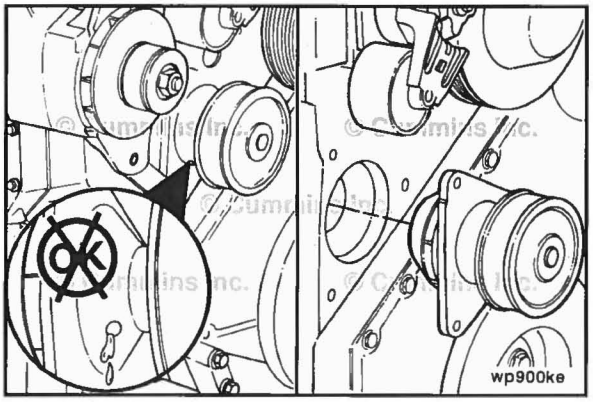
⚠CAUTION⚠

If the coolant leakage is observed as a steady stream upon start-up, stop the engine immediately and replace the water pump.

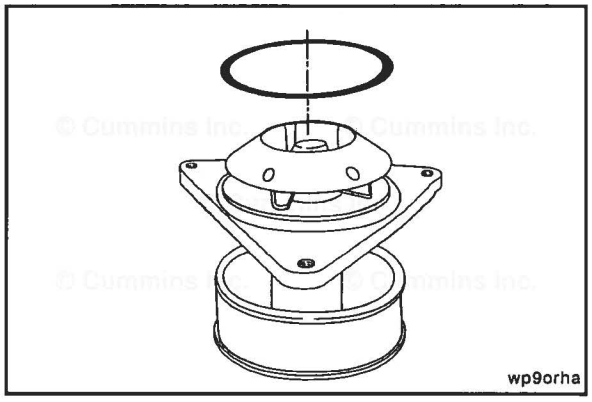
Operate the engine at high idle for 15 minutes with the proper inhibitor and antifreeze levels, and inspect the water pump for leakage.



If the coolant is leaking after the above inspections, replace the water pump.

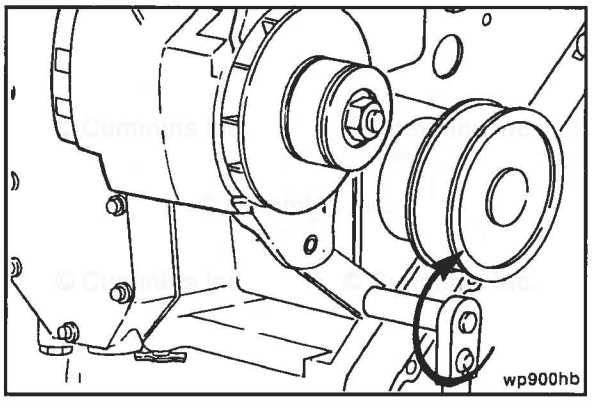


REFERENCE ONLY



Install

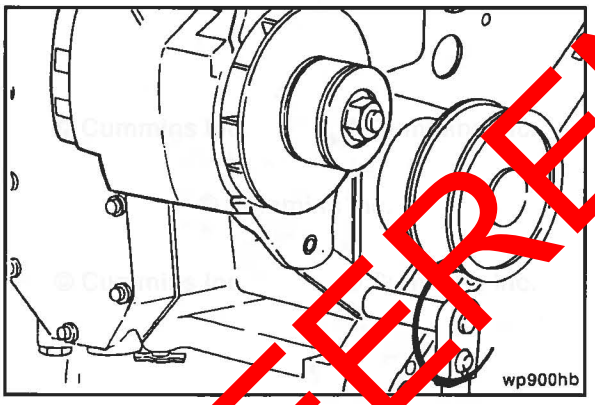
Install a new o-ring into the groove in the water pump.



Install the water pump and water pump mounting capscrews.

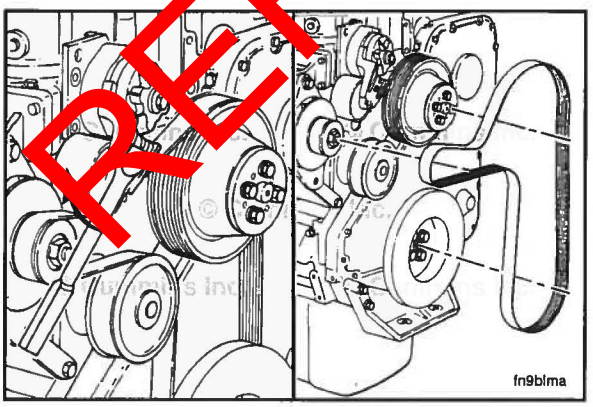
Tighten the water pump mounting capscrews.

Torque Value: 2[illegible] N•m [21[illegible] in-lb]



Install and tighten the alternator link.

Torque Value: 43 N•m [32 ft-lb]



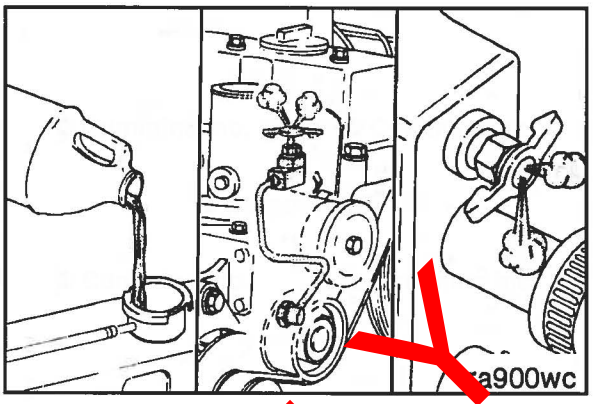
Install the drive belt.

REFERENCE ONLY

Fill

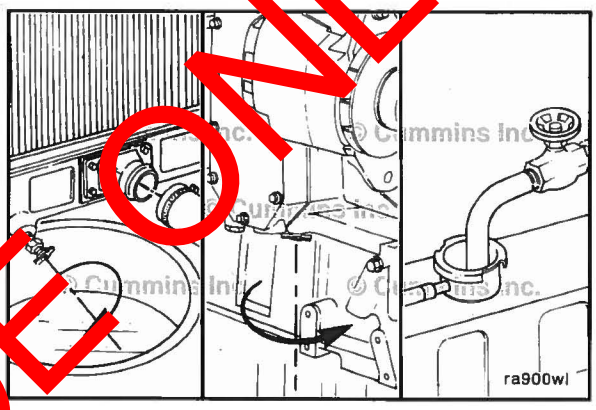
During filling, air **must** be vented from the engine coolant passages. Open the engine vent petcock if equipped. Also, be sure to open the petcock on the aftercooler for aftercooled engines.

NOTE: Venting will permit a fill rate of 19 liters/min. [5 gal/min.].



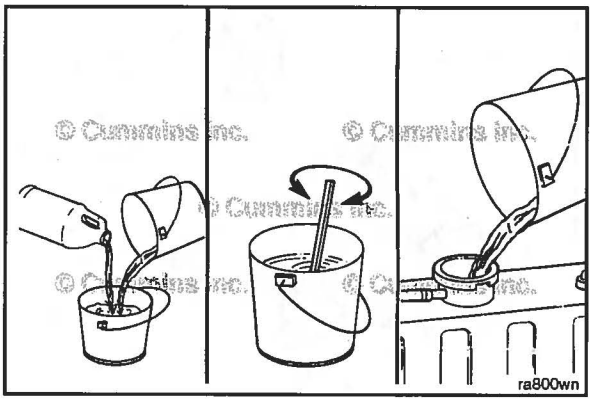
Close the drain valves.

Install all hoses previously removed.



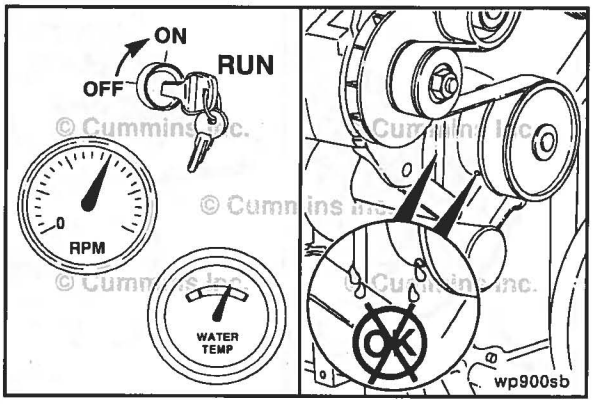
Fill the cooling system with a premixture of 50-percent water and 50-percent ethylene-glycol antifreeze. Refer to Procedure 018-018.

NOTE: The ability of antifreeze to remove heat from the engine is **not** as good as water; pouring antifreeze into the engine first can contribute to an overheated condition before the liquids are completely mixed.

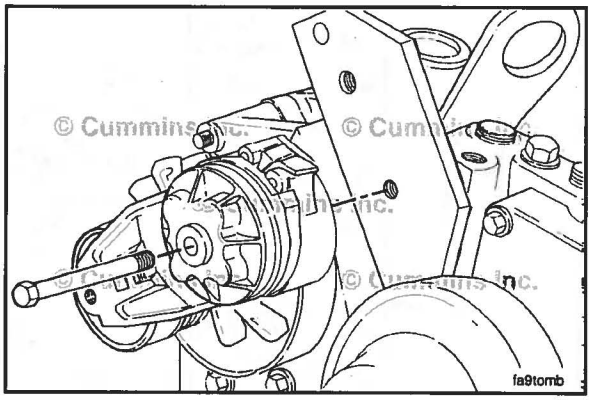


Install the pressure cap.

Operate the engine until it reaches a temperature of 80° C [176° F] and inspect for coolant leaks.



REFERENCE ONLY

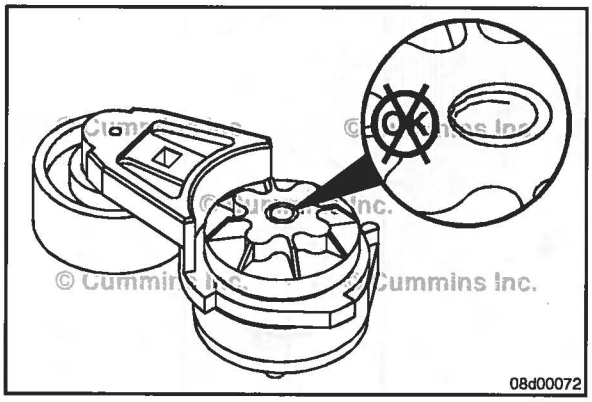


Cooling Fan Belt Tensioner

Remove

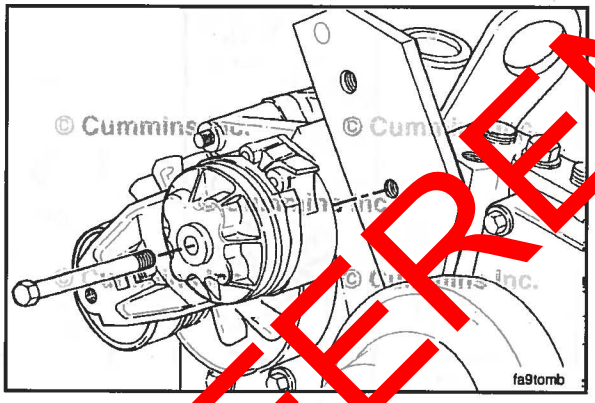
Remove the belt tensioner mounting capscrew.

Remove the belt tensioner from the bracket.



Inspect for Reuse

Inspect the tensioner bushing between the arm and the spring case.

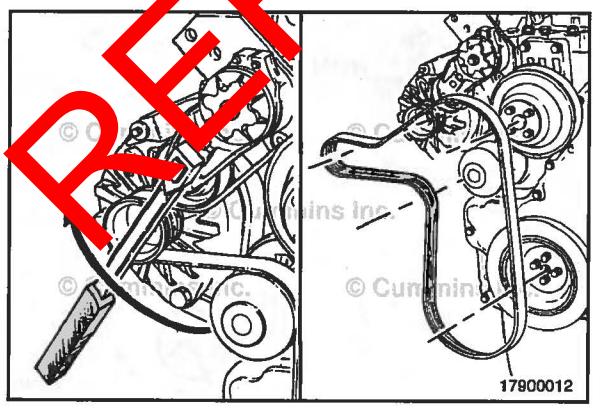


Install

Install the belt tensioner.

Install and tighten the belt tensioner capscrew.

Torque Value: 43 N•m [32 ft-lb]



Lift and hold the tensioner. Install the drive belt and release the tensioner.

Service Tip:

If difficulty is experienced installing the drive belt, for example, the belt seems too short, position the belt over the grooved pulleys first; then, while holding the tensioner up, slide the belt over the water pump pulley.

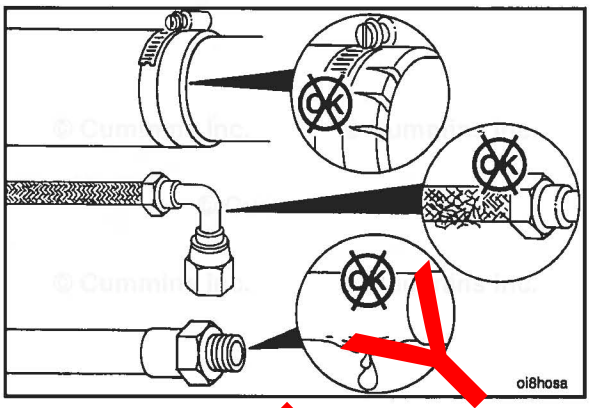
REFERENCE ONLY

Cooling System Hoses

Maintenance Check

Marine and Industrial Applications

Inspect the cooling system hoses and hose connections for leaks or deterioration. Particles of deteriorated hose can be carried through the cooling system and restrict or clog small passages, especially the heat exchanger and lubricating oil cooler, and partially stop circulation. Replace as necessary.

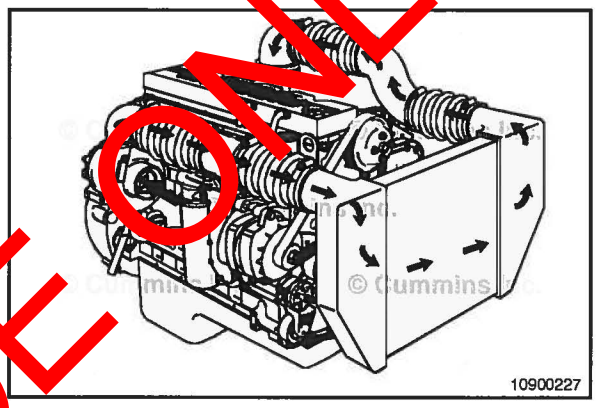


Charge-Air Cooler

General Information

The long-term integrity of the charge air cooler system is the responsibility of the vehicle and component manufacturers; however, the following can be checked by any Cummins Authorized Repair Facility.

NOTE: If the engine experiences a turbocharger failure or any other occasion where oil or debris is put into the charge air cooler, the charge air cooler **must** be cleaned.

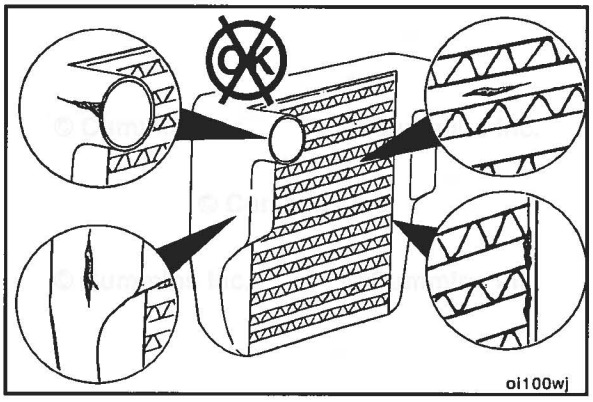


Initial Check

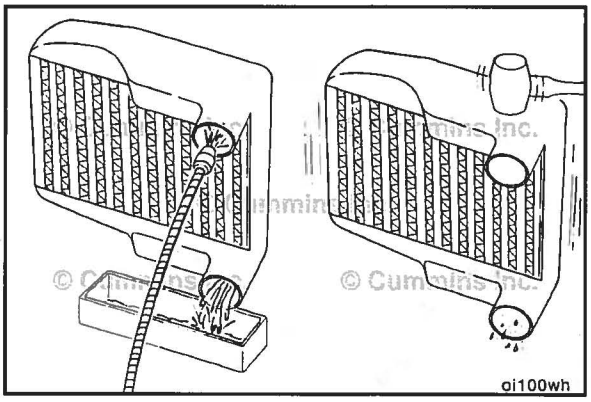
Inspect the charge air cooler for cracks, holes, and damage.

Inspect the tubes, fins, and welds for tears, breaks, or other damage. If any damage causes the charge air cooler to fail the air leak check, the charge air cooler **must** be replaced.

Inspect the charge air cooler plumbing for cracks and damage.



REFERENCE ONLY



Clean

⚠WARNING⚠

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

⚠WARNING⚠

Some solvents are flammable and toxic. Read the manufacturer's instructions before using.

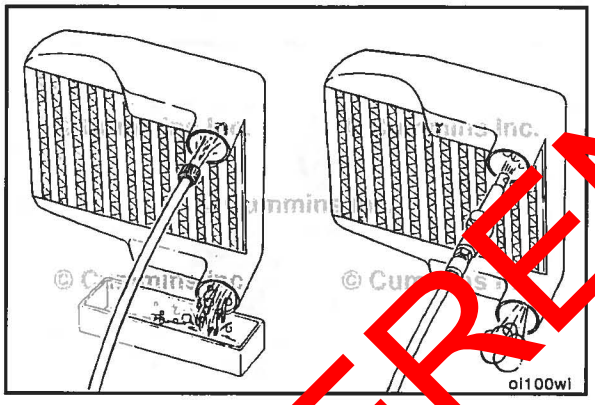
△CAUTION△

Do not use caustic cleaners to clean the charge air cooler. Damage to the charge air cooler will result.

Flush the charge air cooler internally with solvent in the opposite direction of normal airflow. Shake the charge air cooler and lightly tap on the end tanks with a rubber mallet to dislodge trapped debris. Continue flushing until all debris or oil is removed (i.e., the water runs clear).

NOTE: Make sure that the tubes are in the vertical direction when flushing.

If the debris can **not** be totally removed from the charge air cooler, the charge air cooler **must** be replaced.



⚠WARNING⚠

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

⚠WARNING⚠

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

△CAUTION△

The charge air cooler must be rinsed, dried, and cleaned of solvent, oil, and debris, or engine damage will result.

After the charge air cooler has been thoroughly cleaned of all oil and debris with solvent, wash the charge air cooler internally with hot, soapy water to remove the remaining solvent. Rinse thoroughly with clean water.

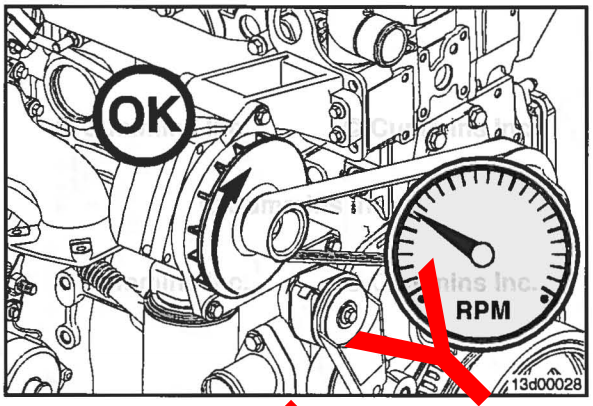
Blow compressed air through the inside of the charge air cooler in the opposite direction of normal airflow until the charge air cooler is dry internally.

REFERENCE ONLY

Alternator

Initial Check

Check the drive belt and alternator pulley to be sure the alternator is rotating.

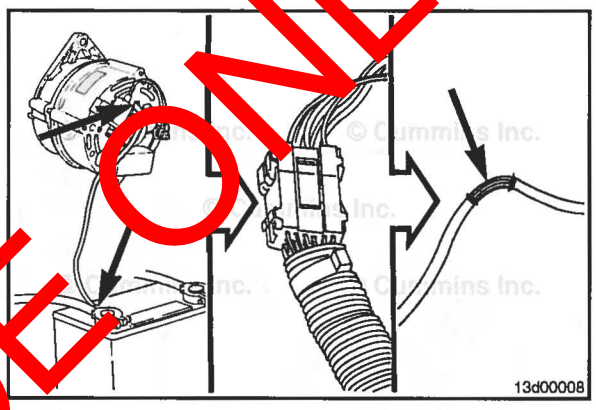


⚠WARNING⚠

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.

Check the battery and all wiring connections.

Inspect the wiring for defects. Check all connections for tightness and cleanliness, including the slip connectors at the alternator and engine compartment bulkhead, and connections at the battery.



Test

⚠WARNING⚠

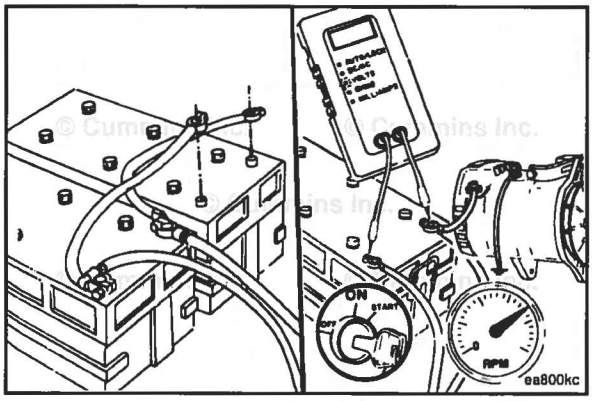
Batteries can emit explosive gases. To reduce the possibility of personal injury, always ventilate the compartment before servicing the batteries. To reduce the possibility of arcing remove the negative (-) battery cable first and attach the negative (-) battery cable last.

⚠WARNING⚠

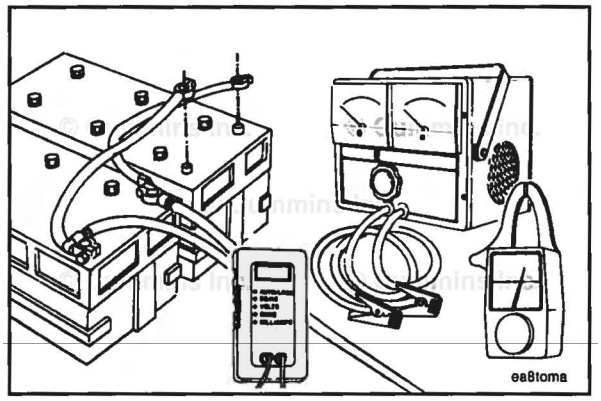
Acid is extremely dangerous and can damage the machinery and can also cause serious burns. Always provide a tank of strong soda water as a neutralizing agent when servicing the batteries. Wear goggles and protective clothing to reduce the possibility of serious bodily injury.

Disconnect all cables that lead to any other battery boxes in the circuit, negative (-) cables first.

Operate the engine at high idle, and measure the alternator voltage output to the batteries with digital multimeter, Part Number 3377161. Refer to the alternator manufacturer's specifications.



REFERENCE ONLY



⚠WARNING⚠

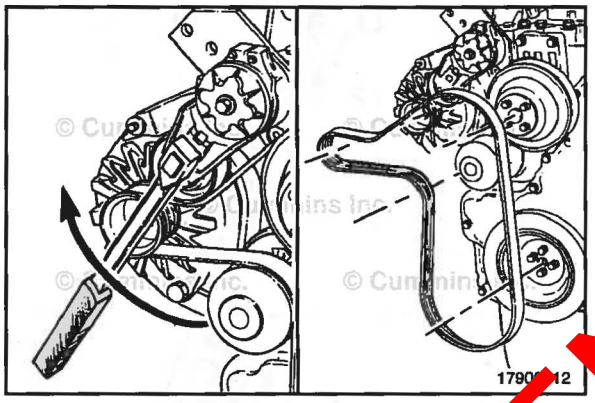
Batteries can emit explosive gases. To reduce the possibility of personal injury, always ventilate the compartment before servicing the batteries. To reduce the possibility of arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

⚠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 bodily injury.

Shut off the engine and remove the test equipment.

Connect all battery cables negative (-) cable last.



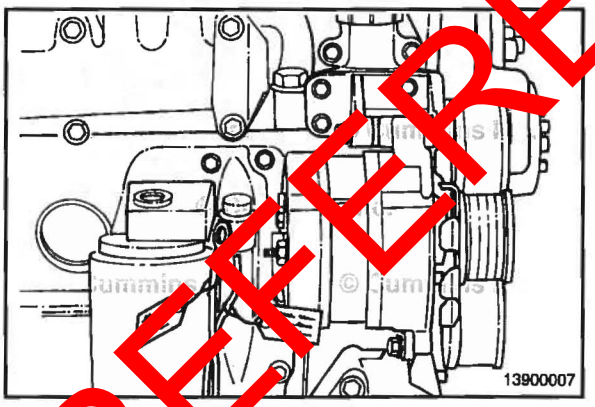
Preparatory Steps

⚠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.

Disconnect the ground cable from the battery terminal.

Remove the drive belt from the alternator pulley.



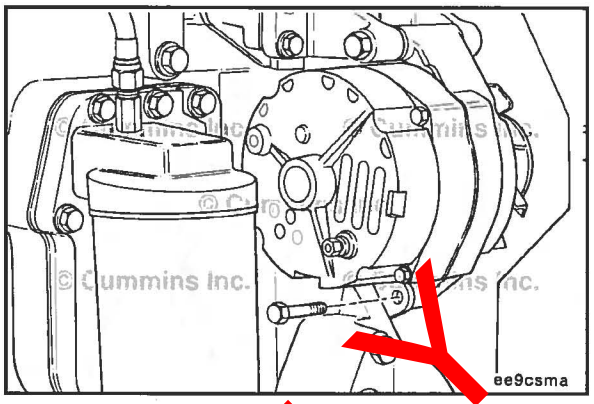
Remove

Remove and tag all wires.

Complete the following steps.

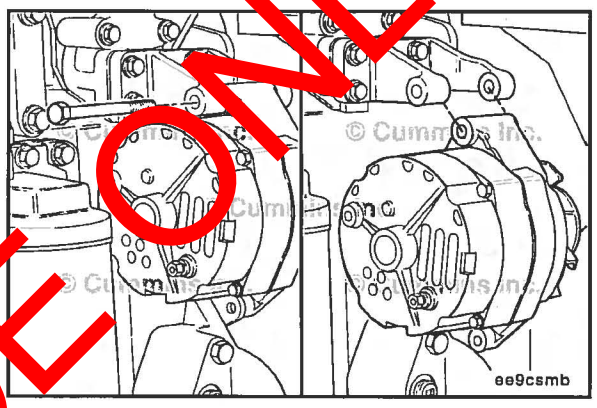
REFERENCE ONLY

Remove the alternator link capscrew.



Remove the alternator mounting capscrew.

Remove the alternator.

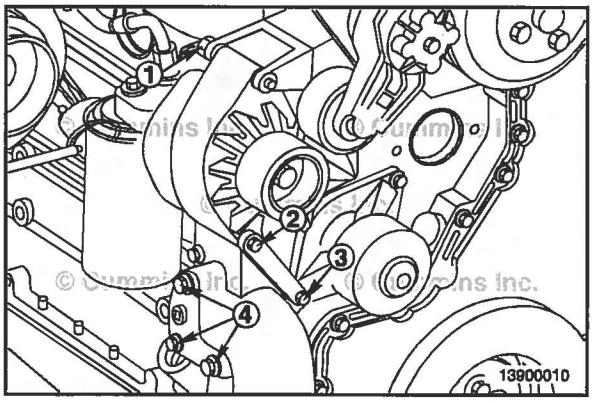


Install

NOTE: Wrench size and torque value are determined by the make and model of alternator. Refer to the Engine Component Torque Values.

To assemble the alternator, the alternator mounting components **must** be tightened in the following sequence:

1. Alternator-to-alternator bracket capscrew
2. Lower brace-to-alternator capscrew
3. Lower alternator brace-to-water pump capscrew
4. Water inlet-to-block capscrews



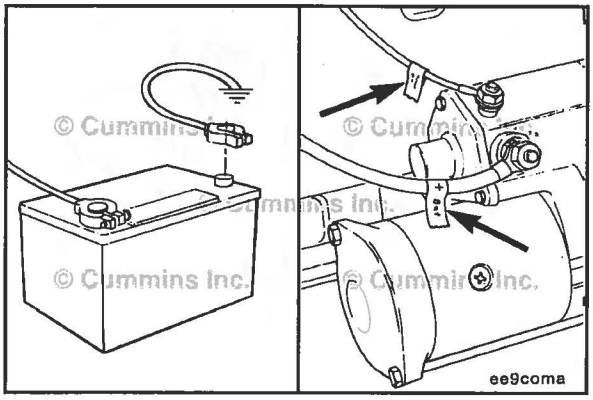
Starting Motor

Preparatory Steps

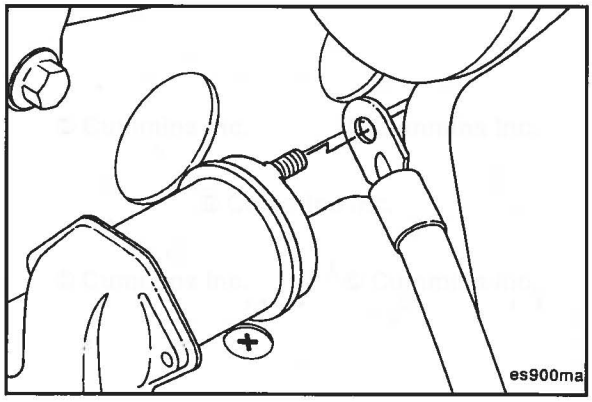
⚠WARNING⚠

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.

- Disconnect the ground cable from the battery terminal.
- Identify each electrical wire with a tag indicating location.



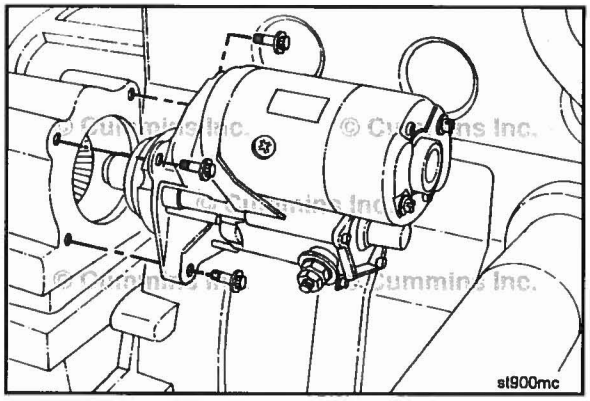
REFERENCE ONLY



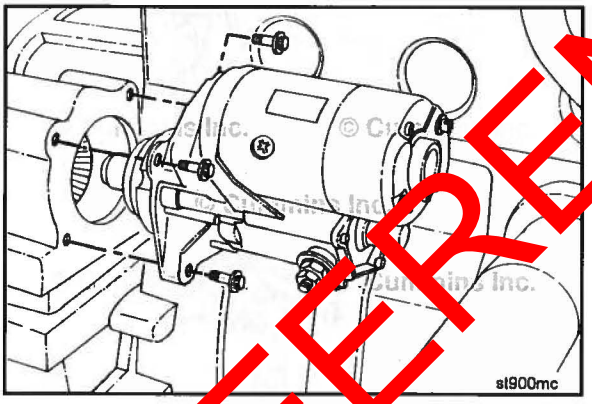
Remove

Remove the battery cable from the solenoid.

Remove all other wires connected to the starter.



Remove the starter motor.

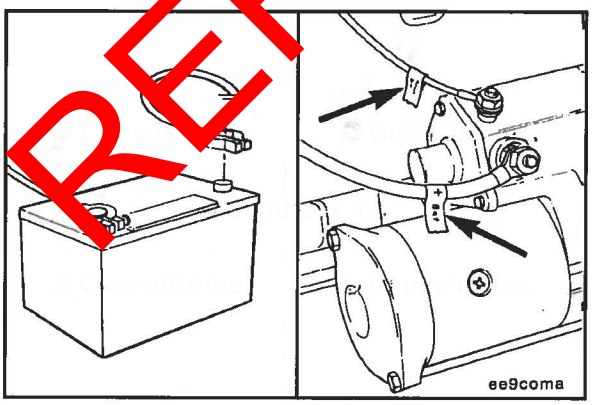


Install

Install the starter motor.

Torque Value: 43 N•m [32 ft-lb]

Connect all cables and all other wires connected to the starter.



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.

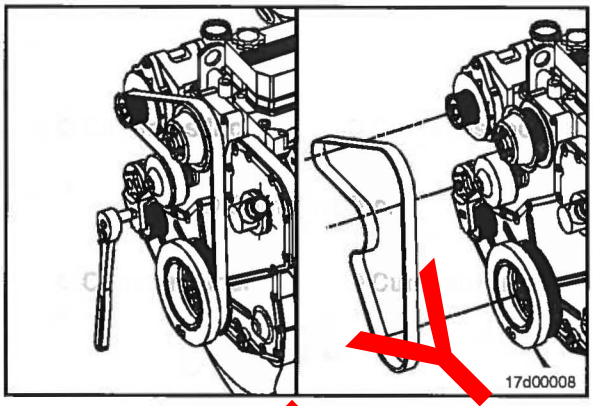
Connect the ground cable from the battery terminal.

REFERENCE ONLY

Belt Tensioner, Automatic (Alternator)

Preparatory Steps

Remove the drive belt.

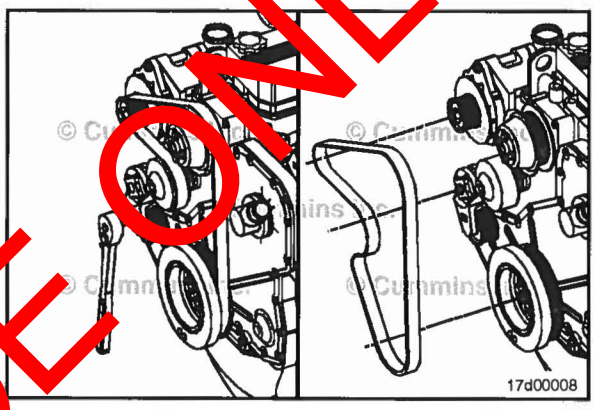


Remove

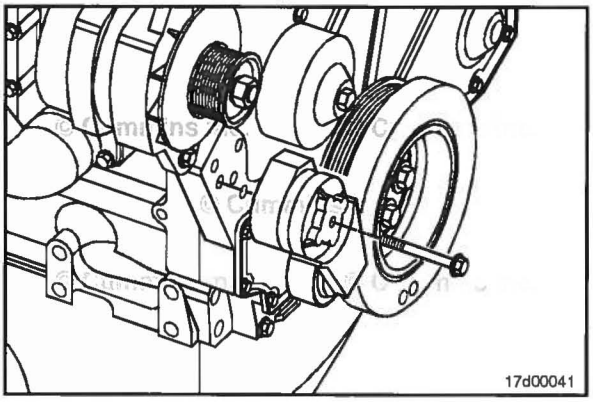
⚠CAUTION⚠

The belt tensioner is spring loaded and must be pivoted away from the drive belt. Pivoting in the wrong direction can damage the belt tensioner.

Lift the belt tensioner to relieve tension in the belt, and remove the belt.



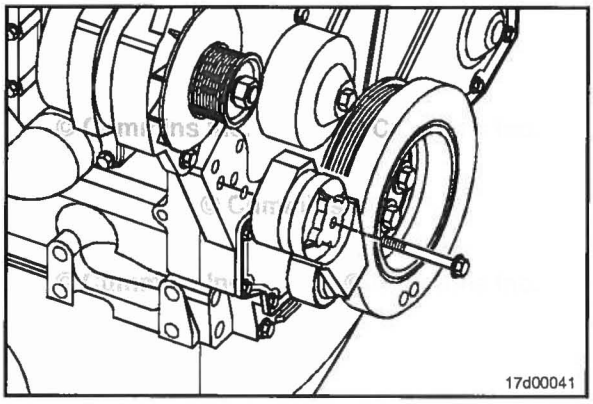
Remove the capscrew and belt tensioner from the bracket.



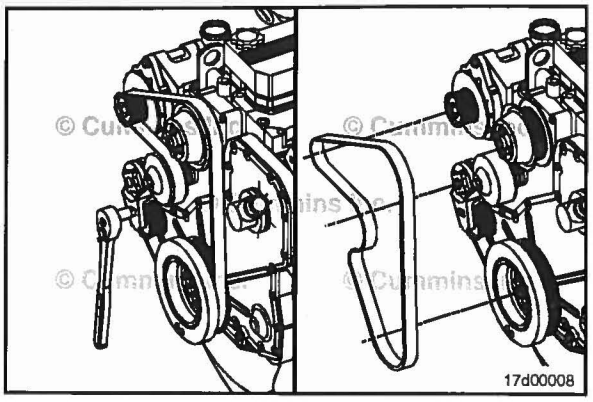
Install

Install the belt tensioner and capscrews.

Torque Value: [illegible] N•m [32 ft-lb]

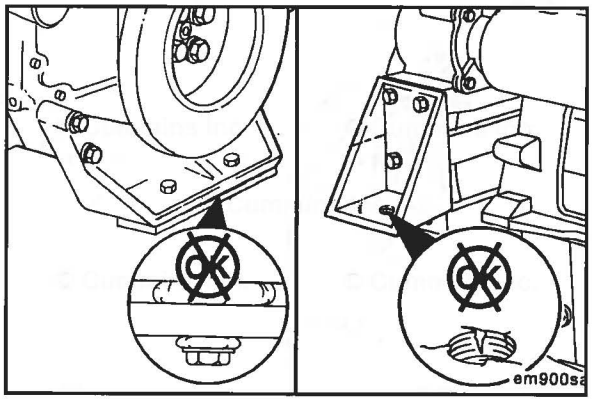


REFERENCE ONLY



NOTE: Position the belt over the grooved pulleys first; then, while holding the tensioner up, slide the belt over the water pump pulley.

Lift and hold the tensioner. Install the drive belt, and release the tensioner.



Engine Mounts

Inspect for Reuse

Inspect all rubber-cushioned mounts for cracks or damage.

Inspect all mounting brackets for cracks or damaged bolt holes.

NOTE: Damaged engine mounts and brackets can cause engine misalignment and driveline component damage, and result in vibration complaints.

REFERENCE ONLY

Section D - System Diagrams

Section Contents

Page

Flow Diagram, Air Intake System D-18
Flow Diagram D-18
Flow Diagram, Compressed Air System D-32
Flow Diagram D-32
Flow Diagram, Cooling System D-14
Flow Diagram D-14
Flow Diagram, Exhaust System D-26
Flow Diagram D-26
Flow Diagram, Fuel System D-2
Flow Diagram D-2
Automotive Applications D-2
Flow Diagram, Lubricating Oil System D-6
Flow Diagram D-6
Automotive Applications D-6
System Diagrams - Overview D-1
General Information D-1

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

System Diagrams - Overview

General Information

The following drawings show the flow through the engine systems. Although the parts can be different for various applications and installations, the flow remains the same. The systems shown are

- Fuel system
- Lubricating oil system
- Coolant system
- Intake air system
- Exhaust system.

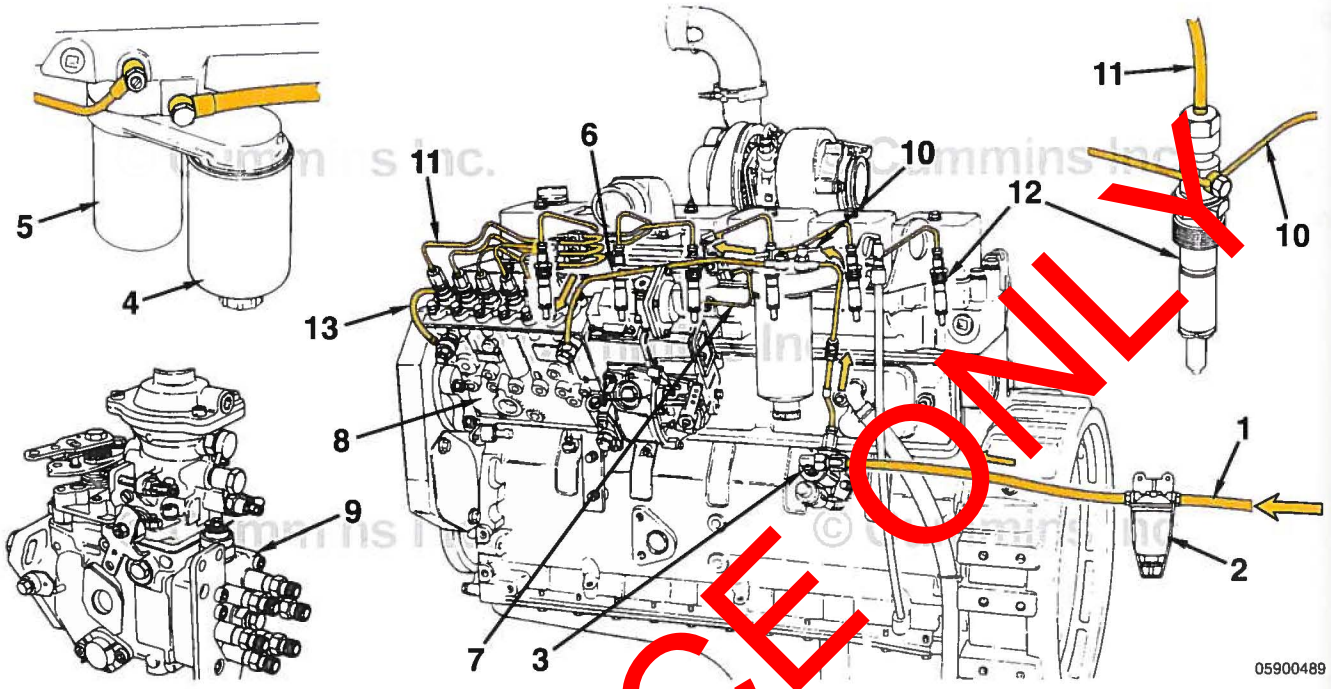
Knowledge of the engine systems can help in troubleshooting, servicing, and general maintenance of the engine.

REFERENCE ONLY

Flow Diagram, Fuel System

Flow Diagram

Automotive Applications



REFERENCE ONLY

Flow Diagram, Fuel System

Flow Diagram

Automotive Applications

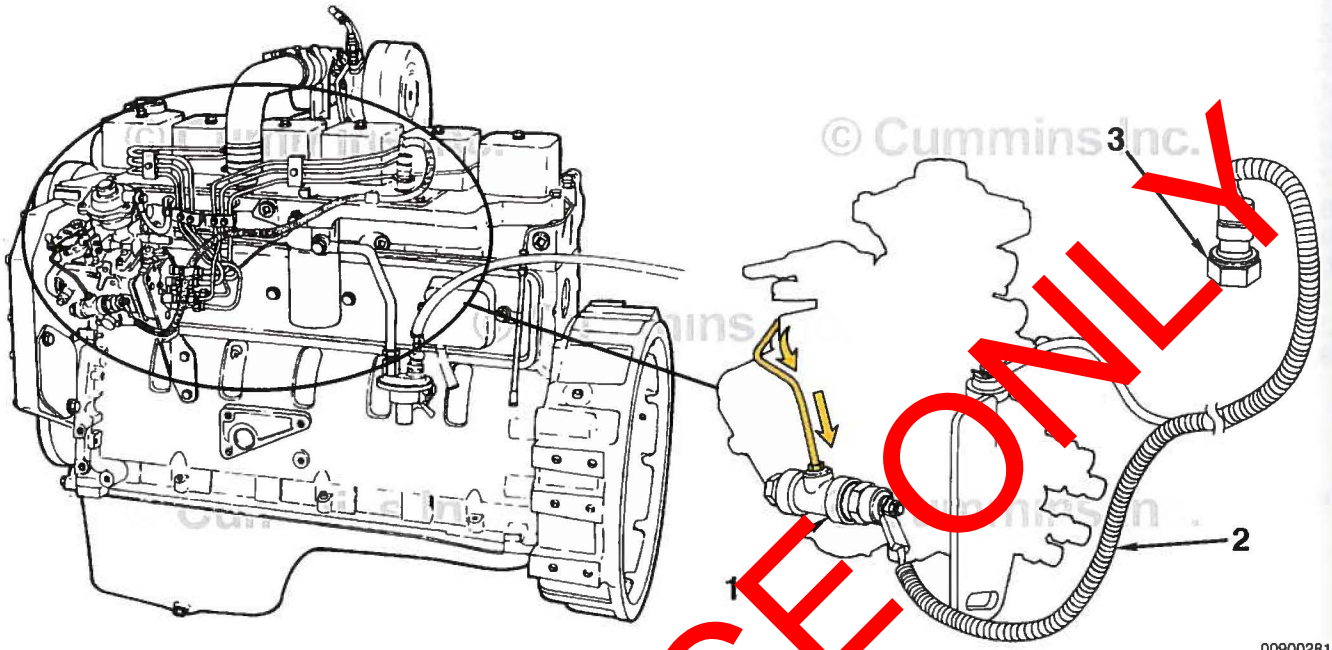
1. Fuel from supply tank
2. Prefilter or screen
3. Fuel lift pump
4. Fuel/water separator
5. Fuel filter
6. Low-pressure fuel line
7. Turbocharger boost control line
8. Bosch® P7100 injection pump
9. Bosch® rotary injection pump
10. Fuel drain manifold
11. High-pressure fuel line
12. Bosch® 7-mm closed-nozzle, hole-type injectors
13. Fuel return to supply tank.

REFERENCE ONLY

Flow Diagram, Fuel System

Flow Diagram

Automotive Applications



© Cummins Inc.
REFERENCE ONLY

Flow Diagram, Fuel System

Flow Diagram

Automotive Applications

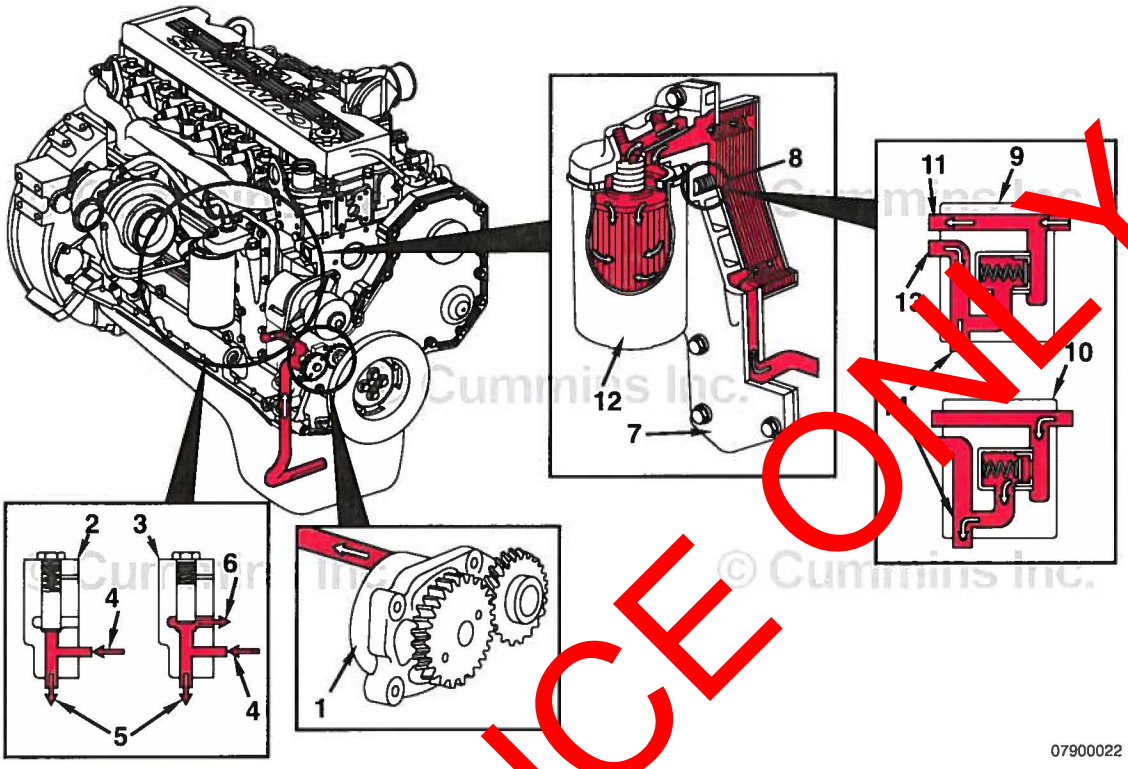
1. KSB valve
2. Wiring harness
3. Temperature switch.

REFERENCE ONLY

Flow Diagram, Lubricating Oil System

Flow Diagram

Automotive Applications



Lubri ting Oil ter and Bypass

REFERENCE ONLY
© Cummins Inc.

Flow Diagram, Lubricating Oil System

Flow Diagram

Automotive Applications

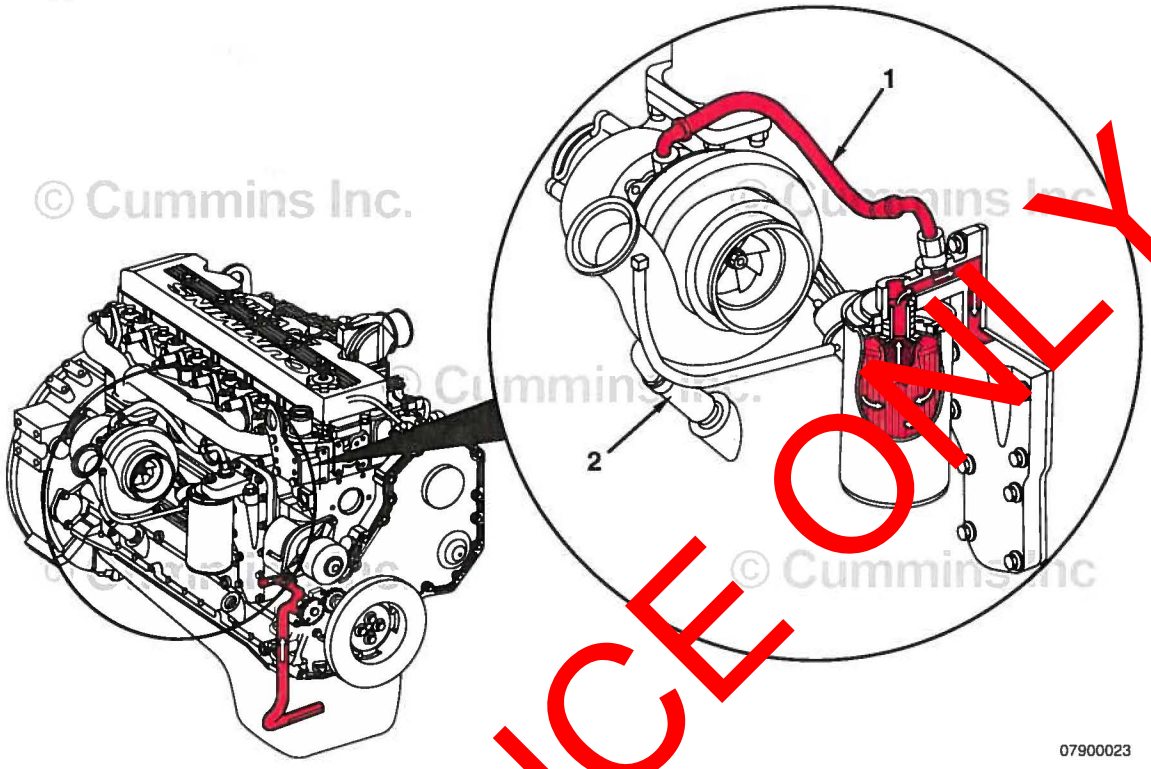
1. Gerotor Lubricating Oil Pump
2. Pressure Regulating Valve Closed
3. Pressure Regulating Valve Open
4. From Lubricating Oil Pump
5. To Lubricating Oil Cooler
6. To Lubricating Oil Pan
7. Lubricating Oil Cooler
8. Filter Bypass Valve
9. Filter Bypass Valve Closed
10. Filter Bypass Valve Open
11. To Lubricating Oil Filter
12. Full-Flow Lubricating Oil Filter
13. From Lubricating Oil Filter
14. Main Lubricating Oil Rifle.

REFERENCE ONLY

Flow Diagram, Lubricating Oil System

Flow Diagram

Automotive Applications



Lubrica[illegible] Oil Turbocharger

© Cummins Inc.
REFERENCE ONLY

Flow Diagram, Lubricating Oil System

Flow Diagram

Automotive Applications

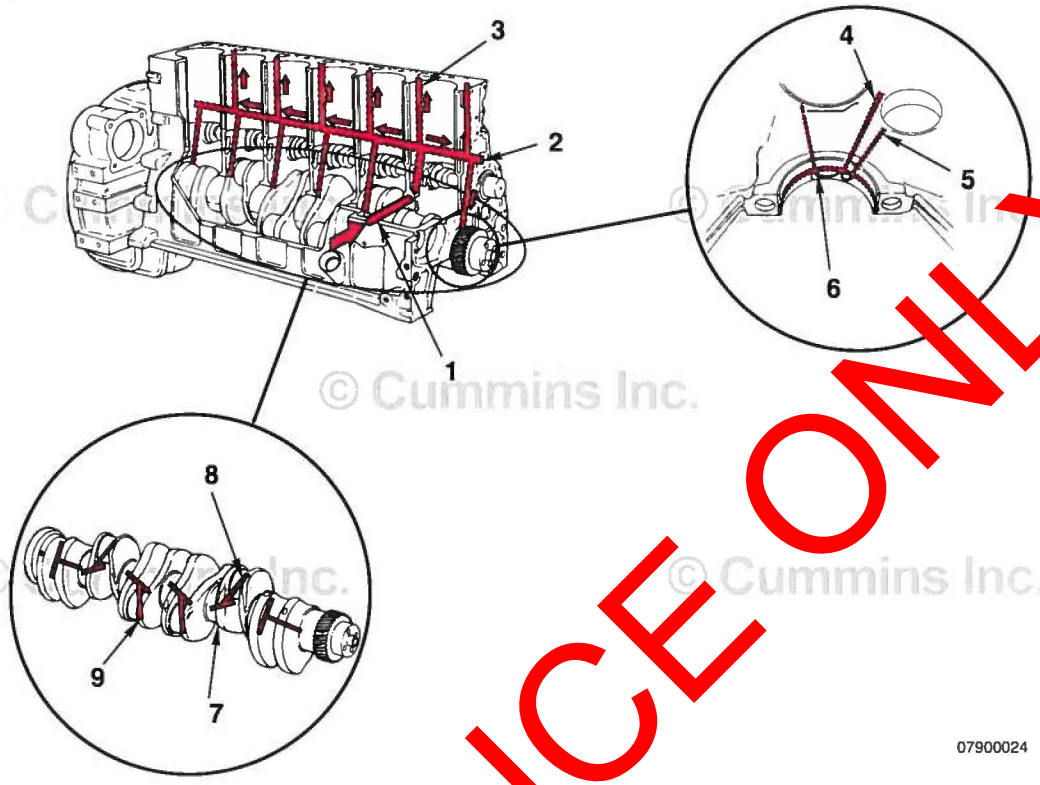
1. Lubricating Oil Supply
2. Lubricating Oil Drain.

REFERENCE ONLY

Flow Diagram, Lubricating Oil System

Flow Diagram

Automotive Applications



Lubrication ... Power Components

© Cummins Inc.
REFERENCE ONLY

Flow Diagram, Lubricating Oil System

Flow Diagram

Automotive Applications

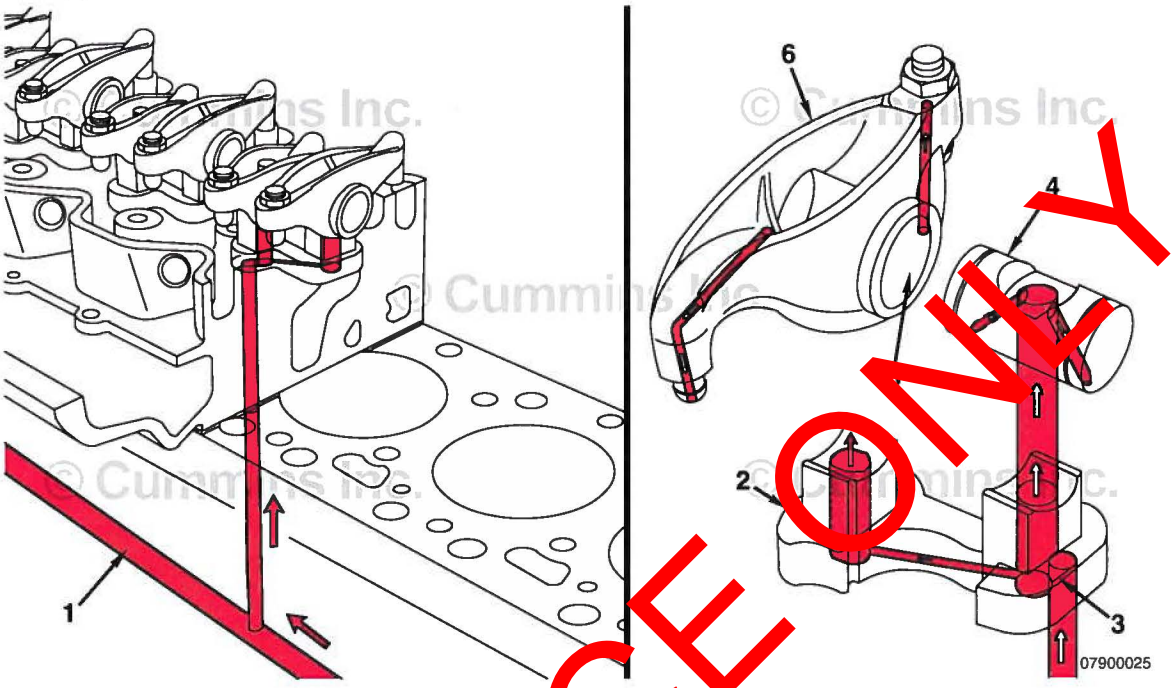
1. From Lubricating Oil Cooler
2. Main Lubricating Oil Rifle
3. To Valve Train
4. From Main Lubricating Oil Rifle
5. To Camshaft
6. To Piston Cooling Nozzle
7. Crankshaft Main Journal
8. To Connecting Rod Bearing
9. Connecting Rod Journal.

REFERENCE ONLY

Flow Diagram, Lubricating Oil System

Flow Diagram

Automotive Applications



Lubrication for the Overhead

© Cummins Inc.
REFERENCE ONLY

Flow Diagram, Lubricating Oil System

Flow Diagram

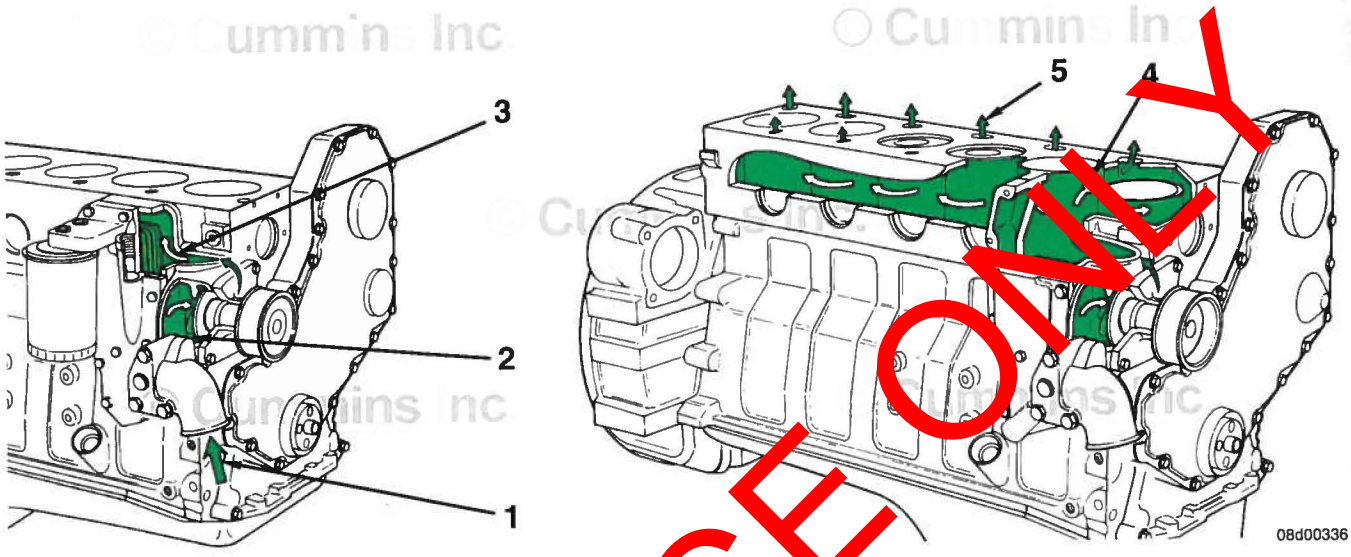
Automotive Applications

1. Main Lubricating Oil Rifle
2. Rocker Lever Support
3. Transfer Slot
4. Rocker Lever Shaft
5. Rocker Lever Bore
6. Rocker Lever.

REFERENCE ONLY

Flow Diagram, Cooling System

Flow Diagram



REFERENCE ONLY

Flow Diagram, Cooling System

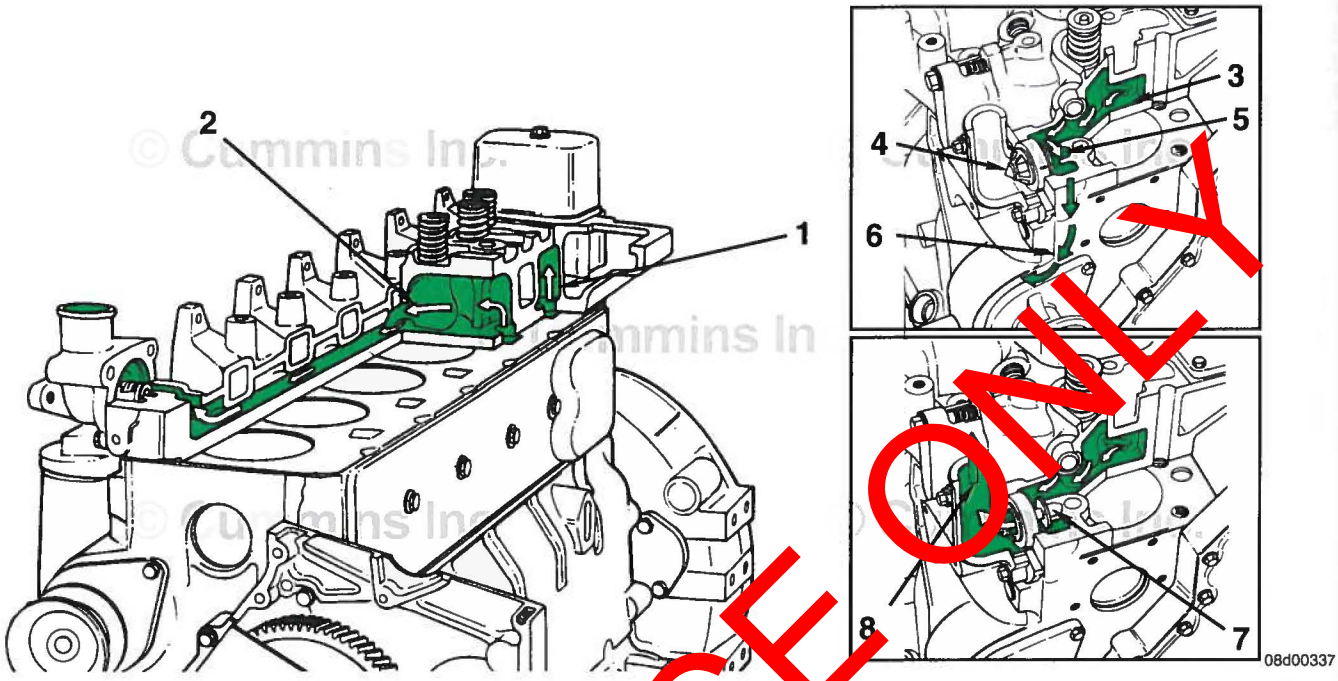
Flow Diagram

1. Coolant inlet
2. Pump impeller
3. Coolant flow past lubricating oil cooler
4. Coolant flow past cylinders
5. Coolant flow to cylinder head.

REFERENCE ONLY

Flow Diagram, Cooling System

Flow Diagram



REFERENCE ONLY

Flow Diagram, Cooling System

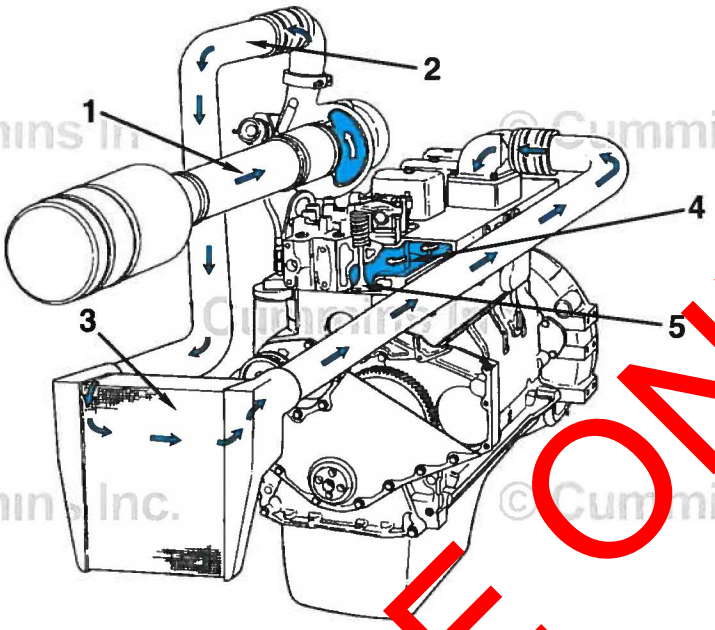
Flow Diagram

1. Coolant flow from the cylinder head
2. Coolant flow to thermostat housing
3. Coolant flow past injector
4. Thermostat
5. Coolant bypass passage
6. Coolant flow to water pump inlet
7. Coolant bypass closed
8. Coolant flow back to radiator.

REFERENCE ONLY

Flow Diagram, Air Intake System

Flow Diagram



10900253

Turbocharged-Charge-Air-Cooled Engine

© Cummins Inc.
REFERENCE ONLY

Flow Diagram, Air Intake System

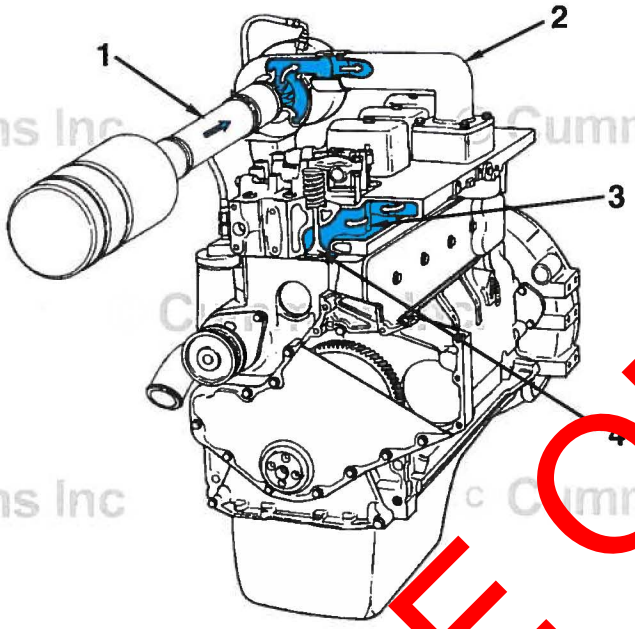
Flow Diagram

1. Intake air inlet to turbocharger
2. Turbocharger air to charge air cooler
3. Charge air cooler
4. Intake manifold
5. Intake valve.

REFERENCE ONLY

Flow Diagram, Air Intake System

Flow Diagram



10900256

Turbocharged (Only) Engine

© Cummins Inc.
© Cummins Inc.
© Cummins Inc
© Cummins Inc.
REFERENCE ONLY

Flow Diagram, Air Intake System

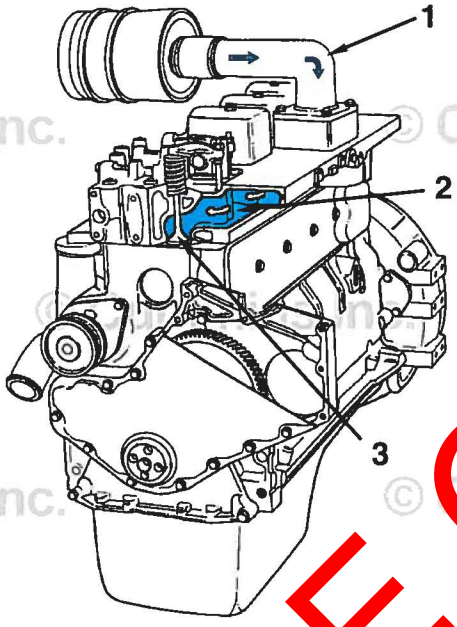
Flow Diagram

1. Intake air inlet to turbocharger
2. Air to intake manifold
3. Intake manifold
4. Intake valve.

REFERENCE ONLY

Flow Diagram, Air Intake System

Flow Diagram



10900254

Naturally Aspirated Engine

© Cummins Inc.
© Cummins Inc.
© Cummins Inc.
© Cummins Inc.
REFERENCE ONLY

Flow Diagram, Air Intake System

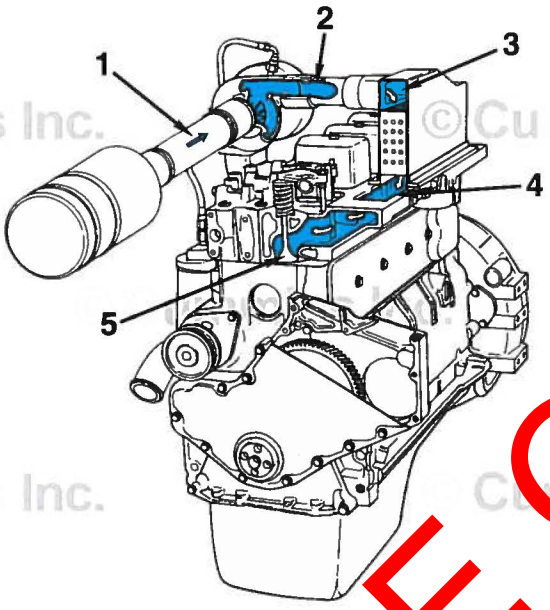
Flow Diagram

1. Intake air inlet
2. Intake manifold
3. Intake valve.

REFERENCE ONLY

Flow Diagram, Air Intake System

Flow Diagram



10900255

Turbocharged-Aftercooled Engine

© Cummins Inc.
REFERENCE ONLY

Flow Diagram, Air Intake System

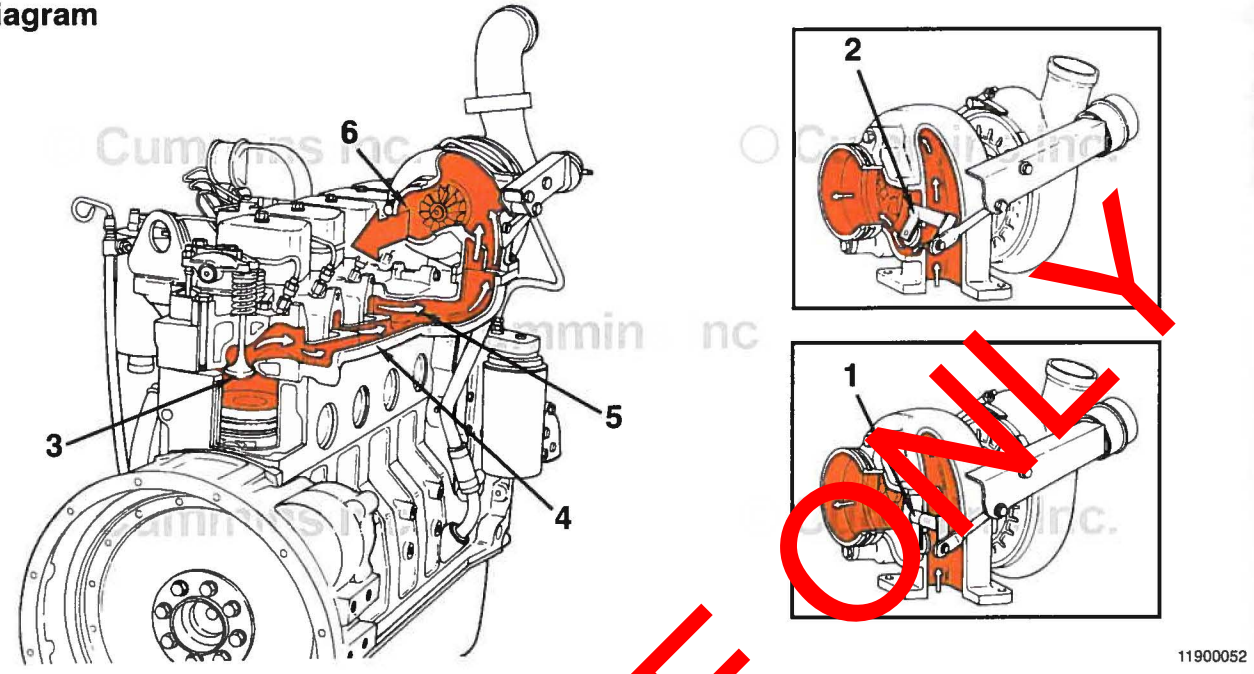
Flow Diagram

1. Intake air inlet to turbocharger
2. Turbocharger air to aftercooler
3. Aftercooler
4. Intake manifold
5. Intake valve.

REFERENCE ONLY

Flow Diagram, Exhaust System

Flow Diagram



Turbocharger with Wastegate

REFERENCE ONLY

Flow Diagram, Exhaust System

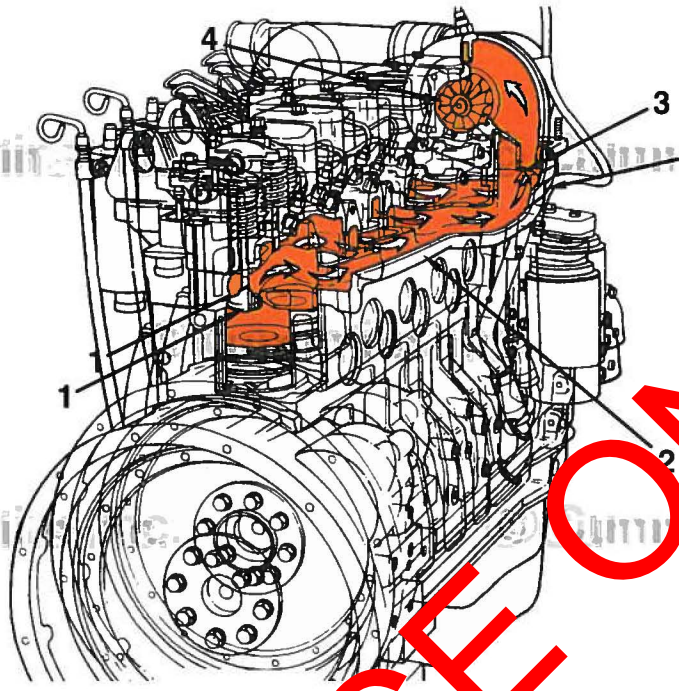
Flow Diagram

1. Wastegate closed
2. Wastegate open
3. Exhaust valve
4. Exhaust manifold
5. Turbocharger exhaust inlet
6. Turbocharger exhaust outlet.

REFERENCE ONLY

Flow Diagram, Exhaust System

Flow Diagram



Naturally Aspirated Engine

REFERENCE ONLY

Flow Diagram, Exhaust System

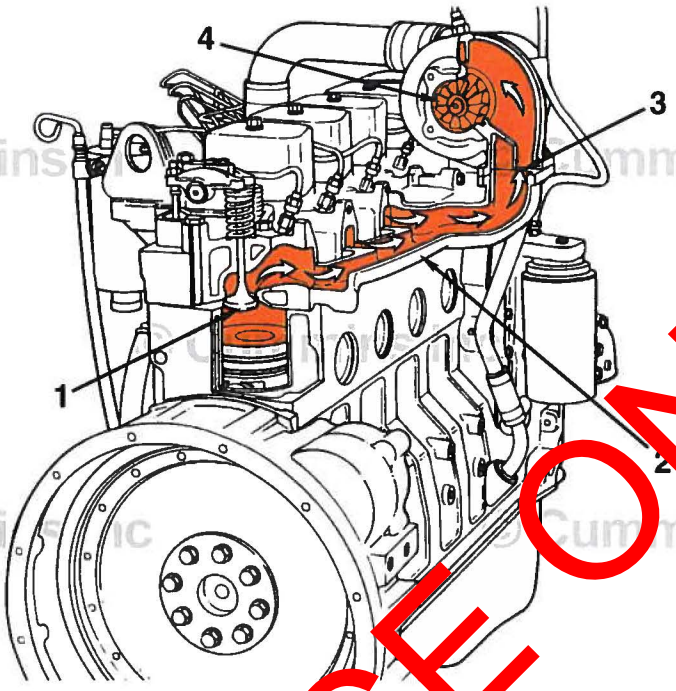
Flow Diagram

1. Exhaust valve
2. Exhaust manifold.

REFERENCE ONLY

Flow Diagram, Exhaust System

Flow Diagram



11900054

Turbocharged Engine

© Cummins Inc.
REFERENCE ONLY

Flow Diagram, Exhaust System

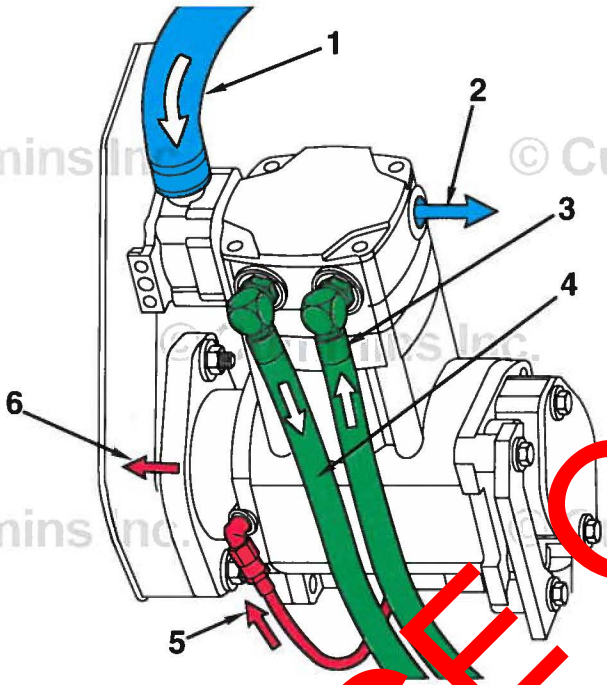
Flow Diagram

1. Exhaust valve
2. Exhaust manifold
3. Turbocharger exhaust inlet
4. Turbocharger exhaust outlet.

REFERENCE ONLY

Flow Diagram, Compressed Air System

Flow Diagram



12900030

© Cummins Inc.
© Cummins Inc.
© Cummins Inc.
© Cummins Inc.
REFERENCE ONLY

Flow Diagram, Compressed Air System

Flow Diagram

1. Air In
2. Air Out
3. Coolant In
4. Coolant Out
5. Lubricating Oil In
6. Lubricating Oil Out Is Internal to the Gear Housing.

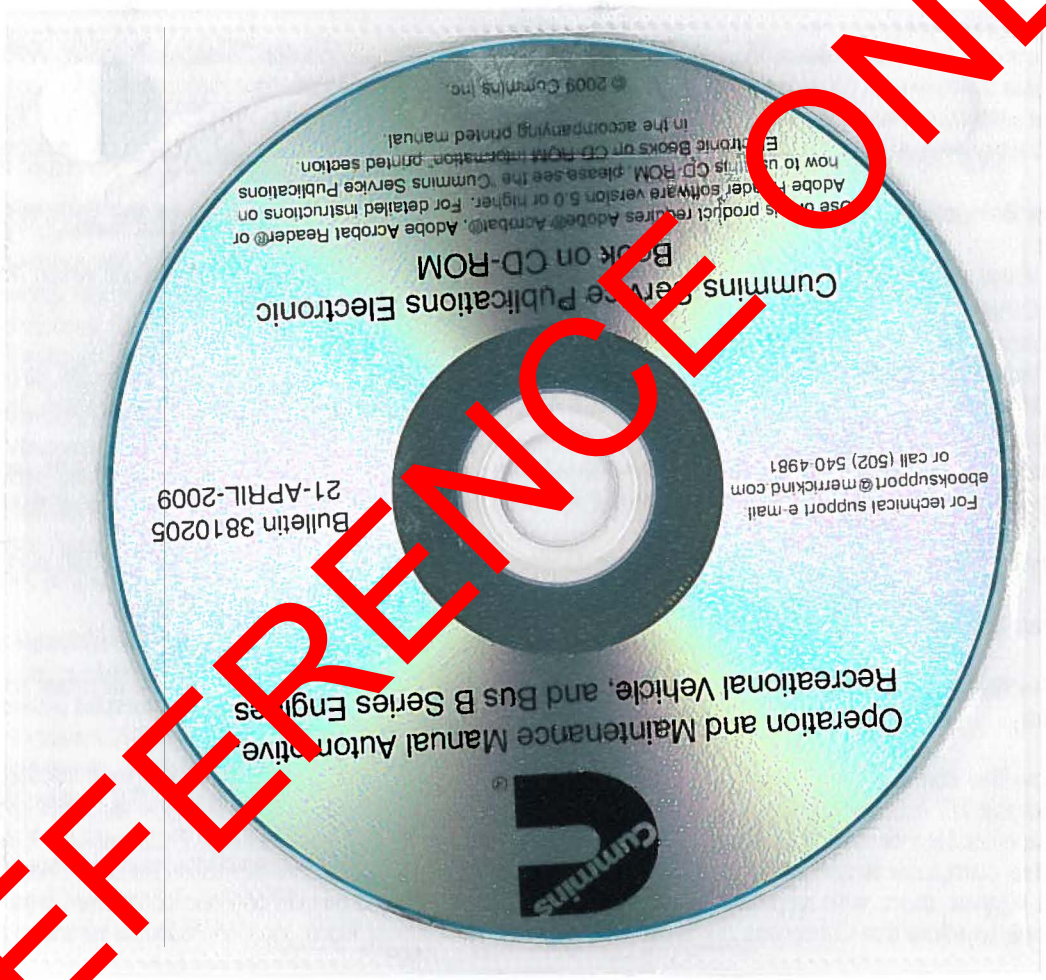
REFERENCE ONLY

Notes

REFERENCE ONLY

Cummins Service Publications Electronic Books on CD-ROM

Enclosed, we've included on CD-ROM, an electronic copy of this publication in Adobe® Acrobat® format (PDF) for your personal use and reference. **Before you begin to use the CD-ROM, please read the "Cummins Service Publications Electronic Books on CD-ROM Information" printed section, beginning on the next page.** This section includes information about this CD-ROM including System Requirements, Local Administrative Rights requirements, How to Use, Helpful Support Tips and other information.



REFERENCE ONLY

Cummins Service Publications Electronic Books on CD-ROM Information

The enclosed CD-ROM provides you with the capability to view this publication electronically as well as perform searches. This CD-ROM is copy protected and will not allow Printing, Changing of Content, Extracting Content or Commenting / Annotating of the PDF file.

This CD-ROM is read only, and you will not be able to copy files from the CD-ROM and have them open or function in any manner. The only method to view the electronic publication is from the original CD-ROM.

This CD-ROM is intended for use by the owner of the printed publication only. Copying or distribution of content from this CD-ROM is expressly prohibited. This CD-ROM will not function from a network server CD-ROM drive. It will function only in a CD-ROM drive directly connected to your computer.

For Microsoft Windows NT 4.0, Microsoft Windows 2000 or Microsoft Windows XP, this CD-ROM requires that you have Local Administrative rights in order to use. See the System requirements section for additional details.

System Requirements:

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.

The Cummins Service Publications Electronic Books on CD-ROM product requires the following system components:

- 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.

About required Local Administrative Rights:

The copy protection system used on this product requires direct access to CD-ROM drives in order to authenticate copy protected discs.

In order to allow the software to enable direct access to CD-ROM drives rights under Microsoft Windows, if you are using Microsoft Windows NT 4.0, Microsoft Windows 2000 or Microsoft Windows XP, your logon account/profile must have Local Administrative Rights on the computer you will be using your Cummins Service Publications Electronic Book on CD-ROM with. If this computer is set up in Restricted Mode, and your logon account/profile does not have Local Administrative Rights, then, with approval of your I.T. department or the owner of your computer, you can choose from the following options to allow the Cummins Service Publications Electronic Book on CD-ROM to function properly:

- 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.)

REFERENCE ONLY

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

About the Copy Protection Software:

- This product may upgrade the proprietary copy protection software files it uses that are placed on your computer system to a new version, if an older version exists on your computer. If you have CD-ROM copy protected items from other companies and they use older versions of the same HexaLock copy protection software that the Cummins Service Publications Electronic Books on CD-ROM uses, it may render them incompatible for use on your computer.

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.)

Adobe Reader 6.0.1 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 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

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).

REFERENCE ONLY

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.

Special Instructions for Cummins PowerSweep PC Users:

(This only applies to Cummins Inc. & Distributor Employees):
Cummins PowerSweep PC users that DO NOT have Local Administrative rights to their PC will require a HexaLock patch software installation. If you are a Cummins Inc. or Distributor Employee who wants to use these CD-ROM's, and you have a PowerSweep PC – please order the 'HexaLock' software from the Cummins Software Shelf. The Software Shelf personnel will contact you to arrange installation. Software will be installed remotely by Software Shelf personnel. Once software is installed, first reboot your PC, then attempt to read your encrypted CD-ROM manual while Cummins Software Shelf personnel are still on the telephone.

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.

Cummins Service Publications Electronic Books on CD-ROM are Copyright © Cummins Inc.
Adobe Acrobat Reader is a registered trademark of Adobe Systems Incorporated.
Microsoft, Windows, and Windows NT are registered trademarks of Microsoft Corporation.
Intel and Pentium are trademarks of Intel Corporation.
HexaLock is Copyright © HexaLock, Ltd.
All other names and products used herein are trademarks for their respective owner.

REFERENCE ONLY

Section L - Service Literature

Section Contents

Page
Additional Service Literature L-1
General Information L-1
Cummins Customized Parts Catalog L-3
General Information L-3
Ordering the Customized Parts Catalog L-3
Ordering by Telephone L-3
Ordering On-Line L-3
Service Literature Ordering Location L-2
Contact Information L-2

REFERENCE ONLY

Section L - Service Literature

Section Contents

Page

Additional Service Literature L-1
General Information L-1
Cummins Customized Parts Catalog L-3
General Information L-3
Ordering the Customized Parts Catalog L-3
Ordering by Telephone L-3
Ordering On-Line L-3
Service Literature Ordering Location L-2
Contact Information L-2

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

Additional Service Literature

General Information

The following publications can be purchased by contacting your Cummins distributor:

Bulletin	Title of Publication
3666087	Service Manual, B3.9, B4.5, B4.5 RGT, and B5.9 Series Engines
3666109	Alternative Repair Manual, B and C Series Engines
3379000	Air For Your Engine
3666132	Coolant Requirements and Maintenance
3810340	Cummins Engine Oil Recommendations
3379001	Fuels for Cummins Engines
3379009	Operation - Cold Weather

REFERENCE ONLY

Service Literature Ordering Location
Contact Information

Region	Ordering Location
United States and Canada	Cummins Distributors or Credit Cards at 1-800-646-5609 or Order online at www.powerstore.cummin.com
All Other Countries	Cummins Distributors or Dealers

REFERENCE ONLY

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 a error and your catalog is not useable, we will correct that error by sending you a new catalog.

REFERENCE ONLY

Notes

REFERENCE ONLY

Section M - Component Manufacturers

Section Contents

	Page
Component Manufacturers' Addresses	M-1
Air Compressors	M-1
Air Cylinders	M-1
Air Heaters	M-1
Air Starting Motors	M-1
Alternators	M-1
Auxiliary Brakes	M-1
Belts	M-1
Catalytic Converters	M-1
Coolant Level Switches	M-1
Clutches	M-1
Coolant Heaters	M-2
Drive Plates	M-2
Electric Starting Motors	M-2
Electronic Switches	M-2
Engine Protection Controls	M-2
Fan Clutches	M-2
Fans	M-2
Fault Lamps	M-2
Filters	M-2
Flexplates	M-2
Fuel Coolers	M-2
Fuel Pumps	M-2
Fuel Warmers	M-2
Gauges	M-3
Governors	M-3
Heat Sleeves	M-3
Hydraulic and Power Steering Pumps	M-3
In-Line Connectors	M-3
Oil Heaters	M-3
Prelubrication Systems	M-3
Radiators	M-3
Throttle Assemblies	M-3
Torque Converters	M-3

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

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) 528-9551

Kim Hotstart Co
P.O. Box 1[illegible]
Spokane, WA 99210-0245
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 Electric
Cleveland Road
Leyland
PR5 1XE
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)1942-25922

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

REFERENCE ONLY

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) 449-660

Engine Protection Controls

Flight Systems Headquarters
Hempt Road
P.O. Box 35
Mechanicsburg, PA 17055
Telephone: (717) 697-0333

The Mason Company
281 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

Truflo Ltd.
Westwood Road
Birmingham
B6 7JF
England
Telephone: (0) 21-3283841

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 4PT
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

REFERENCE ONLY

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) 348-57[illegible]

Hydraulic and Power Steering Pumps

Honeywell Control Systems Ltd.
Honeywell House
Arlington Business Place
Bracknell
Berks RG12 1E[illegible]
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 38[illegible]2
Telephone: (615) [illegible]26-9551

Kim Hotstart Co.
P.O. Box 1124[illegible]
Spokane, WA 992[illegible]1-0245
Telephone: (509) [illegible]-6171

Prelubrication Systems

R[illegible] Industries, Inc.
Suite 109
[illegible]5 Hickory Street
[illegible]ington, 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) 271-2[illegible]97

L and M Radiator, Inc.
1414 East 37th S[illegible]t
Hibbing, MN 55746
Telephone: (218) 263-8993

Throttle Assemblies

Williams Controls, Inc.
141[illegible] 72[illegible] 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

REFERENCE ONLY

Notes

REFERENCE ONLY

Section S - Service Assistance

Section Contents

	Page
Distributors - International	S-33
Locations	S-33
Distributors and Branches	S-4
Australia	S-24
Canada	S-19
China, People's Republic	S-22
New Zealand	S-28
United States	S-4
Division and Regional Offices	S-2
Locations	S-2
Emergency and Technical Service	S-1
General Information	S-1
Problem Solving	S-1
General Information	S-1
Regional Offices - International	S-29
Locations	S-29
Routine Service and Parts	S-1
General Information	S-1

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

Routine Service and Parts

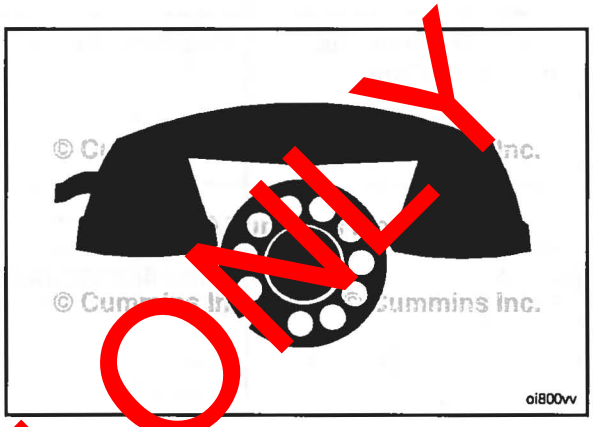
General Information

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.
- East Asia - Customer Assistance Center also for Chinese Domestic Market support Toll-Free:

  400-810-5252

- Outside of North America contact your Regional Office. Telephone numbers and addresses are listed in the International Directory.

REFERENCE ONLY

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

3. 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

Australia Regional Office	**Cummins Engine Company Pty. Ltd.**	2 Caribbean Drive Scoresby, Victoria 3179 Australia Telephone: (61-3) 9765-3222 FAX: (61-3) 9763-0079 **NOTE:** This office also serves New Zealand.
Cummins Americas Regional Office	**Cummins Americas Inc.**	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.
China Beijing	**Cummins (China) Investment Co. Ltd**	28F, Tower A, GATEWAY, No. 3, Xiaguangli North Road, East Third Ring, Chaoyang District Beijing, Beijing ZIP / Postal Code: 100027 China Telephone: [86-10] 64548888 Telefax: [86-10] 67876347
Brazil	**Cummins Brasil Ltda.**	Rua Jati, 266 07112-900 Guarulhos Sao Paulo Brazil Phone: [55-11] 6465-9811 Fax: [55-11] 6412-1483
Daventry	**Cummins Engine Company Ltd (Africa)**	Royal Oak Way South Daventry, Northants ZIP / Postal Code: NN11 5NU United Kingdom Telephone: [44-1327] 886000 Telefax: [44-1327] 886106
Daventry	**Cummins Engine Co. Ltd (Serving Czech Republic)**	Royal Oak Way South Daventry, Northants ZIP / Postal Code: NN11 5NU United Kingdom Telephone: [44-1327] 886000 Telefax: [44-1327] 886106
Daventry	**Cummins Engine Company Ltd (Middle East)**	Royal Oak Way South Daventry, Northants ZIP / Postal Code: NN11 5NU United Kingdom Telephone: [44-1327] 886000 Telefax: [44-1327] 886106
Dubai United Arab Emirates	**Cummins Middle East FZE**	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

REFERENCE ONLY

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 / 53[illegible]-6569
SLP Mexico	**Cummins, S. de R.L. de C.V.**	Arquimedes No. 209 Col. Polanco Mexico, Distrito Federa[illegible] ZIP / Postal Cod[illegible]1560 Mexico Telephone: [5[illegible]-5] 254-3[illegible]22 / 3783 / 3622 Telefax: [52-5] [illegible]54-3645
Russia **Moscow**	**Cummins Engine Company, Inc.**	Park Place Office E7[illegible]8, 113/1 Leninskiy Prospect Mo[illegible] 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

REFERENCE ONLY

Distributors and Branches - United States

Alabama	**Birmingham**	Cummins Mid-South, LLC 2200 Pinson Highway P.O. Box 1147 Birmingham, AL 35217 Telephone: (205) 841-0421 FAX: (205) 849-5926
Alabama	**Mobile**	Cummins Mid-South, LLC 1924 N. Beltline Hwy. Mobile, AL 36617 Telephone: (334) 456-2236 FAX: (334) 452-6419
Alaska	**Anchorage**	Cummins Northwest, Inc. 2618 Commercial Drive Anchorage, AK 995[illegible] Telephone: (907) 279-[illegible]594 FAX: (907) [illegible]6-634[illegible]
Arizona	**Phoenix**	Cummins Rocky Mountain, LLC 2239 N. Black Canyon Hgwy Phoenix, AZ 85009 Telephone: (602) 252-8021 FAX: (602) 253-6725
Arkansas	**Little Rock**	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 [illegible]ndro**	Cummins West, Inc. 14775 Wicks Blvd. San Leandro, CA 94577-6779 Telephone: (510) 351-6101 FAX: (510) 352-3925
California	**Arcata**	Cummins West, Inc. 4751 West End Road Arcata, CA 95521 Telephone: (707) 822-7392 FAX: (707) 822-7585
California	**Bakersfield**	Cummins West, Inc. 4601 East Brundage Lane Bakersfield, CA 93307 Telephone: (805) 325-9404 FAX: (805) 861-8719
California	**Fresno**	Cummins West, Inc. 5333 N Cornelia Ave Fresno, CA 93722 Telephone: (559) 277-6760 FAX: (559) 277-6769

REFERENCE ONLY

California	**Redding**	Cummins West, Inc. 20247 Charlanne Drive Redding, CA 96002 Telephone: (530) 222-4070 FAX: (530) 224-4075
California	**Stockton**	Cummins West, Inc. 5250 Claremont Ave Suite 204 Stockton, California 95207, USA Telephone: (209) 472-3460 FAX: (209) 472-3450
California	**West Sacramento**	Cummins West, Inc. 875 Riverside Parkway West Sacramento, CA 9560[illegible]-150[illegible] Telephone: (916) 371-0630 FAX: (916) 371-2849
California	**Los Angeles**	Cummins Cal [illegible]acific [illegible]nc. 1939 Deere A[illegible]enue (Irv[illegible]ne) Irvine, CA 926[illegible]6 Telephone: (94[illegible] 253-6[illegible]00 FAX: [illegible]949) 253-6070
California	**Montebello**	C[illegible]mmi[illegible] Cal Pacific Inc. 1105 [illegible]outh G[illegible]eenwood Avenue Monte[illegible]llo CA 90640 Tele[illegible]hone: (323) 728-8111 FAX: [illegible]323) 889-7499
California	**Bloomington**	[illegible]ummins Cal Pacific Inc. 3061 S. Riverside Avenue Bloomington, CA 92316 Telephone: (909) 877-0433 FAX: (909) 877-3787
California	**San D[illegible]eg[illegible]**	Cummins Cal Pacific Inc. 310 N. Johnson Avenue El Cajon, CA 92020 Telephone: (619) 593-3093 FAX: (619) 593-0600
California	**[illegible]entu[illegible]**	Cummins Cal-Pacific Inc. 3958 Transport St. Ventura, CA 93003 Telephone: (805) 644-7281 FAX: (805) 644-7284
Colo[illegible]do	**Denver**	Cummins Rocky Mountain, Inc. 8211 East 96th Ave Henderson, Colorado 80640 Telephone: (303) 287-0201 FAX: (303) 288-7080
Colorado	**Grand Junction**	Cummins Rocky Mountain, Inc. 2380 U.S. Highway 6 & 50 P.O. Box 339 Grand Junction, CO 81501 Telephone: (970) 242-5776 FAX: (970) 243-5494

REFERENCE ONLY

Connecticut	**Rocky Hill**	Cummins Metropower, Inc. 914 Cromwell Ave. Rocky Hill, CT 06067 Telephone: (860) 529-7474 FAX: (860) 529-7524
Florida	**Ft. Myers**	Cummins Power South, LLC 2671 Edison Avenue Ft. Myers, FL 33916 Telephone: (941) 337-1211 FAX: (941) 337-5374
Florida	**Jacksonville**	Cummins Power South 755 Pickettville Rd. Jacksonville, FL 32220 Telephone: (904) 378-1902 FAX: (904) 378-1904
Florida	**Hialeah (Miami)**	Cummins Power South, LLC 9900 N.W. 77th Avenue Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 FAX: (305) 557-0992
Florida	**Ocala**	Cummins Power South, LLC 3[illegible] Southwest 52nd Ave. Ocala, FL 34474-1892 Telephone: (352) 861-1122 FAX: (352) 861-1130
Florida	**Orlando**	Cummins Power South, LLC 4020 North Orange Blossom Trail Orlando, FL 32810 Telephone: (407) 298-2080 FAX: (407) 290-8727
Florida	**Tampa**	Cummins Power South, LLC 5421 N. 59th Street Tampa, FL 33610 Telephone: (813) 621-7202 FAX: (813) 621-8250
Florida		Cummins Power South, LLC 5906 Breckenridge Parkway Suite J Tampa, FL 33610 Telephone: (813) 664-5868 FAX: (813) 623-5442
Florida		Cummins Power South, LLC 5912 E. Hillsborough Avenue Tampa, FL 33610 Telephone: (813) 626-1101 FAX: (813) 628-8888
Florida		Cummins Power South, LLC 6606 N. 56th Street Tampa, FL 33610 Telephone: (813) 623-3330 FAX: (813) 628-4162

REFERENCE ONLY

Georgia	**Atlanta**	Cummins South, Inc. 100 University Ave. S.W. Atlanta, Georgia 30315-2202 Telephone: (404) 527-7800 FAX: (404) 527-7832
Georgia		Cummins South, Inc. 5125 Georgia Highway 85 College Park, GA 30349 Telephone: (404) 763-0151 FAX: (404) 766-2132
Georgia	**Albany**	Cummins South, Inc. 1915 W. Oakridge Drive Albany, GA 31707-4938 Telephone: (912) 888-6210 FAX: (912) 883-1670
Georgia	**Augusta**	Cummins South, Inc. 1255 New Sav[illegible]nah [illegible]oad Augusta, GA [illegible]0901-389[illegible] Telephone: (7[illegible]6) 722-88[illegible]5 FAX: (706) 722-[illegible]553
Georgia	**Savannah**	Cu[illegible]mins South, Inc. 8 [illegible]terch[illegible]nge Court Sava[illegible]ah, G[illegible] 31401-1627 Teleph[illegible]e (912) 232-5565 FAX: (912) 232-5145
Hawaii	**Kapolei**	Cu[illegible]mins West Inc. 91-230 Kalaeloa Blvd. Kapolei, HI 96707 Telephone: (808) 682-8110 FAX: (808) 682-8477
Idaho	**Boise**	Cummins Rocky Mountain, LLC 8949 So. Federal Way City Boise, Idaho 84716 Telephone: (208) 336-5000 FAX: (208) 338-5436
Illinois	**C[illegible]icag[illegible]**	Cummins Power, LLC 7145 Santa Fe Drive Hodgkins, IL 60525 Telephone: (708) 579-9222 FAX: (708) 352-7547
Illinois	**Bloomington**	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

REFERENCE ONLY

Illinois	**Madison**	Cummins Mid-South, LLC 222 SR-203 Madison, Illinois 62060 Telephone: (618) 798-9512 FAX: (618) 798-9521
Illinois	**Rock Island**	Cummins Central Power, LLC 7820 - 42nd Street West Rock Island, IL 61201 Telephone: (309) 787-4300 FAX: (309) 787-4397
Indiana	**Indianapolis**	Cummins Mid-States Power, Inc. P.O. Box 42917 3762 West Morris Street Indianapolis, IN 46242-09[illegible]7 Telephone: (317) 243-7979 FAX: (317) 240-192[illegible]
Indiana		Cummins Mi[illegible]Stat[illegible] Po[illegible]er, Inc. P.O. Box 42[illegible]17 3661 West [illegible]orris St Indianapolis, [illegible]I 462[illegible] Tel[illegible]phone: (317) 486-5287 F[illegible]X: (317) 486-5281
Indiana		C[illegible]mins [illegible]d-States Power, Inc. 430[illegible]W [illegible]orris St. 37[illegible]2 West Morris Street Ind[illegible]anapolis, IN 46241 T[illegible]lephone: (317) 240-1967 FAX: (317) 240-1975
Indiana	**Evansville**	Cummins Cumberland, Inc. 7901 Highway 41 North Evansville, IN 47725 Telephone: (812) 867-4400 FAX: (812) 867-4411
Indiana	**Ft. W[illegible]yne**	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**	Cummins Northern Illinois, Inc. 1440 Texas Street Gary, IN 46402 Telephone: (219) 885-5591 FAX: (219) 883-4817
I[illegible]ana	**Indianapolis**	Cummins Mid-States Power, Inc. 3661 West Morris St Indianapolis, IN 46241 Telephone: (317) 486-5287 FAX: (317) 486-5281
Iowa	**Cedar Rapids**	Cummins Central Power, LLC 625 - 33rd Avenue SW Cedar Rapids, IA 52404 Telephone: (319) 366-7537 (24 hours) FAX: (319) 366-7562

REFERENCE ONLY

Iowa	**Des Moines**	Cummins Central Power, LLC 1680 N.E. 51st Avenue Des Moines, IA 50313 Telephone: (515) 262-9591 Parts: (515) 262-9744 FAX: (515) 262-0626
Kansas	**Colby**	Cummins Central Power, LLC 1880 South Range Colby, KS 67701 Telephone: (785) 462-3945 FAX: (785) 462-3970
Kansas	**Garden City**	Cummins Central Power, LLC 1285 Acraway Garden City, KS 67846 Telephone: (316) 275-2877 FAX: (316) 275-2533
Kansas	**Wichita**	Cummins Central Power, LLC 5101 North Broadway Wichita, KS 67219 Telephone: (316) 838-0875 FAX: (316) 838-0704
Kentucky	**Louisville**	Cummins Cumberland, Inc. (Corporate Office) 2301 Nonville Parkway Louisville, KY 40223 Telephone: (502) 254-7375 FAX: (502) 254-1215
Kentucky	**Hazard**	Cummins Cumberland, Inc. Highway 15 South Hazard, KY 41701 Telephone: (606) 436-5718 FAX: (606) 436-5038
Kentucky	**Louisville**	Cummins Cumberland, Inc. 9820 Bluegrass Parkway Louisville, KY 40299 Telephone: (502) 491-4263 FAX: (502) 499-0896
Louisiana	**Morgan City**	Cummins Mid-South, LLC 9508 Highway 90 E Amelia, LA 70340 Telephone: (504) 631-0576 FAX: (504) 631-0081
Louisiana	**New Orleans**	Cummins Mid-South, LLC 110 E. Airline Highway Kenner, LA 70062 Telephone: (504) 465-3412 FAX: (504) 465-3408
Maine	**Scarborough**	Cummins Northeast, Inc. 10 Gibson Road Scarborough, ME 04074 Telephone: (207) 883-8155 FAX: (207) 883-5526

REFERENCE ONLY

Maryland	**Baltimore**	Cummins Power Systems, Inc. 1907 Park 100 Drive MD 21061 Telephone: (410) 590-8700 FAX: (410) 590-8731
Massachusetts	**Boston**	Cummins Northeast, Inc. 100 Allied Drive Dedham, MA 02026 Telephone: (781) 329-1750 FAX: (781) 329-4428
Massachusetts	**Springfield**	Cummins Northeast, Inc. 177 Rocus Street Springfield, MA 01104 Telephone: (413) 737-265[illegible] FAX: (413) 731-1082
Michigan	**Detroit (New Hudson)**	Standby Power, Div. of Cummins Bridgeway, LLC 21810 Clessi[illegible]Ct New Hudson, Michiga[illegible] 48165 Telephone: ([illegible]48) 573-[illegible]600
Michigan		Cum[illegible]ins Bridgeway, LLC 54[illegible]40 Grand River Ave [illegible]w Hudson, Michigan 48165 Tel[illegible]hone: ([illegible]517) 573-1900
Michigan	**Grand Rapids**	Cu[illegible]mins Bridgeway, LLC 371[illegible] Clay Avenue, S.W. Gr[illegible]nd Rapids, MI 49508 Telephone: (616) 538-2250 FAX: (616) 538-3830
Michigan	**Grand Rapi[illegible]s**	Standby Power, Inc. 7580 Expressway Drive S.W. Grand Rapids, MI 49548 Telephone: (616) 281-2211 FAX: (616) 281-3177
Michigan	**Iron [illegible]ountain**	Cummins NPower, LLC 1901 Stevenson Avenue Iron Mountain, MI 49801 Telephone: (906) 774-2424 FAX: (906) 774-1190
Michigan	**Saginaw**	Cummins Bridgeway, LLC 722 N. Outer Drive Saginaw, MI 48605 Telephone: (989) 752-5200 FAX:(989) 752-4194
M[illegible]esota	**St. Paul**	Cummins NPower, LLC 3030 Centre Pointe Drive Suite 500 Roseville, MN 55113 Telephone: (651) 636-1000 FAX: (651) 638-2442
Minnesota	**Duluth**	Cummins NPower, LLC 3115 Truck Center Drive Duluth, MN 55806-1786 Telephone: (218) 628-3641 FAX: (218) 628-0488

REFERENCE ONLY

Mississippi	**Jackson**	Cummins Mid-South, LLC 325 New Highway 49 South Jackson, MS 39288-4224 Telephone: (601) 939-7016 FAX: (601) 932-7399
Missouri	**Kansas City**	Cummins Central Power, LLC 8201 NE Parvin Road Kansas City, MO 64161 Telephone: (816) 414-8200 FAX: (816) 414-8299
Missouri	**Joplin**	Cummins Central Power, LLC 3507 East 20th Street Joplin, MO 64801 Telephone: (417) 623-1661 FAX: (417) 623-1817
Missouri	**Springfield**	Cummins Central Power, LLC 3637 East Kearney Springfield, MO 65803 Telephone: (417) 862-0777 FAX: (417) 862-4129
Missouri	**Columbia**	Cummins Mid-South, LLC 5211 Highway 763 North Columbia, MO 65205 Telephone: (314) 449-3711 FAX: (314) 449-3712
Missouri	**Sikeston**	Cummins Mid-South, LLC 101 Keystone Drive Sikeston, MO 63801 Telephone: (573) 472-0303 FAX: (573) 472-0306
Missouri	**Industrial Power Branch**	Cummins Mid-South, LLC 3256 E. Outer Road Scott City, MO 63780 Telephone: (573) 335-7399 FAX: (573) 335-7062
Montana	**Billings**	Cummins Rocky Mountain, LLC 5151 Midland Road Billings, MT 59101 Telephone: (406) 245-4194 FAX: (406) 245-7923 Toll Free #: (800) 332-7788
Montana	**Missoula**	Cummins Northwest, Inc. 4950 North Reserve Street Missoula, MT 59802-1498 Telephone: (406) 728-1300 FAX: (406) 728-8523
Nebraska	**Omaha**	Cummins Great Plains Diesel, Inc. 5515 Center Street Omaha, NE 68106 Telephone: (402) 551-7678 (24 Hours) FAX: (402) 551-1952

REFERENCE ONLY

Nebraska	**Kearney**	Cummins Central Power, LLC 515 Central Avenue Kearney, NE 68847 Telephone: (308) 234-1994 FAX: (308) 234-5776
Nevada	**Elko**	Cummins Rocky Mountain, LLC 5370 East Idaho Street Elko, NV 89801 Telephone: (702) 738-6405 FAX: (702) 738-1719
Nevada	**Las Vegas**	Cummins Rocky Mountain, LLC 2750 Losee Road North Las Vegas, NV 89030 Telephone: (702) 399-2614 FAX: (702) 399-7457
Nevada	**Sparks**	Cummins Rocky Mountain, LLC 150 Glendale Avenue Sparks, NV 89431 Telephone: (775) 331-4953 FAX: (775) 331-4129
New Jersey	**Newark**	Cummins Metropower, Inc. 41[illegible]5 Doremus Ave. Newark, NJ 07105 Telephone: (973) 491-0100 FAX: (973) 578-8873
New Mexico	**Albuquerque**	Cummins Rocky Mountain, LLC 1921 Broadway N.E. Albuquerque, NM 87102 Telephone: (505) 247-2441 FAX: (505) 842-0436
New Mexico	**Farmington**	Cummins Rocky Mountain, LLC 1101 North Troy King Road Farmington, NM 87401 Telephone: (505) 327-7331 FAX: (505) 326-2948
New York	**Bronx**	Cummins Metropower, Inc. 890 Zerega Avenue Bronx, NY 10473 Telephone: (718) 892-2400 FAX: (718) 892-0055
New York	**Albany**	Cummins Northeast, Inc. 101 Railroad Avenue Albany, NY 12205 Telephone: (518) 459-1710 FAX: (518) 459-7815
New York	**Buffalo**	Cummins Northeast, Inc. 480 Lawrence Bell Dr. Williamsville, NY 14221-7090 Telephone: (716) 631-3211 FAX: (716) 626-0799

REFERENCE ONLY

New York	**Syracuse**	Cummins Northeast, Inc. 6193 Eastern Avenue Syracuse, NY 13211 Telephone: (315) 437-2751 FAX: (315) 437-8141
North Carolina	**Charlotte**	Cummins Atlantic, Inc. 11101 Nations Ford Road Charlotte, NC 28273 Telephone: (704) 588-1240 FAX: (704) 587-4870
North Carolina	**Charlotte**	Cummins Atlantic, Inc. 3700 North Interstate 85 Charlotte, NC 28206 Telephone: (704) 596-7401 FAX: (704) 596-3038
North Carolina	**Greensboro**	Cummins Atlantic, Inc. 513 Preddy Boulevard > = reensboro, NC 274[illegible]6 Telephone: (33[illegible]) 275-45[illegible]1 FAX: (336) 275-[illegible]304
North Dakota	**Fargo**	Cummins NPower, LLC 38[illegible] - 3[illegible]th Ave. SW Fargo ND 58[illegible]04 Telephone: (701) 282-2466 FAX: (701) 277-5399
North Dakota	**Grand Forks**	Cummins NPower, LLC 4728 Gateway Drive Grand Forks, ND 58201 Telephone: (701) 775-8197 FAX: (701) 775-4833
North Dakota	**Minot**	Cummins NPower, LLC 1501 - 20th Avenue, S.E. Minot, ND 58701 Telephone: (701) 852-3585 FAX: (701) 852-3588
Ohio	**Columbus**	Cummins Bridgeway, LLC 4000 Lyman Drive Hilliard (Columbus), OH 43026 Telephone: (614) 771-1000 FAX: (614) 771-0769
Ohio	**Cincinnati**	Cummins Interstate Power, Inc. 10470 Evendale Drive Cincinnati, OH 45241 Telephone: (513) 563-6670 FAX: (513) 563-0594
Ohio	**Cleveland**	Cummins Bridgeway, LLC 7585 Northfield Road Cleveland, OH 44146 Telephone: (440) 439-6800 FAX: (440) (440) 439-2131 Toll Free: (800) 243-6885

REFERENCE ONLY

Ohio	**Toledo**	Cummins Bridgeway, LLC 801 Illinois Avenue Maumee , OH 43537 Telephone: (419) 893-8711 FAX: (419) 893-5362
Ohio	**Youngstown**	Cummins Bridgeway, LLC 7145 Masury Road Hubbard (Youngstown), OH 44425 Telephone: (216) 534-1935 FAX: (216) 534-5606
Oklahoma	**Oklahoma City**	Cummins Southern Plains ,Ltd. 5800 West Reno Oklahoma City, OK 73127 Telephone: (405) 946-4481 (24 hours) FAX: (405) 946-3336
Oklahoma	**Tulsa**	Cummins Southern Plains, Ltd. 16525 East Skelly Drive Tulsa, OK 74116 Telephone: (918) 234-5240 FAX: (918) 234-2342
Oregon	**Coburg/Eugene**	Cummins Northwest, Inc. 91[illegible] Industrial Parkway Coburg, OR 97401 (Telephone: (541) 687-0000 FAX: (541) 687-1977 Toll Free Telephone (800)777-0336
Oregon	**Medford**	Cummins Northwest, Inc. 4045 Crater Lake Highway Medford, OR 97504-9796 Telephone: (541) 779-0151 FAX: (541) 772-2395 Toll Free Telephone (800)826-9414
Oregon	**Pendleton**	Cummins Northwest, Inc. 223 S.W. 23rd Street Pendleton, OR 97801-1810 Telephone: (541) 276-2561 FAX: (541) 276-2564 Toll Free Telephone (800)666-2561
Oregon	**Portland**	Cummins Northwest, Inc. 4711 N. Basin Avenue Portland, OR 97217-3557 Telephone: (503)286-5938 FAX: (503)286-5938 Toll Free Telephone: ((800)283-0336 FAX: (503)240-5553
Pennsylvania	**Philadelphia**	Cummins Power Systems, Inc. 2727 Ford Road Bristol, PA 19007 Telephone: (215) 785-6005 FAX: (215) 785-4085

REFERENCE ONLY

Pennsylvania	**Pittsburgh**	Cummins Power Systems, Inc. 3 Alpha Drive Pittsburgh, PA 15138-2901 Telephone: (412) 820-8300 FAX: (412) 820-8308
Pennsylvania	**Harrisburg**	Cummins Power Systems, Inc. 4499 Lewis Road Harrisburg, PA 17111-2541 Telephone: (717) 564-1344 FAX: (717) 558-8217
Puerto Rico		Cummins de Puerto Rico, Inc. Calle 1 G1 Urb. Industrial, Barrio Palmas Cataño ZIP / Postal Code: 00[illegible] Puerto Rico Telephone: (787) [illegible] FAX: (787) 275-2030
South Carolina	**Charleston**	Cummins Atlantic, Inc. 231 Farmington Road Charleston, SC 29483 Telephone: (843) 851-9819 FAX: (843) 875-4338
South Carolina	**Columbia**	Cummins Atlantic, Inc. 2791 Bishop Road Ext Columbia, South Carolina 29209 Telephone: (803) 799-2410 FAX: (803) 779-3427
South Dakota	**Sioux Falls**	Cummins Central Power, LLC 701 East 54th Street North Sioux Falls, SD 57104 Telephone: (605) 336-1715 FAX: (605) 336-1748
Tennessee	**Memphis**	Cummins Mid-South, LLC 670 Riverside Drive Memphis, TN 38173 Telephone: (901) 577-0600 FAX: (901) 522-8758
Tennessee	**Chattanooga**	Cummins South, Inc. 1509 East 26th Street Chattanooga, TN 37407-1095 Telephone: (423) 629-1447 FAX: (423) 629-1494
Tennessee	**Knoxville**	Cummins Cumberland, Inc. 1211 Ault Road Knoxville, TN 37914 Telephone: (423) 523-0446 FAX: (423) 523-0343
Tennessee	**Memphis**	Cummins Mid-South, LLC 1784 E. Brooks Road Memphis, TN 38116 Telephone: (901) 577-0666 FAX: (901) 522-8758

REFERENCE ONLY

Tennessee	**Nashville**	Cummins Cumberland, Inc. 706 Spence Lane Nashville, TN 37217 Telephone: (615) 366-4341 FAX: (615) 366-5693
Texas	**Arlington**	Cummins Southern Plains, Ltd. 600 N Watson Road Arlington, TX 76004-76011 Telephone: (817) 640-6801 FAX: (817) 640-6852
Texas	**Amarillo**	Cummins Southern Plains, Ltd. 5224 Interstate 40 - Expressway East Amarillo, TX 79120-1570 Telephone: (806) 373-3793 (24 hours) FAX: (806) 372-8547
Texas	**Dallas**	Cummins Southern Plains, Ltd. 3707 Irving Boulevard Dallas, TX 75247 Telephone: (214) 631-6400 (24 hours) FAX: (214) 631-2322
Texas	**El Paso**	Cummins Rocky Mountain, LLC 14[illegible]3 Gateway West El Paso, TX 79927 Telephone: (915) 852-4200 FAX: (915) 852-3295
Texas	**Fort Worth**	Cummins Southern Plains, Ltd. 3250 North Freeway Fort Worth, TX 76111 Telephone: (817) 624-2107 (24 hours) FAX: (817) 624-3296
Texas	**Houston**	Cummins Southern Plains, Ltd. 7045 North Loop East Houston, Texas 77028 Telephone: (713) 679-2220 FAX: (713) 679-7774
Texas	**Mesquite**	Cummins Southern Plains, Ltd. 2615 Big Town Blvd. Mesquite, TX 75150 Telephone: (214) 321-5555 (24 hours) FAX: (214) 328-2732
Texas	**Odessa**	Cummins Southern Plains, Ltd. 1210 South Grandview P.O. Box 633 Odessa, Texas 79761 Telephone: (915) 332-9121 (24 hours) FAX: (915) 333-4655
Texas	**San Antonio**	Cummins Southern Plains, Ltd. 6226 Pan Am Expressway North San Antonio, TX 78218-0385 Telephone: (512) 655-5420 (24 hours) FAX: (512) 655-3865

REFERENCE ONLY

Utah	**Salt Lake City**	Cummins Rocky Mountain, LLC 1030 South 300 West Salt Lake City, UT 84101 Telephone: (801) 524-1321 FAX: (801) 524-1351
Virginia		
Virginia	**Richmond**	Cummins Atlantic, Inc. 3900 Deepwater Terminal Road Richmond, VA 23234 Telephone: (804) 232-7891 FAX: (804) 232-7428
Virginia	**Tidewater**	Cummins Atlantic, Inc. 3729 Holland Blvd. Chesapeake, VA 23323 Telephone: (757) 485-4[illegible]48 FAX: (757) 485-5[illegible]
Washington	**Seattle**	Cummins Nort[illegible]west, Inc 811 S.W. Grad[illegible] Way Renton, WA 980[illegible] Telep[illegible]one: (425) 235-3400 FA[illegible]: (425)235-8202 Toll Fre[illegible]: (800) 274-0336
Washington	**Chehalis**	Cummin[illegible]orthwest, Inc. 926 N[illegible]W. Maryland Cheh[illegible]is, WA 98532-0339 Tel[illegible]phone: (360) 748-8841 FAX: (360) 748-8843 Toll Free: (800) 451-5506
Washington	**Spokane**	Cummins Northwest, Inc. 11134 W. Westbow Blvd. Spokane, WA 99204 Telephone: (509) 455-4411 FAX: (509) 624-4681 Toll Free: (800) 825-2122
Washington	**Tac[illegible]ma**	Cummins Northwest, Inc. 3701 Pacific Highway East Tacoma, WA 98424-1135 Telephone: (253) 922-2191 FAX: (253) 922-2379
Washingt[illegible]n	**Yakima**	Cummins Northwest, Inc. 1905 East Central Avenue Yakima, WA 98901 Telephone: (509) 248-9033 FAX: (509) 248-9035 Toll Free: (800) 688-9033
West Virginia	**Charleston**	Cummins Cumberland, Inc. 3100 MacCorkle Ave. SW P.O. Box 8456 South Charleston, WV 25303 Telephone: (304) 744-6373 FAX: (304) 744-8605

REFERENCE ONLY

West Virginia	**Fairmont**	Cummins Cumberland, Inc. Rt 73 So. 145 Middletown Rd Fairmont, WV 26554 Telephone: (304) 367-0196 FAX: (304) 367-1077
Wisconsin	**DePere**	Cummins NPower, LLC Corporate Office 875 Lawrence Drive DePere, WI 54115-5070 Telephone: (920) 337-1991 FAX: (920) 337-9746
Wisconsin		Cummins NPower, LLC 939 Lawrence Dr DePere, Wisconsin 541[illegible] Telephone: (920) 336-963[illegible] FAX: (920) 7336-8[illegible]
Wisconsin	**Eau Claire**	Cummins N[illegible]ower, LLC W2600 Jo[illegible]ke Road P. O. Box [illegible]070 Eau Claire, [illegible]isco[illegible]n 54701 Te[illegible]ephone: (715)830-0996 [illegible]AX: (715) 830-1087
Wisconsin	**Milwaukee**	C[illegible]mmins NPower, LLC 840[illegible] West Ryan Road [illegible]k Creek, WI 53154 T[illegible]ephone: (414) 768-7400 [illegible]AX: (414) 768-9441
Wisconsin	**Wausau**	Cummins NPower, LLC 7815 Camp Phillips Rd Wausau, WI 54476 Telephone: (715) 359-6888 FAX: (715) 359-3744
Wyoming	**[illegible]illett[illegible]**	Cummins Rocky Mountain, LLC 2700 Hwy. 14 & 16 North P.O. Box 1207 (82717) Gillette, WY 82716 Telephone: (307) 682-9611 FAX: (307) 682-8242 Toll Free: (800) 773-9611
Wyomin[illegible]	**Rock Springs**	Cummins Rocky Mountain, LLC 2000 Foothill Blvd. P.O. Box 1634 Rock Springs, WY 82901 Telephone: (307) 362-5168 FAX: (307) 362-5171

REFERENCE ONLY

Distributors and Branches - Canada

Alberta	**Edmonton**	Cummins Western Canada 11751 - 181 Street Edmonton, AB T5S 2K5 Telephone: (780) 455-2151 FAX: (780) 454-9512
Alberta		Cummins Western Canada 4887 - 35th Street S.E. Calgary, Alberta T2B 3H6, Canada Telephone: (403) 569-1122 FAX: (403) 569-0027
Alberta	**Hinton**	Cummins Western Canada 122 Hampshire Road Hinton, Alberta T7V 1G8, Canada Telephone: (780) 865-5711 FAX: (780) 865-5714
Alberta	**Lethbridge**	Cummins Western Canada 4005 - 14th Ave N Lethbridge, Alberta T1H 6P6, Canada Telephone: (403) 329-6144 FAX: (403) 320-5383
British Columbia	**Vancouver**	Cummins Western Canada 18452 - 26th Avenue Surrey, B.C., Canada V4N 3P8 Telephone: (604) 882-5000 FAX: (604) 882-5080
British Columbia	**Kamloops**	Cummins Western Canada 976 Laval Crescent Kamloops, B.C. Canada V2C 5P5 Telephone: (250) 828-2388 FAX: (250) 828-6713
British Columbia	**Prince George**	Cummins Western Canada Prince George, B.C. V2M 6E9 Telephone: (250) 564-9111 FAX: (250) 564-5853
British Columbia	**Sparwood**	Cummins Western Canada 731 Douglas Fir Road Sparwood, B.C. VOB 2GO, Canada Telephone: (250) 425-0522 FAX: (250) 425-0323
New Brunswick	**Fredericton**	Cummins Eastern Canada, LP R.R.#1 Doak Road Fredericton, New Brunswick E3B 4X2, Canada Telephone: (506) 451-1929 FAX: (506) 451-1927
Newfoundland	**St. John's**	Cummins Eastern Canada, LP 122 Clyde Avenue Donovans Industrial Park Mount Pearl, Newfoundland A1N 2C2 Canada Telephone: (709) 747-0176 FAX: (709) 747-2283

REFERENCE ONLY

Newfoundland	**Wabush**	Cummins Eastern Canada, LP Wabush Industrial Park Wabush, Newfoundland A0R 1B0 Telephone: (709) 282-3626 FAX: (709) 282-3108
Nova Scotia	**Halifax**	Cummins Eastern Canada, LP 50 Simmonds Drive Dartmouth, Nova Scotia B3B 1R3 Telephone: (902) 468-7938 FAX: (902) 468-5177
Ontario		
Ontario	**Kenora**	Cummins Mid-Canada Ltd. Highway 17 East P.O. Box 8 Kenora, Ontario P9N 3X1 Telephone: (807) 548-7241 FAX: (807) 548-8302
Ontario	**Ottawa**	Cummins Eastern Canada, LP 3189 Swansea Crescent Ottawa, Ontario K1G 3W5, Telephone: (613) 736-1146 FAX: (613) 736-1202
Ontario	**Thunder Bay**	Cummins Eastern Canada, LP 1460 W. Walsh Street Thunder Bay Ontario P7E 4X4 Telephone: (807) 577-7561 FAX: (807) 577-1727
Quebec	**Dorval**	Cummins, Eastern Canada, LP 580 Lepihe Dorval, Quebec H9H 1G2 Telephone: (514) 631-5000 FAX: (514) 631-0104
Quebec	**Quebec City**	Cummins Eastern Canada, LP Branch of Cummins Americas, Inc. 2400 Watt Street Ste Foy, Quebec G1P 3T3 Canada Telephone: (418) 651-2911 FAX: (418)651-0965
Quebec	**Val D'Or**	Cummins, Eastern Canada, LP Val D'Or, Quebec J9P 4P6 Telephone: (514) 695-8410 FAX: (514) 695-8917
Saskatchewan	**Lloydminster**	Cummins Western Canada 3709 - 44th Street Lloydminster, SK S9V 0Y9 Telephone: (305) 825-2062 FAX: (305) 825-6702
Saskatchewan	**Regina**	Cummins Western Canada 110 Kress Street Regina, SK S4P 2Z5 Telephone: (306) 721-9710 FAX: (306) 721-2962

REFERENCE ONLY

Saskatchewan	**Saskatoon**	Cummins Western Canada 3001 Faithful Avenue Saskatoon, SK S7K 4R4, Canada Telephone: (306) 933-4022 FAX: (306) 242-1722

REFERENCE ONLY

Distributors and Branches - 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
	Shenyang	Cummins Engine (China) Investment Co. Ltd. ShenYang Workshop & Branch Office. No.5-2 Seventh Street, Shenyang Economic-Technological Development Area, Shenyang, Liaoning 110141, China. Telephone: (86-24) 2556611 Fax: (86-24) 2536559
	Kunming	Cummins (China) Investment Co. Ltd. Kunming Branch. Room 606, Hongta Mansion, No.155 Beijing Road, Kunming, Yunnan 650011, Telephone: (86-871) 3579471/511/579/958 Fax: (86-871) 3579210
	Shanghai	Cummins (China) Investment Co., Ltd. Shanghai Distributor Branch. No. 581, New jin Qiao Road, Pu Dong New Area, Shanghai, Shanghai 201206, China. Telephone: (86-21) 50318966 Fax: (86-21) 50318528
	Urumqi	Cummins Engine (China) Investment Co., Ltd Urumqi Branch. No.7,Shanghai Rd. Urumqi, Xinjiang 830011, China. Telephone: (86-991) 3780332/5/6/7/8/9 Fax: (86-991) 3780334
	Wuhan	Cummins Engine (China) Investment Co., Ltd. Wuhan Branch. No.2 Zhang Po Road, Dong Xi Hu District, A-Kaili Commercial Building, Wuhan, Hubei 430040, China. Telephone: (86-27) 83081677 Fax: (86-27) 83259369 / 83259370
	Guangzhou	Cummins (China) Investment Co., Ltd. Guangzhou. Branch G/F, Unit 1 & 2, Block 5, Xing Hui Yuan, NO. 46, Jinsui Road, Zhu Jiang New City, Guangzhou, Guangdong 510623, China. Telephone: (86-20) 38621009 Fax: (86-20) 38621144

REFERENCE ONLY

	Shenzhen	Shenzhen Chongfa Cummins Engine Company Ltd. Tian An Che Gong Miao Industrial Estate,Unit F2.6 - 2D, Shenzhen Shennan Da Dao, Shenzhen, Guangdong 518040, China. Telephone: (86-755) 83415479 Fax: (86-755) 83415480

REFERENCE ONLY

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 1151 Bunbury, WA 6230 Australia Location: 1 Dyanda 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

REFERENCE ONLY

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 Gallagher 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

REFERENCE ONLY

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 2[illegible]19 Mount Gambier, 5290 South Australia, Australia Location: [illegible] Avery 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

REFERENCE ONLY

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

REFERENCE ONLY

Distributors and Branches - New Zealand

Auckland		Cummins Engine Company, Pty. Ltd. Private Bag 92804 Penrose, Auckland, New Zealand Location: 440 Church Street Penrose Telephone: (64-9) 579-0085
Branches:	**Auckland**	Cummins Engine Company, Pty. Ltd. Private Bag 92804 Penrose, Auckland, New Zealand Location: 440 Church Street Penrose Telephone: (64-9) 579-0085
Branches:	**Christchurch**	Cummins Engine Company, Pty. Ltd. P.O. Box 16149 Hornby, Christchurch, New Zealand Location: 35 Parkhouse Road Sockburn, Christchurch Telephone: (64-3) 348-8170
Branches:	**Dunedin**	Cummins Engine Company, Pty. Ltd. P.O. Box 2333 South Dunedin, New Zealand Location: 8 Devon Street Dunedin Telephone: (643) 477-8818
Branches:	**Palmerston North**	Cummins Engine Company, Pty. Ltd. P.O. Box 9024 Palmerston North, New Zealand Location: 852-860 Tremaine Avenue Telephone: (64-6) 356-2209
Branches:	**Rotorua**	Cummins Engine Company, Pty. Ltd. P.O. Box 934 Rotorua, New Zealand Location: 328 Te Ngae Road Rotorua Telephone: (647) 345-6699

REFERENCE ONLY

Regional Offices - International - Locations

Regional Office - Daventry

Cummins Engine Co. Ltd (Serving Czech Republic), (Middle East), (Africa)
Royal Oak Way South
Daventry, Northamptonshire
ZIP / Postal Code: NN11 8NU
Brussels
Telephone: (44-1327) 886 000
Fax: (44-1327) 886 100

Region	Africa	
Countries Covered:	Burkina Faso	Burundi
	Cameroon	Central African Republic
	Chad	Congo (Democratic Republic),
	Congo (People's Republic)	Cote d'Ivoire (Ivory Coast)
	Djibouti	Equatorial Guinea
	Eritrea	Ethiopia
	Gabon	Gambia
	Ghana	Guinea
	Guinea-Bissau	Kenya
	Liberia	Libya
	Mali	Malta
	Mauritania	Morocco
	Niger	Nigeria
	Rwanda	Sao Tome & Principe
	Senegal	Sierra Leone
	Somalia	Togo
	Tunisia	Uganda
	Cape Verde	
Region	Czech Republic	
Countries Covered:	Austria	Czech Republic
	Hungary	Poland
Region	Middle East	
Countries Covered:	Afghanistan	Bahrain
	Cyprus	Egypt
		Iraq
	Jordan	Kuwait
	Lebanon	Oman
	Pakistan	Qatar
	Republic of Yemen	Saudi Arabia
	Turkey	United Arab Emirates

Cumbrasa Regional Office - Brazil

Cummins Brasil Ltda.
Rua Jati, 266
07180-900 Guarulhos
Sao Paulo, Brazil
Telephone: (55-11) 6465-9811
Fax: (55-11) 6412-1483

Country Covered:	Brazil

REFERENCE ONLY

Beijing Regional Office - China

Cummins Corporation Bejing Branch (CCBJ)
28, Tower A, Gateway, 18, Xiaguangli
North Road, East Third Ring
Chaoyang District
Beijing 100027
People's Republic of China
Telephone: (86-10) 84548888
Fax: (86-10) 6462-0226

Countries Covered:
- China
- Hong Kong S.A.R
- Mongolia
- Taiwan

Gross-Gerau Regional Office - Germany

Cummins Diesel Deutschland GmbH
Odenwaldstr. 23
Groß-Gerau 64521
Germany
Telephone: (49-6152) 174-0
Fax: (49-6152) 174-141

Countries Covered:
- Germany
- Switzerland

Cummins India Ltd.

Kothrud
Pune, Maharashtra
ZIP / Postal Code: 411029
India
Telephone: (91-20) 2538-5435 / 5240 / 1105
Fax: (91-20) 2538-0125

Countries Covered:
- Bhutan
- India
- Nepal

Tokyo Regional Office - Japan

Cummins Japan Ltd.
2nd Floor, Ichibashi Shiba Bldg
13-14, Shiba 2-chome
Minato, Tokyo
ZIP / Postal Code: 105-0014
Japan
Telephone: (81-3) 5444-7600
Fax: (81-3) 5444-0530

Country Covered:
- Japan

REFERENCE ONLY

Seoul Regional Office - Korea

Cummins Korea Ltd.
25th floor, ASEM tower
159-1, Samsung-Dong
Kangnam-ku, Seou
ZIP / Postal Code: 135-798
South Korea
Telephone: (82-2) 3420-0901
Fax: (82-2) 3452-4113 / 539-6569

Country Covered: South Korea

Col. Polanco Regional Office - Mexico

Cummins, S. de R.L. de C.V.
Arquimedes No. 209
Col. Polanco
4605 Modern Lane
Mexico, Distrito Federal
ZIP / Postal Code: 11560
Mexico
Telephone: (52-5) 254-3822 / 3783 / 3622
Fax: (52-5) 254-3645

Country Covered:

- Mexico
- Guatemala
- Honduras
- Costa Rica
- Nicaragua
- Panama

Moscow Regional Office - Russia

Cummins Engine Co., Inc.
Park Place
Office E708
113/1 Leninsky Prospect
Russia 117198
Telephone: (7-495) 956-51-22 / 23
Fax: (7-495) 956-53-62

Countries Covered:

- Armenia
- Azerbaijan
- Belarus
- Tajikistan
- Georgia
- Kyrgyzstan
- Kazakhstar
- Moldova
- Russia
- Turkmenistan
- Ukranie
- Uzbekistan

REFERENCE ONLY

Southeast Asia Regional Office - Singapore Singapore	
Cummins Diesel Sales Corporation 8 Tanjong Penjuru ZIP / Postal Code: 609019 Singapore Telephone: (65) 265-0155 Fax - Parts/MIS/Shipping: (65) 6264-0664	

Countries Covered:

- Bangladesh
- Brunei
- Cambodia
- Indonesia
- Laos
- Malaysia
- Philippines
- Singapore
- Sri Lanka
- Thailand
- Vietnam

Latin America Regional Office - Miramar (U.S.A.)	
Cummins Americas, Inc. 3350 SW 148 Avenue Suite 205 Miramar, FL 33027 U.S.A. Telephone: (954) 431-5511 Fax: (954) 433-5797	

Countries Covered:

- Argentina
- Bolivia
- Chile
- Colombia
- Dominica
- Dominican Republic
- El Salvador
- Ecuador
- Costa Rica
- Guatemala
- Honduras
- Nicaragua
- Paraguay
- Peru
- Uruguay
- Venezuela

REFERENCE ONLY

Distributors - International - Locations

Cummins Middle East FZE	**Cummins Middle East FZE**	P.O. Box No 17636, Units ZF 05 & 06 Jebel Ali Free Zone, Dubai United Arab Emirates Telephone: 00 9714 8838998 Fax: 00 9714 8838997
United Arab Emirates	**Cummins Emirates Sales & Service LLC**	P.O. Box No 54044 Al Quoz Industrial Estate, Dubai United Arab Emirates Telephone: 00 9714 3478184 Fax: 00 9714 3478185 Toll Free: 800 4184
United Arab Emirates	**Cummins Emirates Sales & Service LLC**	P.O. Box No 70242, Abu Dhabi United Arab Emirates Telephone: 00 9712 6[illegible] Fax: 00 9712 6722981
ALBANIA		(Please contact the Central & Eastern European Regional Office) Cummins Diesel Deutschland GmbHGross-Gerau Odenwaldstraße 23 Groß-Gerau Zip / Postal Code: 64521 Germany Telephone: (49-6152) 174-0 Fax: (49-6152) 174-141
ALGERIA		(Please contact) Cummins Diesel S.A. 39 rue Ampère BP 190 Chassieu cédex 69680 France Telephone: (33-4) 72 22 92 72 Fax: (33-4) 78 90 19 56
ALGERIA		-See SOUTH PACIFIC ISLANDS (Please contact) Cummins 2 Caribbean Drive Scoresby 3179 Victoria AUSTRALIA Telephone: (61-3) 9765-3222 Fax: (61-3) 9763-0079
ANDORRA		- See European Regional Office - Mechelen
ANDORRA		Cummins Belgium Egide Walschaertsstraat, 2 Industriepark Zuid 2800 Mechelen Belgium Europe Telephone: (32-15) 47 91 00 Fax: (32-15) 27 56 86
ANDORRA		

REFERENCE ONLY

ANGOLA	**(Please contact) Cummins Diesel South Africa (Pty) Ltd**	13 Eastern Service Road Kelvin (Neighbourhood), Alexandra Rua Major Kahangulo, 134/140 Gauteng, South Africa ZIP / Postal Code: 2054 South Africa Telephone: (27-11) 321 8700 Fax: (27-11) 444 2012
ANTIGUA		Miami (Office In U.S.A.) Cummins Power South, LLC 9900 N.W. 77 Ave. Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992
ARGENTINA	**Buenos Aires**	Distribuidora Cummins, S.A. Ruta Panamericana KM [illegible] El Talar de Pacheco, Buenos Aires ZIP / Postal Code: CP [illegible] Argentina Telephone: (54-11) 4736-6400 Fax: (54-11) 4736-[illegible]6466
ARUBA, ISLAND OF		(Please contact) Cummins Power South, LLC 9900 N.W. 77th Ave. Hialeah Gardens, Florida 33016 Telephone: (1-305) 821-4200 Fax: (1-305) 557-2992
AUSTRALIA	**Bunbury**	Cummins 11 Dryanda Court Picton Bunbury, Western Australia 6229 Telephone: (61-8) 9725-6777 Fax: (61-8) 9725-6444
AUSTRALIA	**Cairns**	Cummins 11 Liberty Street Cairns, Queensland 4870 Australia Telephone: (61-7) 935-2999 Fax: (61-7) 4035 2909
AUSTRALIA	**Campbellfield**	Cummins 1788-1800 Hume Highway Campbellfield, Victoria 3061 Australia Telephone: (613) 9357-9200 Fax: (613) 9357 9916
AUSTRALIA	**Dandenong**	Cummins 46 Greens Road Dandenong, Victoria 3175 Australia Telephone: (613) 9706-8088 Fax: (613) 9706 8016
AUSTRALIA	**Darwin**	Cummins Lot 1758 Graffin Crescent Winnellie, Darwin Northern Territory 0820 Australia Telephone: (61-8) 8947-0766 Fax: (61-8) 8984 4569

REFERENCE ONLY

AUSTRALIA	**Devonport**	Cummins 2 Matthews Way Devonport, Tasmania 7310 Australia Telephone: (61-3) 6424-8800 Fax: (61-3) 6424 2200
AUSTRALIA	**Emerald**	Cummins 23 Old Sheepyard Place Emerald, Queensland 4720 Australia Telephone: (61-7) 4982 4022 Fax: (61-7) 4982 4159
AUSTRALIA	**Grafton**	Cummins 18 - 20 Induna Street South Grafton, New South Wales 2460 Australia Telephone: (61-2) 6641 0900 Fax: (61-2) 6641 1099
AUSTRALIA	**Hexham**	Cummins Engine Company, Pty. Ltd. 21 Galleghan Street Hexham Newcastle, New South Wales, Australia 2322 Telephone: (61-2) 4964-8466 Fax: (61-2) 4964-8616
AUSTRALIA	**Kalgoorlie**	Cummins Lot 6 Great Eastern Highway Cnr Hunter Street Kalgoorlie, Western Australia ZIP / Postal Code: 6430 Australia Telephone: (61-8) 9080 1300 Fax: (61-8) 9091 7933
AUSTRALIA	**Karratha**	Cummins 1964 Anderson Road Karratha, Western Australia 6714 Australia Telephone: (61-8) 9144 4646 Fax: (61-8) 9143 1507
AUSTRALIA	**Laverton**	Cummins 191-195 Boundary Road Laverton North, Victoria 3026 Australia Telephone: (61-3) 8368 0800 Fax: (61-3) 9360 0438
AUSTRALIA	**Leeton**	Cummins 29 Brady Way Leeton, NSW 2705 Australia Telephone: (61-2) 6953-3077 Fax: (61-2) 6953-3109

REFERENCE ONLY

AUSTRALIA	**Mackay**	Cummins 46 Southgate Drive Paget, Queensland ZIP / Postal Code: 4740 Australia Telephone: (61-7) 4952 8100 Fax: (61-7) 4952 5631
AUSTRALIA	**Mount Gambier**	Cummins 2 Avey Road Mount Gambier, South Australia 5290 Australia Telephone: (61-8) 8725 6422 Fax: (61-8) 8724 9764
AUSTRALIA	**Penrith**	Cummins Total Truck Centre141 Coree Avenue Penrith, New South Wales Australia Telephone: (61-2) 47 2 8 Fax: (61-2) 4 31 1140
AUSTRALIA	**Queanbeyan**	Cummins 15-1 Bayldon Road Queanbeyan, New South Wales 2620 Australia Telephone: (61-2) 6297 3433 Fax: ( ) 6297 6709
AUSTRALIA	**Swan Hill**	Cummins 5 McAllister Road Swan Hill, Victoria 3585 Australia Telephone: (61-3) 5033 1511 Fax: (61-3) 5032 9662
AUSTRALIA	**Tamworth**	Cummins Lot 65 Gunnedah Road Tamworth, New South Wales 2340 Australia Telephone: (61-2) 6765 5455 Fax: (61-2) 6765 5443
AUSTRALIA	**Townsville**	Cummins 704-710 Ingham Road Townsville, Queensland 4810 Australia Telephone: (61-7) 4774 7733 Fax: (61-7) 4774 7640
AUSTRALIA	**Welshpool**	Cummins 443 Horrie Miller Drive Industrial Park Perth International Airport, Western Australia 6105 Australia Telephone: (61-7) 9475 8777 Fax: (61-7) 9475 8666
AUSTRALIA	**Wetherill Park**	Cummins 492-494 Victoria Street Wetherill Park, New South Wales 2164 Australia Telephone: (61-2) 9616 5300 Fax: (61-2) 9616 5399

REFERENCE ONLY

AUSTRALIA	**Wodonga**	Cummins 9 - 11 McKoy Street Wodonga, Victoria 3690 Australia Telephone: (61-2) 6024 3655 Fax: (61-2) 6024 3102
AUSTRIA	**Neudörfl**	Cummins Bickfordstraße 25 Neudörfl, Burgenland 7201 Austria Telephone: (43-2622) 77418 0 Fax: (43-2622) 77418 4
BAHAMAS	**Miami (Office in U.S.A.)**	Cummins Power South, LLC 9900 N W 77th Ave. Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992
BAHRAIN	**Bahrain**	Yusuf Bin Ahmed Kanoo W.L.L. Commercial Division 832 Mailees Al Tawoos Highway, Al-Hamriya 611, Sitra Manama ZIP / Postal Code: Kingdom of Bahrain Bahrain Telephone: (973) 17 738200 Fax: (973) 17 732828
BALEARIC ISLANDS	**Madrid (Office in Spain)**	Cummins Ventas y Servicio, S.A. Torrelaguna, 56 Madrid 28027 Spain Telephone: (34-91) 367-2000 376-2404 Fax: (34-91) 407 6604
BANGLADESH	**MIR Trading Co.**	House #55/1, Road # 8/A Dhamondi R/A Dhaka 1205 Bangladesh Telephone: (880-2) 8959425-7, 8960680-1, 8960643 Fax: (880-2) 8961373
BARBADOS	**Miami (Office in U.S.A.)**	Cummins Power South, LLC 900 N W 77th Ave. Hialeah Gardens, Florida 33016 Telephone: (305) 821-821-4200 Fax: (305) 557-2992
BELGIUM	**Mechelen**	Cummins Distributor Egide Walschaertsstraat, 2 Industriepark Zuid Mechelen ZIP / Postal Code: 2800Belgium Telephone: (32-15) 479 100 Fax: (32-15) 275 686
BELIZE	**Tampa (Office in U.S.A.)**	Cummins Power South, LLC 5421 N. 59th Street Tampa, FL 33610 Telephone: (813) 621-7202 Fax: (813) 621-8250

REFERENCE ONLY

BENIN		- See Togo
BENIN	**TOGOMAT s.a.**	Zone Industrielle CNPPME Lome Togo Telephone: (228) 2272395 Fax: (228) 2270310
BERMUDA	**Bronx (Office in U.S.A.)**	Cummins Metropower, Inc. 890 Zerega Avenue Bronx, NY 10473 Telephone: (718) 892-2400 Fax: (718) 892-0055
BHUTAN	**Pune (Office in India)**	Cummins Diesel Sales & Service (India) Ltd 35A/1/2, Erandawana Pune, Maharashtra 411038 India Telephone: (91-20) 25431283/7 25432666 25431773 Fax: (91-20) 25439400
BOTSWANA **- See Southern Africa Regional Office - Kelvin**	**Cummins Diesel South Africa (Pty)**	9 Impala Road Kelvin (Neighbourhood), Alexandra Gauteng, South Africa 2054 South Africa Telephone: (27-11) 321 8800 Fax: (27-11) 444 3254
BRAZIL	**Belo Horizonte**	Distribuidora Cummins Minas Ltda. Anel Rodoviario, Km 01 - Bairro Olhos D'Agua Norte Belo Horizonte, Minas Gerais 31950 Brazil Telephone: (55-31) 3288-1344 Fax: (55-31) 3288-1141
BRAZIL	**Campo Grande**	Cummins Distribuidora de Motores Diesel e Equipamentos Ltda. Av. Rod. BR 163, nr. 5185 Campo Grande, MATO GROSSO DO SUL 79060 Brazil Telephone: (55-67) 387-8707 Fax: (55-67) 387-8707
BRAZIL	**Curitiba**	Distribuidora Parana de Motores Cummins Ltda. Abel Scuissiato 3020, Bairro Atuba Curitiba, PARANA 83408 Brazil Telephone: (55-41) 3675-4500 Fax: (55-41) 3675-6077
BRAZIL	**Fortaleza**	Distribuidora Cummins Diesel do Nordeste Ltda BR 116, km.10 - nr.10.001, Messejana Fortaleza, CEARA ZIP / Postal Code: 60871 Brazil Telephone: (55-85) 4011-6400 Fax: (55-85) 4011-6400

REFERENCE ONLY

BRAZIL	**Goianian**	Distribuidora Cummins Centro Oeste Ltda. Centro Oeste Ltda. Av. Caiapo , 777 Bairro Santa Genoveva Goiania, GOIAS 74672 Brazil Telephone: (55-62) 269-1010 / 1011 Fax: (55-62) 269-1032 / 1021
BRAZIL	**Manaus**	Powertech Comercial Ltda. Av. Efigenio Sales 1717 - Parque 10 Estrada da Ponta Negra, 6080 - Sao Manaus, AMAZONAS 69060 Brazil Telephone: (55-92) 642-2014 Fax: (55-92) 236-6711
BRAZIL	**Porto Alegre**	Distribuidora Meridional Motores Cummins Ltda. Av. Assis Brasil , 9000 Porto Alegre, RIO GRANDE DO SUL 91140 Brazil Telephone: (55-51) 3021-2288 Fax: (55-51) 3364-2288
BRAZIL	**Rio de Janeiro**	Cummins Distribuidora de Motores Diesel e Equipamentos Ltda. Av. Brasil, 20289 Rio de Janeiro, RIO DE JANEIRO 21515 Brazil Telephone: (55-21) 2196-3131 Fax: (55-21) 2196-3121
BRAZIL	**Sao Paulo**	Cummins Distribuidora de Motores Diesel e Equipamentos Ltda. Rua Coronel Euclides Machado, 52 Freguesia do O Sao Paulo, SAO PAULO 02713 Brazil Telephone: (55-11) 3931-2900 Fax: (55-11) 3931-2900
BRITISH VIRGIN ISLANDS		- See Puerto Rico
BRITISH VIRGIN ISLANDS	**Cummins de Puerto Rico, Inc.**	Calle 1 G1 Urb. Industrial, Barrio Palmas Cataño 00962 Puerto Rico Telephone: (787) 275-2000 Fax: (787) 275-2030
BRUNEI		- See Malaysia
BRUNEI	**Scott & English (M) Sdn Bhd**	12 Jalan U1/15, Seksyen U1 Hicom-Glenmarie Industrial Park Shah Alam, Selangor Darul Ehsan 40150 Malaysia Telephone: (60-3) 7805-1111 Fax: (60-3) 7803-5122
BURKINA - FASO		- See North/West/East and Central Africa Regional Office - Daventry

REFERENCE ONLY

BURKINA - FASO	**Cummins Engine Company Ltd**	Royal Oak Way South Daventry, Northants ZIP / Postal Code: NN11 5NU United Kingdom Telephone: (44-1327) 886000 Fax: (44-1327) 886106
BULGARIA		-See Germany Regional Office - Gross-Gerau
BULGARIA	**Cummins Diesel Deutschland GmbH**	Odenwaldstraße 23 Groß-Gerau, Hessen 64521 Germany Telephone: (49-6152) 174-0 Fax: (49-6152) 174-141
BURMA	**Kuala Lumpur (Office In Malaysia)**	Scott & English (M) Sdn Bhd 12 Jalan U1/15, Seksyen U1 Hicom-Glenmarie Industrial Park Shah Alam, Selangor Darul Ehsan 40150 Malaysia Telephone: (60-3) 7805-1111 Fax: (60-3) 7803-5132
BURUNDI	**Brussels (Office in Belgium)**	Cummins Belgium N.V./S.A. Egide Walschaertsstraat, 2 Industriepark Zuid Mechelen 2800 Belgium Telephone: (32-15) 479 100 Fax: (32-15) 275 686
CAMBODIA		Scott & English (Cambodia) Ltd. No. 20A E0/E1 Russian Boulevard Phnom Penh Cambodia Telephone: (855-23) 723741 Fax: (855-23) 723741
CANARY ISLANDS	**Madrid (Office in Spain)**	Cummins Ventas y Servico S. A. Torrelaguna 56 Madrid 28027 Spain Telephone: (34-91) 367 20 00 / 367 24 04 Fax: (34-91) 407 66 04
CAPE VERDE		- See ECV Portugal Electro Central Vulcanizadora, Lda Rua Conselheiro Martins de Carvalho Lote 1480 Restelo Lisbon ZIP / Postal Code: 1400 Portugal Telephone: (351-21) 3034800 Fax: (351-21) 3034801 / 2
CENTRAL AFRICAN REPUBLIC		- See North/West Africa Regional Office - Daventry Cummins Engine Company Ltd Royal Oak Way South Daventry, Northants NN11 5NU United Kingdom Telephone: (44-1327) 886000 Fax: (44-1327) 886106

REFERENCE ONLY

CHAD		- See North/West/East and Central Africa Regional Office - Daventry Cummins Engine Company Ltd Royal Oak Way South Daventry, Northants NN11 5NU United Kingdom Telephone: (44-1327) 886000 Fax: (44-1327) 886106
CHILE	**Santiago**	Distribuidora Cummins Chile, S.A. Avda. Americo Vespucio # 0631 Santiago, Quilicura ZIP / Postal Code: 873-0596 Chile Telephone: (56-2) 655-725[illegible] / 72[illegible]5 Fax: (56-2) 655-7216 / 7436
CHINA, PEOPLE'S REPUBLIC	**Beijing**	Cummins Engine (Beij[illegible]) Co., [illegible]. No. 8, Wan Yua[illegible]et Beijing Econo[illegible]c and [illegible]chn[illegible]logy Development Zone Beijing, 10017[illegible] People's Repu[illegible]lic of Ch[illegible]na Telepho[illegible]ne: (86-10[illegible]82258 Fax: [illegible]6-10) 67882285
CHINA, PEOPLE'S REPUBLIC	**Shenyang**	Cu[illegible]mi[illegible]s Engine (China) Investment Co., Ltd. [illegible]hen[illegible]ang Worksh[illegible]& Branch Office No.5[illegible] Seventh Street Shen[illegible]ang Economic-Technological Development [illegible]a Shenyang, Liaoning 110141 China Telephone: (86-24) 25506611 Fax: (86-24) 25365599
CHINA, PEOPLE'S REPUBLIC	**Kunmi[illegible]g**	Cummins (China) Investment Co. Ltd. Kunming Branch Room 606, Hongta Mansion No.155 Beijing Road Kunming, Yunnan 650011 Telephone: (86-871) 3579471/511/579/958 Fax: (86-871) 3579210
CHINA, PEOPLE[illegible] REPUBLIC	**Shanghai**	Cummins (China) Investment Co., Ltd. Shanghai Distributor Branch No. 581, New jin Qiao Road Pu Dong New Area Shanghai, Shanghai 201206 China Telephone: (86-21) 50318966 Fax: (86-21) 50318528
CHINA, [illegible]EOPLE'S REPUBLIC	**Urumqi**	Cummins Engine (China) Investment Co., Ltd Urumqi Branch No.7,Shanghai Rd. Urumqi, Xinjiang 830011 China Telephone: (86-991) 3780332/5/6/7/8/9 Fax: (86-991) 3780334

REFERENCE ONLY

CHINA, PEOPLE'S REPUBLIC	**Wuhan**	Cummins Engine (China) Investment Co., Ltd. Wuhan Branch No.2 Zhang Po Road, Dong Xi Hu District A-Kaili Commercial Building Wuhan, Hubei 430040 China Telephone: (86-27) 83081677 Fax: (86-27) 83259369 / 83259370
CHINA, PEOPLE'S REPUBLIC	**Guangzhou**	Cummins (China) Investment Co., Ltd. Guangzhou Branch G/F, Unit 1 & 2, Block 5, Xing Hu NO. 46, Jinsui Road, Zhu Jiang New Ci Guangzhou, Guangdong 510623 China Telephone: (86-20) 3862 009 Fax: (86-20) 38621144
CHINA, PEOPLE'S REPUBLIC	**Shenzhen**	Shenzhen Chonofa ummins Engine Company Ltd. Tian An Ch Gong Mia Industrial Estate, Unit F2.6 - 2D Shenzhen hennan a Dao Shenzhen, ng 518040 Ch na elep one: (86-755) 83415479 Fax (86-755) 83415480
COLOMBIA	**Barranquilla**	Cu s de Colombia, S.A. alle 65 (Avenida Murillo) #6-31 D agonal a Gran Abastos oledad, Atlantico Colombia Telephone: (57-53) 282600 / 282601 / 282602 / 282603 / 282604 Fax: (57-53) 282640 / 282641
COLOMBIA	**Bog**	Cummins de los Andes S.A. Avenida Ciudad de Cali No. 11-22 Location: Bogota, Cundinamarca Colombia Telephone: (57-1) 294-8444 Fax: (57-1) 2294-8431
COLOMBIA	**Bucaramanga**	Cummins API Ltda. Kilómetro 7 Vía a Girón - Zona Industrial A.A. 1821 Bucaramanga, Colombia Bucaramanga, Santander Colombia Telephone: (57-76) 468060 / 469262 / 469263 Fax: (57-76) 468065
CO OMBIA	**Cali**	Tecnodiesel Limitada Apartado Aereo No. 6398 Carrera 8, No. 27-43 Cali, Valle Colombia Telephone: (57-2) 442-2422 Fax: (57-2) 442-1798

REFERENCE ONLY

COLOMBIA	**Medellin**	Equitel Carrera 52, # 10-184 Medellin, Antioquia Colombia Telephone: (57-4) 255-4200 Fax: (57-4) 255-4104
COLOMBIA	**Pereira**	Tecnodiesel Limitada Carrera 16 No. 9 - 68 Avenida Simon Bolivar, Dosquebradas Pereira, Risaralda Colombia Telephone: (57-63) 306102 Fax: (57-63) 300062
COMOROS		- See Southern Africa Regional Office - Kelvin
COMOROS		Cummins Diesel South Africa (Pty) Ltd 9 Impala Road Kelvin (Neighbourhood) Alexandra Gauteng, South Africa 2054 South Africa Telephone: (27-11) 328-8800 Fax: (27-11) 444 3254
CONGO, PEOPLE'S REPUBLIC	**Mechelen (Office in Belgium)**	Cummins Belgium N.V./S.A. Egide Walschaertsstraat, 2 Industriepark Zuid Mechelen 2800 Belgium Telephone: (32-15) 479 100 Fax: (32-15) 275 686
CORSICA		- See France (Please contact) Cummins Diesel S.A. 39 rue Ampère BP 190 Chassieu cédex 69680 Telephone: (33-4) 479 100 Fax: (33-4) 78 90 19 56
COSTA RICA	**San Jose**	Oficina Regional Cummins de Centro America Urbanización Rincón Verde Dos Casa 13E San Pablo de Heredía Costa Rica Telephone: (506) 238-1160 Fax: (506) 238-1108
CYPRUS	**Nicosia**	Alexander Dimitriou & Sons Limited 158 Limassol Ave Latsia Nicosia CY-2235 Cyprus Telephone: (357-22) 715 300 Fax: (357-22) 715 400

REFERENCE ONLY

CZECH REPUBLIC		- See Central & Eastern Europe Cummins Czech Republic s.r.o. Komercni zona Pruhonice Cestlice Obchodni 132 Praha, Prague 251 01 Czech Republic Telephone: (420-272) 680 110 Fax: (420-272) 680 090
DENMARK	**Glostrup**	Cummins Diesel Salg & Service A/S Hovedvejen 233B, Osted Roskilde 4000 Denmark Telephone: (45-46) 42 35 5 Fax: (45-46) 42 30 50
DJIBOUTI		- See North/West/East and Central Africa
DJIBOUTI		Cummins Engine Company Ltd Royal Oak Way South Daventry, Northants ZIP / Postal Code: NN11 5NU United Kingdom Telephone: (44-1327) 886000 Fax: (44-1327) 886106
DOMINICAN REPUBLIC	**Santo Domingo**	Arglco C. por A. Calle Jose A. Soler No.3 Esq. Lope de Vega Santo Domingo, Distrito Nacional Dominican Republic Telephone: (809) 562-6281 Fax: (809) 562-4233
DUBAI		- See United Arab Emirates
DUBAI		Cummins Middle East FZE P.O. Box No 17636, Units ZF 05 & 06 Jebel Ali Free Zone, Dubai United Arab Emirates Telephone: (00 9714) 8838998 Fax: (00 9714) 8838997
DUBAI	**United Arab Emirates**	Cummins Emirates Sales & Service LLC P.O. Box No 54044 United Arab Emirates Telephone: (00 9714) 3478184 Fax: (00 9714) 3478185 Toll Free: (800) 4184
ECUADOR	**Guayaquil**	Indusur S.A. Ave. Carlos Julio Arosemena Km. 4 Guayaquil, Guayas Ecuador Telephone: (593-4) 220-1177 / 220-0655 Fax: (593-4) 220-1052
ECUADOR	**Quito**	Rectificadora Botar S.A. Av. 10 de Agosto # 5980 Quito, Pichincha Ecuador Telephone: (593-2) 2265-177 / 2265-209 / 2265-225 / 2265-193 Fax: (593-2) 2459-031

REFERENCE ONLY

EGYPT	**Cairo**	Egyptian International Motors CO. Ltd (EIM) Autostrade Road Al-Mugattam, Cairo Egypt Telephone: (20-2) 5061600 / 1 / 2 Fax: (20-2) 5065620
EL SALVADOR	**San Salvador**	Maquinaria Salvadoreña, S.A. de C.V. Blvd. Ejercito Nacional y 54 Ave. Norte Edificio MAQSA San Salvador El Salvador El Salvador Telephone: (503) 2293-1666 Fax: (503) 2293-1656
ENGLAND		- See United Kingdom
ENGLAND		Cummins UK Rutherford Drive Park Farm South Wellingborough, Northants ZIP / Postal Code: NN8 6AN United Kingdom Telephone: (44-1933) 334200 Fax: (44-1933) 334198
EQUATORIAL GUINEA		- See North/West/East and Central Africa Regional Office - Daventry
EQUATORIAL GUINEA		Cummins Engine Company Ltd Royal Oak Way South Daventry, Northants ZIP / Postal Code: NN11 5NU United Kingdom Telephone: (44-1327) 886000 Fax: (44-1327) 886106
ESTONIA		Cummins Czech Republic s.r.o. Komercni zona Pruhonice Cestlice Obchodni 132 Praha, Prague 251 01 Czech Republic Telephone: (420-272) 680 110 Fax: (420-272) 680 090
FAROE ISLANDS	**Wellingborough (Office in United Kingdom)**	Cummins UK Rutherford Drive Park Farm South Wellingborough, Northants NN8 6AN England Telephone: (44-1933) 334200 Fax: (44-1933) 334198
FERNANDO PO		- See Spain
FERNANDO PO		Cummins Ventas y Servico S. A. Torrelaguna 56 Madrid 28027 Spain Telephone: (34-91) 367 20 00 / 367 24 04 Fax: (34-91) 407 66 04
FIJI		- See Cummins New Zealand

REFERENCE ONLY

FIJI		Cummins 9 Langley Road Manukau City Centre, Auckland 1702 New Zealand Telephone: (64-3) 277 1000 Fax: (64-3) 277 1001
FINLAND	**Helsinki**	Machinery Oy Ansatie 5 Vantaa ZIP / Postal Code: FIN-01741 Finland Telephone: (358-9) 89551
FRANCE	**Lyon**	CUMMINS DIESEL S.A. 39 rue Ampère BP 190 Chassieu cédex 69 France Telephone: (33-4) [illegible] 72 Fax: (33-4) [illegible]
GABON		- See North/West/East and Central Africa Regional Office - Daventry
GAMBIA		Matforce [illegible] Avenue Faidherbe Dakar Senegal Telephone: (221-8) 399500 Fax: (221-8) 399531 / 399550
GEORGIA		- See Moscow Regional Office - Moscow
GEORGIA		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 Fax: (7-495) 956-53-62
GERMANY	**Groß-Gerau**	Cummins Diesel Deutschland GmbH Odenwaldstraße 23 Groß-Gerau, Hessen 64521 Germany Telephone: (49-6152) 174-0 Fax: (49-6152) 174-141
GHANA	**Accra**	J&D Diesels and Systems P.O. Box c2381 Cantonments Accra, Ghana Telephone: (233-21) 30-14-51 Fax: (233-21) 301 201
GREECE	**Athens**	ERGOTRAK Industrial Machinery & Equipment Trading Company 14 km. National Road of Athens-Lamia Kifissia 14510 Greece Telephone: (30-210) 6293400 / 41 Fax: (30-210) 6201845

REFERENCE ONLY

GREENLAND		- See Denmark Cummins Diesel Salg & Service A/S Hovedvejen 233B, Osted Roskilde 4000 Denmark Telephone: (45-46) 42 35 50 Fax: (45-46) 42 30 50
GRENADA	**Miami (Office in U.S.A.)**	Cummins Power South, LLC 9900 N W 77th Ave. Hialeah Gardens, Florida 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992
GUADELOUPE	**Miami (Office in U.S.A.)**	Cummins Power South, LLC 9900 N W 77th Ave. Hialeah Gardens, Florida 3301[illegible] Telephone: (305) 821-[illegible] Fax: (305) 557-2[illegible]
GUAM	**Barrigada**	Mid-Pac Far E[illegible]st, Inc. Airport Industr[illegible]l Park 825 Tiyan Parkw[illegible]y Barri[illegible]ada, Guam 96931 Tel[illegible]phon[illegible] (671) 632-5160 Fa[illegible] (67[illegible]) 632-5186
GUATEMALA	**Guatemala City**	Maquin[illegible]y Equipos, S.A. Carr[illegible]era a Amatitlan, Kilómetro 12, Zona 12, Guat[illegible]mala City G[illegible]temala Guatemala Telephone: (502) 2477-2746 / 2477-2747 / 2477-2748 / 2477-2749 / 2477-2750 Fax: (502) 2477-3929
GUINEA	**Mechel[illegible] (Offi[illegible]e in [illegible]elgium)**	Cummins Belgium N.V./S.A. Egide Walschaertsstraat, 2 Industriepark Zuid Mechelen 2800 Belgium Telephone: (32-15) 479 100 Fax: (32-15) 275 686
GUINEA BISSAU		- See North/West/East and Central Africa Regional Office - Daventry Cummins Engine Company Ltd Royal Oak Way South Daventry, Northants NN11 5NU United Kingdom Telephone: (44-1327) 886000 Fax: (44-1327) 886106
GUYANA	**Miami (Office in U.S.A.)**	Cummins Power South, LLC 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992

REFERENCE ONLY

GUYANA, FRENCH	**See France**	CUMMINS DIESEL S.A. 39 rue Ampère BP 190 Chassieu cédex 69680 France Telephone: (33-4) 72 22 92 72 Fax: (33-4) 78 90 19 56
HAITI	**Miami (Office in U.S.A.)**	Cummins Power South, LLC 9900 N W 77th Ave. Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992
HOLLAND	**- See Netherlands**	Cummins Holland B V Galvanistraat 35 Dordrecht, Zuid-Holland 33[illegible] GI Netherlands Telephone: (31-78) 6[illegible]1200 Fax: (31-78)[illegible]
HONDURAS	**Tegucigalpa**	Comercial [illegible]eisz Ho[illegible]duras, S.A. Desvio Colo[illegible] La [illegible]adera, Bl[illegible]. Toncontin [illegible]egucigalpa Hon[illegible]uras Te[illegible]phon[illegible]: (504) 233-5615 / 234-7072 Fax: [illegible]4) 233-9531 / 234-3718
HONG KONG	**Kowloon**	C[illegible]mmins Hong Kong Ltd. [illegible]F Unison Industrial Centre 27-31 Au Pui Wan Street, Fo Tan, Shatin, N.T. Hong Kong, Hong Kong Hong Kong S.A.R.ong Kong Telephone: (852) 2606-5678 Fax: (852) 2691-1641
ICELAND	**V[illegible]asal[illegible]n H.[illegible]**	Ananaustrum 1 Reykjavik 121 Iceland Telephone: (354) 5526122 Fax: (354) 580 5301
INDIA	**P[illegible]ne**	Cummins Diesel Sales & Service (India) Ltd 35A/1/2, Erandawana Pune, Maharashtra 411038 Telephone: (91-20)25431234 , 25430666, 25431703 Fax: (91-20) 25439490
[illegible]NDI[illegible]	**Kolkata**	Cummins Diesel Sales & Service (India) Ltd 94, Tivoli Court, 1/C Ballygunge Circular Road Kolkata, West Bengal 700019 India Telephone: (91-33) 22472481 / 22470774 / 22478065 Fax: (91-33) 22473833

REFERENCE ONLY

INDIA	**New Delhi**	Cummins Diesel Sales & Service (India) Ltd. 911-912, Hemkunt Tower, 98 Nehru Place New Delhi, Delhi 110019 India Telephone: (91-11) 26431051 / 26445756 / 26445759 / 26416947 Fax: (91-11) 26212817
INDIA	**Raipur**	Cummins Diesel Sales & Service (India) Ltd. Vanijya Bhavan' 1st Floor, Sai Nagar Fafadi Devendra Nagar Road Raipur, Madhya Pradesh 4[illegible] India Telephone: (91-771) 2521101 / 2521102 Fax: (91-771) 2521103
INDIA	**Ranchi**	Cummins Diesel Sales & Service (India) Ltd. `Shanti Kunj' G-202, Vidyalaya Marg Road No. 01, Ashok Nagar, Ranchi, Jharkhand 834002 India Telephone: (91-651) 2241948 / 2241521 Fax: (91-651) 2242815
INDONESIA	**Jakarta**	P.T. Ultrak 1978 J1. R.S.C. Veteran No. 4 Pasar, Rempoa Jakarta 12330 Indonesia Telephone: (62-21) 736-1978 / 3301 / 5085 Fax: (62-21) 736-1977 / 3302
IRAQ		- See Middle East Regional Office or United Arab Emirates
IRAQ		Cummins Emirates Sales & Service LLC P.O. Box No 54044 Al Quoz Industrial Estate, Dubai United Arab Emirates Telephone: 00 9714 3478184 Fax: 00 9714 3478185 Toll Free: 800 4184
IRELAND	**Wellingborough (Office in England)**	Cummins UK Rutherford Drive Park Farm South Wellingborough, Northants NN8 6AN United Kingdom Telephone: (44-1933) 334200 Fax: (44-1933) 334198
ISRAEL	**Tel Aviv**	Israel Engines & Trailers 33 Hahashmal Street Tel Aviv 61003 Israel Telephone: (972-3) 7106222 Fax: (972-3) 5604540

REFERENCE ONLY

ITALY	**Milan**	Cummins Italia S.p.A. Via Einaudi, 5 Peschiera Borromeo, Milano 20068 Italy Telephone: (39-02) 51 65 581 Fax: (39-02) 51 65 58 56
IVORY COAST		- See Cote d' Ivoire Ste. des Ets. Lemercier et Fils 10 rue des Brasseurs Abidjan 15 Cote d'Ivoire Cote d'Ivoire Telephone: (225-21) 352528 / 350687 / 350676 Fax: (225-21) 358562 / 24395
JAMAICA		Cummins Power South, LLC 9900 N W 77th Ave Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992
JAPAN	**Tokyo**	Cummins Japan Ltd 2-1-7, Higashi-Kojiya 6-chome Ota-ku, Tokyo 144-0033 Japan Telephone: (81-3) 5735-0600 Fax: (81-3) 5735-0605
JORDAN	**Amman**	SETI Jordan Ltd. Sayader Wadi Alseer Industrial Street Amman, Jordan Jordan Telephone: (962-6) 582 7300 / 4261 Fax: (962-6) 585 6854
KENYA	**Nairobi**	Simba Colt Motors Ltd Cummins Engine Division, PO Box 48296, Code 00100 Shimo-La-Tewa Road, Nairobi Kenya Telephone: (254-20) 650029 Fax: (254-20) 534870
KOREA - SOUTH KOREA	**Seoul**	Cummins Diesel Sales & Service Co., Ltd. 354-4, Chonheung-ri, Songgo-eup Chonan-city, Choongchungnam-do 330-836 South Korea Telephone: (82-41) 620-9202/3 Fax: (82-41) 621-9121 to 2
KOREA - SOUTH KOREA		Cummins Korea Ltd 2nd Floor, Choyang Bldg. 113 Samsung Dong, Kangnam-ku Seoul, Korea Telephone: (82-2) 3420-0901 Fax: (82-2) 3452-4113 / 539-6569

REFERENCE ONLY

KUWAIT	**Kuwait**	General Transportation & Equipment Co. (GTE) (Sales Department) Safat 13011 Kuwait Telephone: (965) 483 3380/1/2 Fax: (965) 481 2860
LAOS		Diethelm & Co. Ltd Ban Phonsinouan, Unit 18, New Road Sisattanak District, Vientiane Laos P.D.R. Telephone: (856-21) 453 100 Fax: (856-21) 453-103
LATVIA	**Please contact the Central & Eastern European Regional Office**	Cummins Diesel Deutschland GmbH Odenwaldstraße 23 Groß-Gerau ZIP / Postal Code: 645[illegible] Germany Telephone: (49-6152) 17[illegible]-0 Fax: (49-6152) 17[illegible]
LEBANON	**Beirut**	S.A.R.L. Charles Keller SAL Corniche du Fleuve Beirut Lebanon Lebanon Telephone: (961-1) 425040 / 425041 / 426042 Fax: (961-1) 425637 / 425389
LESOTHO	**- See South Africa**	Cummins Diesel South Africa (Pty) Ltd 13 Eastern Service Road Kelvin (Neighbourhood), Alexandra Gauteng, South Africa 2054 South Africa Telephone: (27-11) 321 8700 Fax: (27-11) 444 2012
LIBYA	**- See North/West Africa Regional Office - Daventry**	Cummins Engine Company Ltd Royal Oak Way South Daventry, Northants NN11 5NU United Kingdom Telephone: (44-1327) 886000 Fax: (44-1327) 886106
LIECHTENSTEIN	**- See Switzerland**	AKSA Wurenlos AG Grosszelgstrasse 15 Wuerenlos CH-5436 Switzerland Telephone: (41-56) 436 77 00 Fax: (41-56) 436 77 19
LUXEMBOURG		Cummins Diesel Deutschland GmbH Odenwaldstraße 23 Groß-Gerau, Hessen 64521 Germany Telephone: (49-6152) 174-0 Fax: (49-6152) 174-141

REFERENCE ONLY

MACAU	**- See Hong Kong**	Cummins Hong Kong Ltd. 2/F Unison Industrial Centre 27-31 Au Pui Wan Street, Fo Tan, Shatin, N.T.cccc Hong Kong, Hong Kong Hong Kong S.A.R. Telephone: (852) 2606-5678 Fax: (852) 2691-1641
MADAGASCAR	**- See Southern Africa Regional Office**	Cummins Diesel South Africa (Pty) Ltd 13 Eastern Service Road Kelvin (Neighbourhood), Alexandra Gauteng, South Africa 2054 ZIP South Africa Telephone: (27-11) 321 8[illegible]00 Fax: (27-11) 444 2012
MADEIRA ISLANDS	**- See Portugal**	Electro Central Vulcanizad[illegible]a, L[illegible]a Rua Conselheiro M[illegible]rtins [illegible]arvalho Lote 1480 Re[illegible]ta Lisbon 140[illegible] Portugal Telephone: (351-21) [illegible]8034800 Fax: (351-21) [illegible]801 / 2
MALAYSIA	**Kuala Lumpur**	Scott & English (M) Sdn Bhd 12, Jalan U1/15, Seksyen U1 H[illegible]om-Glenmarie Industrial Park Sha[illegible]lam, Selangor Darul Ehsan 40150 Malaysia Telephone: (60-3) 7805-1111 Fax: (60-3) 7803-5122
MALI	**- See Senegal (Matforce)**	Matforce 10 Avenue Faidherbe Dakar Senegal Telephone: (221-8) 399500 Fax: (221-8) 399531 / 399550
MALTA	**Valletta**	International Machinery Ltd Regency House 254 Republic Street Valletta, Malta Malta Telephone: (356-21) 232620 / 233343 Fax: (356-21) 235484 / 247571
MARTINIQUE		Cummins Power South, LLC 9900 N.W. 77 Ave. Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992
MEXICO	**Guadalajara**	Distribuidora Megamak de Occidente Metalurgia No. 2980 Fracc. Alamo Industrial Guadalajara, Jalisco 45560 Mexico Telephone: (52-3) 666-0329 / 666-0383 Fax: (52-3) 666-0333

REFERENCE ONLY

MEXICO	**Monterrey**	Converto Dexel Monterrey Privada Nazry Hasbun #2, Carr. Migue Aleman 14.8 Parque Industrial Hasna Apodaca, Nuevo León 66473 Mexico Telephone: (52-81) 81310200 Fax: (52-81) 81310200
MEXICO	**Merida**	Distribuidora Megamak del Sureste Av. Aviacion Civil No. 647 Col. Sambula Merida, Yucatan 97259 Mexico Telephone: (52-9) 930-1300 Fax: (52-9) 930-1315
MEXICO	**Puebla**	Cummins De Oriente S.A. de C.V. Km. 10 + 400 Carr. Fed. Puegla-Taxcala Puebla, Puebla [illegible] Mexico Telephone: (52-2) 248-7[illegible]74 / 5 / 30-5083 / 6 Fax: (52-2) 249-7679
MEXICO	**Queretaro**	Converto Dexel Queretaro Blvd. Bernardo Quintana No. 518, Col. Arboledas Queretaro, Queretaro ZIP / Postal Code: 76140 Mexico Telephone: (52-442) 211-8700 Fax: (52-442) 211-8700
MOROCCO	**Casablanca**	Groupe Auto Hall 44 avenue Lalla Yacout Casablanca Morocco Telephone: (212-22) 442121 / 317044 / 317052 Fax: (212-22) 318915 / 315633
MOZAMBIQUE	**- Se[illegible] Africa Regional Office - Kelvin**	Cummins Diesel South Africa (Pty) Ltd 13 Eastern Service Road Kelvin (Neighbourhood), Alexandra Gauteng, South Africa 2054 South Africa Telephone: (27-11) 321 8700 Fax: (27-11) 444 2012
NEPAL	**Pune (Office in India)**	Cummins Diesel Sales & Service (India) Ltd. 35A/1/2, Erandawana Pune, Maharashtra 411038 India Telephone: (91-20) 25431234 / 25430666 / 25431703 Fax: (91-20) 25439490
NETHERLANDS	**Dordrecht**	Cummins Holland B V Galvanistraat 35 Dordrecht, Zuid-Holland 3316 GH Netherlands Telephone: (31-78) 6181200 Fax: (31-78) 6176579

REFERENCE ONLY

NETHERLANDS ANTILLES		Cummins Power South, LLC 9900 N W 77th Ave. Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992
NEW GUINEA	**- See Papua New Guinea**	Cummins Macdhui Street Lae Papua New Guinea Telephone: (675) 472 3699 Fax: (675) 472 3803
NEW GUINEA	**- See Papua New Guinea**	Cummins Macdhui Street Lae Papua New Guinea Telephone: (675) 472 3699 Fax: (675) 472 3803
New Zealand	**Auckland**	Cummins 9 Langley Road Manukau City Centre, South Auckland 1702 New Zealand Telephone: (64-9) 277 1000 Fax: (64-9) 277 1001
New Zealand	**Christchurch**	Cummins 33 Clarkhouse Road Christchurch New Zealand Telephone: (64-3) 348 8170 Fax: (64-3) 348 8007
New Zealand	**Dunedin**	Cummins 8 Devon Street Dunedin New Zealand Telephone: (64-3) 477 8818 Fax: (64-3) 477 8061
New Zealand	**Palmerston North**	Cummins 852 - 860 Tremaine Avenue Palmerston North, Wanganui-Manawatu 5301 New Zealand Telephone: (64-3) 356 2209 Fax: (64-3) 356 9130
New Zealand	**Rotorua**	Cummins 328 Te Ngae Road Bay of Plenty Rotorua New Zealand Telephone: (64-7) 345 6699 Fax: (64-7) 345 6694
NICARAGUA	**Managua**	F. Alf. Pellas, S.A. Gadala Maria Cuatro Cuadras Oeste Barrio Acahualinca Managua, Nicaragua Nicaragua Telephone: (505) 268-2244 Fax: (505) 266-1060

REFERENCE ONLY

NIGERIA	**Lagos**	Scoa Power (A Division of Scoa Nigeria Plc) 15, Creek Road Apapa Lagos Nigeria Telephone: (234-1) 5873623 / 5877322 Fax: (234-1) 5450646
NIGERIA	**Paris (Office in France)**	SCOA Inter Immeublearie Josephe Rue du Marechal de Lattre de Tassigny 78990 Elancourt, France France Telephone: (33-1) 30 688 268 Fax: (33-1) 30 688 269
NORTHERN IRELAND	**- See United Kingdom**	Cummins Engine Company Ltd Royal Oak Way South Daventry, Northant ZIP / Postal Co e: NN1 5N United Kingdo Telephone: (44 327) 88 000 Fax: (44-1327) 88
NORWAY	**Oslo**	Cu mins Norway A S Hes hagen 3 stbo s 151 Drobak Norwa Telep one: (47) 64 90 70 80 (47) 64 90 70 90
OMAN	**Ruwi**	Universal Engineering Services LLC PO Box 2688 Ruwi 112 Oman Telephone: (968) 597531 / 597537 Fax: (968) 597514
PAKISTAN	**Karach**	Cummins Sales & Service Pakistan 2 Bangalore Town Main Shahrah-e-Faisal Karachi 75350 Pakistan Telephone: +92-21-4539603 / 4539604/ 4539605 Fax: +92-21-4532519
PANAMA	**Panama City**	Grupo Tiesa, S.A. Via Transistmica Milla 8 Frente a Bacardi Partillo Panama Panama Telephone: (507) 231-0266 Fax: (507) 231-2535
PARAGUAY	**Asuncion**	De La Sobera S.A. Eusebio Ayala 1947 P.O. Box 1160 Asuncion Paraguay Telephone: (595) 21 202 913

REFERENCE ONLY

PERU	**Lima**	Mitsui Maquinarias Peru, S.A. Av. Nicolas Ayllon 2648 Parcela Rustica Sta. Angelica Ate Lima ZIP / Postal Code: 03 Peru Telephone: (51-1) 326-4957 Fax: (51-1) 326-4954
PHILIPPINES	**EDSA**	Cummins Sales & Service Philippines, Inc Lot 1 & 2, Block 15, LIIP Avenue, Laguna International Industrial Park, Ma[illegible]asan, Binan Laguna Philippines Telephone: (63-2) 843-0630 Fax: (63-2) 539-0290
POLAND		Cummins Engine Compan[illegible] Limited Sp. z.o.o. Oddzial w Polsce ul. Stawowa 1[illegible]9 Krakow 31-346 Poland Telephone: (48-12) 661 53 05 & (48-12) 661 53 25 Fax: (48-1[illegible]) 661 53 15
PORTUGAL	**Lisbon**	[illegible]ectro Central Vulcanizadora, Lda Rua Co[illegible]neiro Martins de Carvalho Lisbo[illegible] ZIP / [illegible]ostal Code: 1400 [illegible]ugal Telephone: (351-21) 3034800 Fax: (351-21) 3034801 / 2
QATAR	**Doha**	Jaidah Motors & Trading Co. P.O. Box 150 Doha, Qatar (Arabian Gulf) Telephone: (974) 4466888 Fax: (974) 441 4100 / 441 5400
REUNION	**- See Lyon Regional Office - Lyon**	CUMMINS DIESEL S.A. 39 rue Ampère BP 190 Chassieu cédex 69680 France Telephone: (33-4) 72 22 92 72 Fax: (33-4) 78 90 19 56
RIO DE ORO	**- See Spain**	Cummins Ventas y Servico S. A. Torrelaguna 56 Madrid 28027 Spain Telephone: (34-91) 367 20 00 / 367 24 04 Fax: (34-91) 407 66 04
ROMANIA	**- See Germany Regional Office - Gross-Gerau**	Cummins Diesel Deutschland GmbH Odenwaldstraße 23 Groß-Gerau, Hessen 64521 Germany Telephone: (49-6152) 174-0 Fax: (49-6152) 174-141

REFERENCE ONLY

RUSSIA		OOO Cummins Klyazma 1G Khimki Disctrict, Moscow Region 141400 Russia Telephone: (7-495) 540 86 24 / 25 Fax: (7-495) 540 86 99
RWANDA	**Mechelen**	Cummins Belgium N.V./S.A. Egide Walschaertsstraat, 2 Industriepark Zuid Mechelen 2800 Belgium Telephone: (32-15) 479 100 Fax: (32-15)275 686
ST. LUCIA		Cummins Power South, LLC 9900 N W 77th Ave. Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992
ST. LUCIA	**Miami (Office in U.S.A.)**	Cummins Power South, LLC 9900 N W 77th Ave. Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992
SAN MARINO	**- See Italy**	Cummins Italia S.p.A. Italy via Einaudi, 5 Peschiera Borromeo, Milano 20068 Telephone: (39-02) 51 65 581 Fax: (39-02) 51 65 58 56
SAO TOME AND PRINCIPE	**- See North/West/East and Central Africa Regional Office - Daventry, England**	Cummins Engine Company Ltd Royal Oak Way South Daventry, Northants ZIP / Postal Code: NN11 5NU United Kingdom Telephone: (44-1327) 886000 Fax: (44-1327) 886106
SAUDI ARABIA	**Al Khobar**	General Contracting Company - OLAYAN P.O. Box 356 King Abdul Aziz Road Al-Khobar Saudi Arabia Telephone: (966-3) 882-0888 Fax: (966-3) 8828560 / 8827914
SCOTLAND	**- See United Kingdom**	Cummins UK Rutherford Drive Park Farm South Wellingborough, Northants ZIP / Postal Code: NN8 6AN United Kingdom Telephone: (44-1933) 334200 Fax: (44-1933) 334198

REFERENCE ONLY

SENEGAL	**Dakar**	Matforce 10 Avenue Faidherbe Dakar Senegal 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 Africa Regional Office - Daventry, England**	Cummins Engine Company Ltd Royal Oak Way South Daventry, Northants ZIP / Postal Code: United Kingdom Telephone: (44-1327) 886000 Fax: (44-1327) 886106
SIERRA LEONE	**- See North/West/East and Central Africa Regional Office - Daventry**	Cummins Engine Company Ltd Royal Oak Way South Daventry, Northants ZIP / Postal Code: NN11 5NU United Kingdom Telephone: (44-1327) 886000 Fax: (44-1327) 886106
SINGAPORE	**Singapore**	Cummins Engine (Singapore) Pte Ltd 8 Tanjong Penjuru Singapore 609019 Singapore Telephone: (65) 6261-3555 Fax: (65) 6261-2405
SLOVAKIA		- See European Regional Office - Gross-Gerau
SOLOMON ISLANDS	**The Czech branch covers sales and service for the Czech Republic and Slovakia**	Cummins Czech Republic s.r.o. Komercni zona Pruhonice Cestlice Obchodni 132 Praha, Prague 251 01 Czech Republic Telephone: (420-272) 680 110 Fax: (420-272) 680 090
SOLOMON ISLANDS	**-See SOUTH PACIFIC ISLANDS**	(Please contact) Cummins 2 Caribbean Drive Scoresby 3179 Victoria Telephone: (61-3) 9765-3222 Fax: (61-3) 9763-0079
SOMALIA	**- see Southern Africa Regional Office**	(Please contact) Cummins Diesel South Africa (Pty) Ltd 13 Eastern Service Road Kelvin (Neighbourhood), Alexandra Gauteng, South Africa 2054 South Africa Telephone: (27-11) 321 8700 Fax: (27-11) 444 2012

REFERENCE ONLY

SOUTH AFRICA	**Johannesburg**	Cummins Diesel South Africa (Pty) Ltd 13 Eastern Service Road Kelvin (Neighbourhood), Alexandra Gauteng, South Africa 2054 South Africa Telephone: (27-11) 321 8700 Fax: (27-11) 444 2012
SOUTHWEST AFRICA	**- see Southern Africa Regional Office**	(Please contact) Cummins Diesel South Africa (Pty) Ltd 13 Eastern Service Road Kelvin (Neighbourhood), Alexandra Gauteng, South Africa 2054 South Africa Telephone: (27-11) 321 87[illegible] Fax: (27-11) 444 2012
SPAIN	**Madrid**	Cummins Ventas y Se[illegible]ico S.[illegible] Torrelaguna, 56 Madrid 28027 Spain Telephone: (34-91) 367 [illegible]0 00 / 367 24 04 Fax: (34-91) 407 [illegible]
SPANISH GUINEA	**- See Spain**	Cummins Ventas y Servico S. A. Torrelaguna, 56 Madrid 28027 Spain Telephone: (34-91) 367 20 00 / 367 24 04 Fax: (34-91) 407 66 04
SRI LANKA	**Colombo**	Trade Promoters Ltd 272/25, Sudharshana Mawatha Malabe Sri Lanka Telephone: (94-11) 2413002 Fax: (94-11) 5550034
SUDAN	**- See Middle East Regional Office United Arab Emirates**	United Arab Emirates Cummins Middle East FZE Units ZF 5/6 Jebel Ali Free Zone P.O.Box No 17636 Dubai United Arab Emirates Telephone: (971-4) 883 8998 Fax: (971-4) 883 7971
SURINAM		Cummins Power South, LLC 9900 N W 77th Ave. Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992
SWAZILAND	**- See South Africa**	Cummins Diesel South Africa (Pty) Ltd 13 Eastern Service Road Kelvin (Neighbourhood), Alexandra Gauteng, South Africa ZIP / Postal Code: 2054 South Africa Telephone: (27-11) 321 8700 Fax: (27-11) 444 2012

REFERENCE ONLY

SWEDEN	**Stockholm**	Cummins Sweden Maskingata 17C Brista Industriomade Märsta, Stockholm 195 60 Sweden Telephone: (46-8) 595 133 90 Fax: (46-8) 595 133 99
SWITZERLAND	**Regensdorf**	AKSA Wurenlos AG Grosszelgstrasse 15 Wuerenlos CH-5436 Switzerland Telephone: (41-1) 436 77 00 Fax: (41-56) 436 77 19
SYRIA	**Damascus**	Puzant Yacoubian & Sons Yacoubian Building Abou Baker El Sadd[illegible] Street Damascus Syria Telephone: (963-11) [illegible]12 8600 Fax: (963-11) 212 86[illegible]
TAHITI, ISLAND OF	**- See French Polynesia**	Cummins MerCruiser Diesel 245 Brisbane Road Ingora Waters, Queensland 4216 Australia Telephone: (61-7) 5500 9060 Fax: (61-7) 5500 9070
TAIWAN		Cummins Taiwan Pte. Ltd. No.49 Ting Hu Road Tkuei Shan Hsiang Taoyuan, Taiwan 104 Taiwan Telephone: (886-3) 211-5160 Fax: (886-2) 211-4158
TANZANIA	**- See South African Regional Office - Kelvin, South Africa**	Cummins Diesel South Africa (Pty) Ltd 13 Eastern Service Road Kelvin (Neighbourhood), Alexandra Gauteng, South Africa ZIP / Postal Code: 2054 South Africa Telephone: (27-11) 321 8700 Fax: (27-11) 444 2012
THAILAND	**Bangkok**	DKSH (Thailand) Ltd 1696 New Petchburi Road Bangkok 10310 Thailand Telephone: (66-2) 254-4900 / 454-2173 Fax: (66-2) 253-5560 / 652-9417 / 8 / 9
TOGO (and BENIN)	**Lome**	TOGOMAT s.a. Zone Industrielle CNPPME Lome Togo Telephone: (228) 2272395 Fax: (228) 2270310

REFERENCE ONLY

TONGA, ISLAND OF	**-See SOUTH PACIFIC ISLANDS**	(Please contact) Cummins 2 Caribbean Drive Scoresby 3179 Victoria AUSTRALIA Telephone: (61-3) 9765-3222 Fax: (61-3) 9763-0079
TRINIDAD and TOBAGO		Cummins Power South, LLC 9900 N W 77th Ave. Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992
TURKEY	**Istanbul**	Hamamcioglu Muesseseleri Ticaret T.A.S. Okul Cad. No. 13 34956 Orhanli - P.K. 62 Tuzla Istanbul Turkey Telephone: (90-216) 394 3200 Fax: (90-216) 394 3208 / 09
UKRAINE	**- See Moscow Regional Office - Moscow**	Cummins Engine Company, Inc. Park Place Office E708, 113/1 Leninskiy Prospect Moscow 117198 Russia Telephone: (7-495) 956-51-22 / 23 Fax: (7-495) 956-53-62
UNITED ARAB EMIRATES	**Dhabi**	Cummins Middle East FZE Units ZF 05&06 Jebel Ali Free Zone Dhabi United Arab Emirates Telephone: (971-4) 883 8998 Fax: (971-4) 883 7971
UNITED KINGDOM	**Wellingborough**	Cummins UK Rutherford Drive Park Farm South Wellingborough, Northants NN8 6AN United Kingdom Telephone: (44-1933) 334200 Fax: (44-1933) 334198
VATICAN CITY	**- See Italy**	Cummins Italia S.p.A. Via Einaudi, 5 Peschiera Borromeo, Milano 20068 Italy Telephone: (39-02) 51 65 581 Fax: (39-02) 51 65 58 56
VENEZUELA	**Caracas**	Dieselval, C.A. Ave. Lisandro Alvarado, Sector La Florida Edificio Dieselval Valencia, Carabobo Venezuela ZIP / Postal Code: Venezuela Venezuela Telephone: (58-241) 8353074 / 8355265 Fax: (58-241) 8314553 / 8314818

REFERENCE ONLY

VIETNAM	**Hanoi**	Diethelm & Co. Ltd., Engrg. 94, Tran Quoc Toan Street, Hoan Kiem District Hanoi Vietnam Telephone: (84-4) 9424-725 Fax: (84-4) 9424-730
VIETNAM	**Ho Chi Minh City**	Diethelm & Co. Ltd., Engrg. 189 Dien Bien Phu Street, Ward 15 Binh Thanh District Ho Chi Minh City, S.R. Vietnam Telephone: (84-8) 5121-33[illegible] Fax: (84-8) 5121-335
WESTERN SAMOA	**-See SOUTH PACIFIC ISLANDS**	(Please contact) Cummins 2 Caribbean Drive Scoresby 317[illegible] Victoria AUSTRALI[illegible] Telephone: [illegible]61-3) 97[illegible]5-3222 Fax: (61-3) 9[illegible]9
YEMEN	**Sana'a**	[illegible]ubieri Trading Company [illegible] Qiyadah Street Sa[illegible]a'a Repu[illegible]c of Yemen T[illegible]ephone: (967-1) 223943 / 224051 F[illegible]x: (967-1) 221611 / 245838
SERBIA & MONTENEGRO		Cummins Dizel Motori Prodaja i Servis Autoput, 22 11080 Zemum Beograd, Serbia & Montenegro Serbia & Montenegro Telephone: (381-11) 314 90 71 Fax: (381-11) 314 91 27
ZAMBIA	**N[illegible]**	Cummins Zambia Ltd Lufunza Avenue Ndola, Zambia Zambia Telephone: (260-2) 610 729 Fax: (260-2) 612 756
ZIMBA[illegible]WE	**Harare**	Cummins Zimbabwe (Pvt) Ltd. 72 Birmingham Road Southerton, Zimbabwe Zimbabwe Telephones: (263-4) 621871 / 2 / 3 / 4 / 5 Fax: (263-4) 621880

REFERENCE ONLY

Section TS - Troubleshooting Symptoms

Section Contents

	Page
Troubleshooting Procedures and Techniques	TS-1
General Information	TS-1
Troubleshooting Symptoms Charts	TS-2
General Information	TS-2
Alternator Not Charging or Insufficient Charging	TS-3
Coolant Contamination	TS-4
Coolant Loss	TS-5
Coolant Temperature Above Normal	TS-7
Coolant Temperature Below Normal	TS-6
Engine Difficult to Start or Will Not Start (Exhaust Smoke)	TS-9
Engine Difficult to Start or Will Not Start (No Exhaust Smoke)	TS-11
Engine Noise Excessive	TS-13
Engine Power Output Low	TS-14
Engine Runs Rough at Idle, Warm Engine	TS-17
Engine Runs Rough or Misfires	TS-18
Engine Speed Surges at Low or High Idle	TS-19
Engine Starts But Will Not Keep Running	TS-20
Engine Vibration Excessive	TS-21
Engine Will Not Crank or Cranks Slowly	TS-22
Engine Will Not Reach Rated Speed (RPM)	TS-23
Engine Will Not Shut Off	TS-25
Exhaust Smoke Excessive Under Load	TS-26
Fuel Knock	TS-28
Fuel or Lubricating Oil Leaking From Exhaust Manifold	TS-29
Lubricating Oil Contaminated	TS-30
Lubricating Oil Loss	TS-31
Lubricating Oil Pressure High	TS-32
Lubricating Oil Pressure Low	TS-33
Smoke, White — Excessive	TS-35

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

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

REFERENCE ONLY

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.

REFERENCE ONLY

Alternator Not Charging or Insufficient Charging

Cause	Correction
STEP 1 Battery cables or connections are loose, broken, or corroded (excessive resistance)	Check the battery cables and connections. Refer to Procedure 013-009 (Battery Connections) in Section 4.
OK Go To Next Step	
STEP 2 Alternator belt is loose or missing	Check the alternator belt tension. Check pulleys in belt wrap, and repair, if necessary. Replace belt or belt tensioner, or both. Refer to Procedure 013-021 (Belt Tensioner, Automatic (Alternator) in Section A.
OK Go To Next Step	
STEP 3 Alternator drive pulley is loose on the water pump shaft	Make sure the drive pulley is tight on the shaft. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Alternator is malfunctioning	Test the alternator output. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 5 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

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 an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 4 Cylinder head gasket is leaking	Check the cylinder head gasket. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 5 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Coolant Loss

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 External engine leak	Inspect the engine and its components for seal, gasket, tappet cover, oil cooler, or drain cocks leaks.
OK Go To Next Step	
STEP 3 Combustion gases are entering the cooling system	Check for combustion gases in the cooling system. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 4 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 5 Air compressor cylinder head is cracked or porous, or has a leaking gasket (nonmarine engines only)	Inspect the air compressor cylinder head and gasket. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 6 Lubricating oil cooler is leaking oil	Check the lubricating oil cooler for oil leaks. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 7 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Coolant Temperature Below Normal

Cause	Correction
STEP 1 Radiator shutters are stuck open or opening early	Check the shutter operation. Repair or replace the shutters if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 2 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 3 Temperature switch failed	With the key system on, short out the harness at the temperature switch. If it engages, troubleshoot the sensor or check for air in the coolant system. Remove the sensor and make sure at ambient conditions the sensor is open; and at the correct temperature 91°C [196°F], make sure the sensor closes. Replace if necessary an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 4 Temperature gauge malfunction	Check or replace the temperature gauge. Refer to the OEM service manual.
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. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 6 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Coolant Temperature Above Normal

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 Procedure 008-018 (Cooling System) in Section 7.
OK Go To Next Step	
STEP 2 Radiator fins are damaged or obstructed with debris	Inspect the radiator fins. Clean and repair the fins as necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 3 Cooling system hose is collapsed, restricted, or leaking	Inspect the hoses. Refer to Procedure 008-086 (Cooling System Hoses) in Section A.
OK Go To Next Step	
STEP 4 Lubricating oil level is below specification	Check the oil level. Verify the dipstick calibration and 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 5 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 6 Fan drive belt is loose, tight, or not in alignment	Check the fan drive belt. Refer to Procedure 008-087 (Cooling Fan Belt Tensioner) in Section A.
OK Go To Next Step	
STEP 7 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 8 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	

REFERENCE ONLY

Coolant Temperature Above Normal

Cause	Correction
STEP 9 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 10 Temperature gauge malfunction	Check or replace the temperature gauge. Refer to the OEM service manual.
OK Go To Next Step	
STEP 11 Thermostat is **not** correct or is malfunctioning	Check the thermostat for the correct part number and for correct operation. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 12 Fuel pump is malfunctioning	Test the fuel pump on a fuel pump test stand. Replace the fuel pump if necessary.
OK Go To Next Step	
STEP 13 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 14 Water pump is malfunctioning	Check the water pump for correct operation. Replace the water pump if necessary.
OK Go To Next Step	
STEP 15 Air in the cooling system	Inspect and vent the cooling system. Refer to the OEM service manual.
OK Go To Next Step	
STEP 16 Cooling system is contaminated with dirt, scale, or sludge	Clean the cooling system. Refer to Procedure 008-018 (Cooling System) in Section 7.
OK Go To Next Step	
STEP 17 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

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 Engine cranking speed is too slow	Check the engine cranking speed with a handheld tachometer or electronic service tool. If the cranking speed is slower than 150 rpm, refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 3 Starting aid is malfunctioning	Check for correct operation of cold-starting aid. Refer to Procedure 101-004 (Cold Weather Starting Aids) in Section 1.
OK Go To Next Step	
STEP 4 Air in the fuel system	Bleed the fuel system and check for leaks. Refer to Procedure 006-003 (Air in Fuel) in Section A.
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 Fuel drain backup	Verify the fuel return line is plumbed to the bottom of the fuel tank.
OK Go To Next Step	
STEP 7 Fuel pump overflow valve is malfunctioning	Check the overflow valve. Replace if necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 8 Fuel transfer pump malfunctioning	Inspect the fuel transfer pump. Replace if necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 9 Intake air restriction is high	Check the air intake system for restriction. Refer to Procedure 010-058 (Air Intake Piping) in Section 4.
OK Go To Next Step	

REFERENCE ONLY

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

Cause	Correction
STEP 10 Fuel contaminated	Verify by operating the engine with clean fuel from a temporary tank.
OK Go To Next Step	
STEP 11 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 12 Valves or injectors adjusted wrong	Adjust valves and injectors.
OK Go To Next Step	
STEP 13 Injector is malfunctioning	Inspect the injectors. Replace the injectors as necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 14 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

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 Electrical or manual fuel shutdown binds	Check for loose wires and verify that the solenoid is functioning. Check to be sure manual shutoff lever is **not** binding at the injection pump. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Air in the fuel system	Bleed the fuel system and check for leaks. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 5 Fuel transfer pump malfunctioning	Inspect the fuel transfer pump. Replace if necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 6 Fuel drain backup	Verify the fuel return line is plumbed to the bottom of the fuel tank.
OK Go To Next Step	
STEP 7 Fuel pump overflow valve is malfunctioning	Check the overflow valve. Replace if necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 8 Throttle linkage adjustment is **not** correct	Check throttle linkage adjustment. Refer to the OEM service manual.
OK Go To Next Step	
STEP 9 Fuel injection pump is malfunctioning	Perform the fuel injection pump test. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	

REFERENCE ONLY

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

Cause	Correction
STEP 10 Fuel injection pump timing is **not** correct	Put the engine at top dead center. Check and adjust the fuel timing. Refer to an Authorized Cummins Repair Location.

OK
Go To Next Step

STEP 11
Contact a Cummins Authorized Repair Facility

REFERENCE ONLY

Engine Noise Excessive

Cause	Correction
STEP 1 Drive belt is loose, tight, or **not** in alignment	Check and adjust the drive belt as needed. Refer to Procedure 103-002 (Drive Belts) in Section 6.
OK Go To Next Step	
STEP 2 Air intake or exhaust leaks	Inspect the air intake and exhaust systems for air leaks. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 3 Valve lash excessive	Adjust valves. Make sure the push rods are **not** bent or rocker levers **not** severely worn. Refer to Procedure 003-004 (Overhead Set) in Section 6.
OK Go To Next Step	
STEP 4 Turbocharger noise	Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 5 Vibration damper is damaged	Inspect the vibration damper. Refer to Procedure 001-051 (Vibration Damper, Rubber) or 001-052 (Vibration Damper, Viscous) in Section 7.
OK Go To Next Step	
STEP 6 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Engine Power Output Low

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 Lubricating oil level is above or below specification	Check the oil level. Add or drain oil, if necessary. Refer to Procdure 007-043 (Lubricating Oil Level) in Section 3.
OK Go To Next Step	
STEP 3 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 4 Fuel shutoff lever (mechanical) partially engaged	Check or replace shutoff lever in run position.
OK Go To Next Step	
STEP 5 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 6 Air-fuel tube leaking, wastegate diaphragm ruptured, or wastegate plumbing damaged	Tighten the fittings, repair plumbing, replace wastegate diaphragm. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 7 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 8 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 an Authorized Cummins Repair Location.
OK Go To Next Step	

REFERENCE ONLY

Engine Power Output Low

Cause	Correction
STEP 9 Exhaust leaks at the manifold or turbocharger	Check and correct any leaks in the exhaust manifold or turbocharger gaskets. Check for a cracked exhaust manifold. 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. Completely vent air from the fuel system. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 11 Fuel quality is poor	Operate the engine from a temporary tank of number 2 diesel fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 12 Fuel supply is **not** adequate	Check the flow through the filter to locate the source of the restriction. Refer to Procedure 006-015 (Fuel Filter (Spin-On Type)) in Section 5.
OK Go To Next Step	
STEP 13 Fuel return restriction excessive	Inspect the fuel return lines for restrictions. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 14 Fuel pump overflow valve is malfunctioning	Check the overflow valve. Replace if necessary. Refer to an Authorized Cummins 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 an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 16 Intake manifold air temperature is above specification	Check intake air temperature. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	

REFERENCE ONLY

Engine Power Output Low

Cause	Correction
STEP 17 Fuel temperature is above specification	Fill the fuel tanks. Turn off or bypass the fuel heaters, and check the fuel cooler. Refer to the OEM service manual.
OK Go To Next Step	
STEP 18 Fuel injection pump timing is **not** correct	Put the engine at top dead center. Check and adjust the fuel timing. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 19 Exhaust system restriction is above specification	Perform the Oxidation Catalyst Pressure Test. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 20 Turbocharger wastegate is malfunctioning (if equipped)	Check the wastegate for correct operation. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 21 Turbocharger is worn or malfunctioning	Check for the specified boost pressure. Inspect the turbocharger. Replace if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 22 Valve lash excessive	Adjust valves. Make sure the push rods are **not** bent or rocker levers **not** severely worn. Refer to Procedure 003-004 (Overhead Set) in Section 6.
OK Go To Next Step	
STEP 23 Injector is malfunctioning	Inspect the injectors. Replace the injectors as necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 24 Fuel injection pump is malfunctioning	Remove the fuel injection pump. Check the calibration of the fuel injection pump. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 25 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Engine Runs Rough at Idle, Warm Engine

Cause	Correction
STEP 1 Idle speed is set too low for accessories	Check and adjust the low-idle screw. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 2 Air in the fuel system	Bleed the fuel system and check for leaks. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 3 Fuel pump overflow valve is malfunctioning	Check the overflow valve. Replace if necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 4 Fuel transfer pump malfunctioning	Inspect the fuel transfer pump. Replace if necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 5 Fuel injection pump timing is incorrect	Check and adjust the injection pump timing. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 6 Injector is malfunctioning	Inspect the injectors. Replace the injectors as necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 7 Engine mounts are worn, damaged, or **not** correct	Check the engine mounts. Refer to Procedure 016-010 (Engine Mounts) in Section A.
OK Go To Next Step	
STEP 8 Fuel injection pump is malfunctioning	Remove the fuel injection pump. Check the calibration of the fuel injection pump. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 9 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Engine Runs Rough or Misfires

Cause	Correction
STEP 1 Fuel contaminated	Verify by operating the engine with clean fuel from a temporary tank.
OK Go To Next Step	
STEP 2 Air in the fuel system	Bleed the fuel system and check for leaks. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 3 Fuel leak	Check the fuel lines, fuel connections, and fuel filters for leaks. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 4 Fuel pump overflow valve is malfunctioning	Check the overflow valve. Replace if necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 5 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 an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 6 Valve lash excessive	Adjust valves. Make sure the push rods are **not** bent or rocker levers **not** severely worn. Refer to Procedure 003-004 (Overhead Set) in Section 6.
OK Go To Next Step	
STEP 7 Injector is malfunctioning	Inspect the injectors. Replace the injectors as necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 8 Fuel injection pump timing is **not** correct	Put the engine at top dead center. Check and adjust the fuel timing. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 9 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

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 an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 3 Air in the fuel system	Bleed the fuel system and check for leaks. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 4 Fuel supply line or passage restriction between the fuel pump and the injectors	Check the fuel supply line or passage for sharp bends or restriction. an Authorized Cummins Repair Location
OK Go To Next Step	
STEP 5 Injector is malfunctioning	Replace the malfunctioning injector. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 6 Fuel injection pump is malfunctioning	Remove the fuel pump. Refer to an Authorized Cummins Repair Location. Calibrate the fuel pump.
OK Go To Next Step	
STEP 7 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Engine Starts But Will Not Keep Running

Cause	Correction
STEP 1 Idle speed is set too low for accessories	Check and adjust the low-idle screw. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 2 Engine-driven units are engaged	Disengage engine-driven units.
OK Go To Next Step	
STEP 3 Fuel shutoff lever (mechanical) partially engaged	Check for correct solenoid operation. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Air in the fuel system	Bleed the fuel system and check for leaks. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 5 Fuel filter or fuel suction line is restricted	Replace the fuel filter. Refer to Procedure 006-015 (Fuel Filter (Spin-On Type)) in Section A.
OK Go To Next Step	
STEP 6 Fuel supply line or passage restriction between the fuel pump and the injectors	Check the fuel supply line or passage for sharp bends or restriction. an Authorized Cummins Repair Location
OK Go To Next Step	
STEP 7 Fuel contaminated	Verify by operating the engine with clean fuel from a temporary tank.
OK Go To Next Step	
STEP 8 Fuel injection timing is **not** correct	Check the fuel pump timing. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 9 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Engine Vibration Excessive

Cause	Correction
STEP 1 Engine **not** running smoothly	Refer to the Engine Runs Rough or Misfires symptom tree.
OK Go To Next Step	
STEP 2 Engine mounts are worn, damaged, or **not** correct	Inspect the engine mounts. Replace as needed. Refer to Procedure 016-010 (Engine Mounts) in Section A.
OK Go To Next Step	
STEP 3 Fan drive or fan controls are malfunctioning	Check the fan drive and controls. Refer to Procedure 008-087 (Cooling Fan Belt Tensioner) in Section A or the OEM service manual.
OK Go To Next Step	
STEP 4 Vibration damper malfunctioning (six cylinder **only**)	Inspect the vibration damper. Replace, if necessary. Refer to Procedures 001-051 (Vibration Damper, Rubber) or 001-052 (Vibration Damper, Viscous) in Section 7.
OK Go To Next Step	
STEP 5 Alternator bearing worn or damaged	Clean and replace the alternator. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 6 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Engine Will Not Crank or Cranks Slowly

Cause	Correction
STEP 1 Engine-driven units are engaged	Disengage engine-driven units.
OK Go To Next Step	
STEP 2 Crankshaft rotation is impaired	Check the crankshaft for ease of rotation. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 3 Electrical system is "open" (blown fuses, broken wires, or loose connections)	Check the fuses, wires, and connections. Refer to the OEM service manual and manufacturer's wiring diagram.
OK Go To Next Step	
STEP 4 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 Procedure 013-007 (Batteries) in Section 4.
OK Go To Next Step	
STEP 5 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 6 Starting circuit component is malfunctioning	Check the starting circuit components. Refer to the OEM service manual.
OK Go To Next Step	
STEP 7 Starting motor operates but **not** cranking the engine	Remove the starting motor and inspect for broken teeth on the ring gear and pinion. Inspect for a broken starting motor spring.
OK Go To Next Step	
STEP 8 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

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 Throttle linkage adjustment is **not** correct	Check throttle linkage adjustment. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 3 Tachometer is **not** calibrated or is malfunctioning	Compare the tachometer reading with a handheld tachometer or an electronic service tool reading. Calibrate or replace the tachometer as necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 4 Air-fuel tube leaking, wastegate diaphragm ruptured, or wastegate plumbing damaged	Tighten the fittings, repair plumbing, replace wastegate diaphragm. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 5 Charge air cooler restricted (if equipped)	Inspect the air cooler for internal and external restrictions. Replace the restricted cooler if necessary. Refer to Procedure 010-027 (Charge-Air Cooler) in Section A.
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 Procedure 006-015 (Fuel Filter (Spin-On Type)) in Section 5.
OK Go To Next Step	
STEP 7 High-speed screw is **not** adjusted correctly	Loosen the locknut, and adjust the high-speed (top-0) screw. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 8 Fuel shutoff lever (mechanical) partially engaged	Make sure fuel shutoff lever is in the RUN position. Replace if necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 9 Exhaust back pressure too high	Measure and correct if above specification. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	

REFERENCE ONLY

Engine Will Not Reach Rated Speed (RPM)

Cause	Correction
STEP 10 Fuel transfer pump malfunctioning	Inspect the fuel transfer pump. Replace if necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 11 Fuel injection pump is malfunctioning	Remove the fuel pump. Refer to an Authorized Cummins Repair Location. Calibrate the fuel pump.
OK Go To Next Step	
STEP 12 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Engine Will Not Shut Off

Cause	Correction
STEP 1 Fuel shutoff valve is malfunctioning	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 an Authorized Cummins Repair Location.
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 an Authorized Cummins Repair Location.
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 an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 4 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

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. Completely vent air from the fuel system. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 3 Air filter is restricted	Check the air filter for restrictions. Refer to Procedure 010-052 (Air Cleaner Restriction) in Section 4.
OK Go To Next Step	
STEP 4 Fuel injection pump timing is **not** correct	Put the engine at top dead center. Check and adjust the fuel timing. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 5 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 an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 6 Injector sealing washer not correct	Check to see if an extra sealing washer is installed under injector. Remove any additional sealing washer. **Only** one is required. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 7 Injector is malfunctioning	Inspect the injectors. Replace the injectors as necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 8 Turbocharger is malfunctioning	Monitor the turbocharger boost pressure with an electronic service tool. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	

REFERENCE ONLY

Exhaust Smoke Excessive Under Load

Cause	Correction
STEP 9 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 10 Fuel injection pump is malfunctioning	Remove the fuel pump. Refer to an Authorized Cummins Repair Location. Calibrate the fuel pump.
OK Go To Next Step	
STEP 11 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 an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 12 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Fuel Knock

Cause	Correction
STEP 1 Engine is overloaded	Check for added loading from malfunctioning accessories or driven units, brakes dragging, and other changes in vehicle, vessel, or equipment loading. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 2 Fuel quality is poor	Operate the engine from a temporary tank of good-quality number 2 diesel fuel. Clean and flush vehicle's fuel system. Fill fuel system with a good-quality number 2 diesel fuel.
OK Go To Next Step	
STEP 3 Air in the fuel system	Bleed the fuel system and check for leaks. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 4 Fuel injection pump timing is **not** correct	Put the engine at top dead center. Check and adjust the fuel timing. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 5 Injectors worn or malfunctioning	Inspect the injectors and replace any malfunctioning injectors. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 6 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

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 Procedure 010-058 (Air Intake Restriction) in Section 4.
OK Go To Next Step	
STEP 2 Injector needle valve sticking	Inspect the injectors. Replace if necessary. Refer to an Authorized Cummins 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 an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 4 Turbocharger oil seal is leaking	Check the turbocharger for oil seals and for leaks. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 5 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Lubricating Oil Contaminated

Cause	Correction
STEP 1 Coolant is leaking into the lubricating oil	Check for coolant in the oil. Refer to the Lubricating Oil Contaminated symptom tree.
OK Go To Next Step	
STEP 2 Lubricating oil sludge is excessive	Change the oil and filters. Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 4.
OK Go To Next Step	
STEP 3 Lubricating oil is contaminated with coolant or fuel	Change the oil and filters. Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 4 or a Cummins Authorized Repair Facility.
OK Go To Next Step	
STEP 4 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 an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 5 Injector needle valve sticking	Inspect the injectors. Replace if necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 6 Fuel injection pump is malfunctioning	Remove the fuel injection pump. Check the calibration of the fuel injection pump. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 7 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Lubricating Oil Loss

Cause	Correction
STEP 1 Lubricating oil leak (external)	Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 2 Lubricating oil level is above specification	Check the oil level. Verify the dipstick calibration and 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 3 Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Use the oil type recommended in Section V of the engine operation and maintenance manual Procedure 018-003 (Lubricating Oil Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 4 Lubricating oil cooler is leaking	Check the lubricating oil cooler for coolant leaks and cracks. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 5 Air compressor is pumping lubricating oil into the air system	Check the air lines for carbon buildup and lubricating oil. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 6 Blowby excessive	Check for excessive blowby. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 7 Turbocharger oil seal is leaking	Check the turbocharger for oil seals and for leaks. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 8 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Lubricating Oil Pressure High

Cause	Correction
STEP 1 Lubricating oil pressure sensor or gauge is malfunctioning or is **not** in the correct location	Check the oil pressure switch or gauge for correct operation and location. Refer to an Authorized Cummins Repair Location.
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 Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Use the oil type recommended in Section V of the engine operation and maintenance manual Procedure 018-003 (Lubricating Oil Recomendations and Specifications) in Section V.
OK Go To Next Step	
STEP 4 Lubricating oil pressure is above specification	Check the oil pressure. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 5 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Lubricating Oil Pressure Low

Cause	Correction
STEP 1 Lubricating oil level is low	Check and replenish lubricating oil. Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3.
OK Go To Next Step	
STEP 2 Lubricating oil pressure sensor or gauge is malfunctioning or is **not** in the correct location	Check the oil pressure switch or gauge for correct operation and location. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 3 Lubricating oil is diluted with fuel	Change the oil. Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 4. If the oil becomes diluted again, contact an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 4 Lubricating oil is diluted with water	Check for a missing dipstick, rain caps, or oil fill caps. Change the oil. Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 4.
OK Go To Next Step	
STEP 5 Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Use the oil type recommended in Section V of the engine operation and maintenance manual Procedure 007-002 (Lubricating Oil and Filters) in Section 4.
OK Go To Next Step	
STEP 6 Lubricating oil leak (external)	Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 7 Lubricating oil viscosity **not** correct	Make sure the correct lubricating oil is being used. Refer to Procedure 018-003 (Lubricating Oil Recomendations and Specifications) in Section V.
OK Go To Next Step	
STEP 8 Lubricating oil high-pressure relief valve is malfunctioning or lubricating pump pressure regulator	Remove and inspect the high-pressure relief valve. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	

REFERENCE ONLY

Lubricating Oil Pressure Low

Cause	Correction
STEP 9 Lubricating oil filter is plugged	Change the oil and filter. Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 4.

OK
Go To Next Step

STEP 10
Contact a Cummins Authorized Repair Facility

REFERENCE ONLY

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 Coolant temperature is below specification	Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 3 Intake manifold air temperature is below specification	Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 4 Fuel rate is low, fuel pressure is low, intake manifold pressure is low	Check the fuel pump output pressure, pulsation damper, and pressure regulator. Replace the fuel pump if necessary.
OK Go To Next Step	
STEP 5 Injection timing incorrect	Check injection timing. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 6 Fuel pump return overflow valve is malfunctioning	Inspect the return overflow valve. Replace if necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 7 Temperature switch failed	With the key system on, short out the harness at the temperature switch. If it engages, troubleshoot the sensor or check for air in the coolant system. Remove the sensor and make sure at ambient conditions the sensor is open; and at the correct temperature, 91°C [196°F], make sure the sensor closes. Replace if necessary an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 8 KSB is malfunctioning (Bosch VE pump **only**)	Refer to the OEM service manual.
OK Go To Next Step	

REFERENCE ONLY

Smoke, White — Excessive

Cause	Correction
STEP 9 Injector sealing washer **not** correct	Check to see if an extra sealing washer is installed under injector. Remove any additional sealing washer. **Only** one is required. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 10 Injector sealing washer **not** correct	Remove injector and install the proper sealing washer. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 11 Injector is malfunctioning	Inspect the injectors. Replace the injectors as necessary. Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 12 Coolant flow through the radiator is **not** correct	Refer to an Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 13 Fuel injection pump is malfunctioning	Remove the fuel pump. Refer to an Authorized Cummins Repair Location. Calibrate the fuel pump.
OK Go To Next Step	
STEP 14 Contact a Cummins Authorized Repair Facility	

REFERENCE ONLY

Section V - Maintenance Specifications

Section Contents

Page

Air Intake System V-5
Specifications V-5
Capscrew Markings and Torque Values V-18
Capscrew Markings and Torque Values - Metric V-18
Capscrew Markings and Torque Values - U.S. Customary V-18
General Information V-18
Coolant Recommendations and Specifications V-12
Cooling System Sealing Additives V-14
Cooling System Soluble Oils V-14
Fully Formulated Coolant/Antifreeze V-12
Cooling System V-4
Specifications V-4
Cummins/Fleetguard® Filter Specifications V-8
General Information V-8
Drive Belt Tension V-15
Tension Chart V-15
Electrical System V-7
Specifications V-7
Engine Component Torque Values V-16
General Information V-16
Exhaust System V-6
Specifications V-6
Fraction, Decimal, Millimeter Conversions V-20
Conversion Chart V-20
Fuel Recommendations and Specifications V-9
Fuel Recommendations V-9
Fuel System V-2
Specifications V-2
General Engine V-1
Specifications V-1
Lubricating Oil Recommendations and Specifications V-10
Arctic Operation V-11
General Information V-10
New Engine Break-in Oils V-11
Lubricating Oil System V-3
Specifications V-3
Newton-Meter to Foot-Pound Conversions V-21
Conversion Chart V-21
Pipe Plug Torque Values V-22
Torque Tables V-22
Sealants V-17
General Information V-17
Tap Drill Charts - U.S. Customary and Metric V-23
General Information V-23
Weights and Measures - Conversion Factors V-24
Conversion Chart V-24

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

General Engine

Specifications

Horsepower
B3.9, B5.9.....Refer to engine dataplate
Bore
B3.9, B5.9.....102 mm [4.02 in]
Stroke
B3.9, B5.9.....120 mm [4.72 in]
Displacement
B3.9.....3.9 liters [238 C.I.D.]
B5.9.....5.9 liters [360 C.I.D.]
Engine Weight (dry) Less Flywheel and Electric Components
B3.9.....308 to 329 kg [679 to 725 lb]
B5.9.....388 to 411 kg [855 to 906 lb]
Firing Order
B3.9.....1-3-4-2
B5.9.....1-5-3-6-2-4
Valve Clearance
B3.9 and B5.9
Intake.....0.25 mm [0.010 in]
Exhaust.....0.51 mm [0.020 in]
Compression Ratio
B3.9.....(rotary pump) 17.6:1
B5.9.....(in-line pump) 17.9:1
Crankshaft Rotation (viewed from the front of the engine)
B3.9 and B5.9..... **Clockwise**
Aspiration
Turbocharged
B3.9.....Yes
B5.9.....Yes
Aspiration
Charge Air Cooled
B3.9.....Yes
B5.9.....Yes

REFERENCE ONLY

Fuel System

Specifications

Distributor-Type Fuel Injection Pumps B3.9 and B5.9 Engines

Maximum Inlet Restriction to the Fuel Transfer Pump **Must Not** Exceed.....100 mm Hg [4 in Hg]
Maximum Allowable Return Line Restriction.....518 mm Hg [20.4 in Hg]
Maximum Allowable Pressure Drop across Fuel Filter.....35 kPa [5 psi]
Maximum Inlet Pressure to the Injection Pump **Must Not** Exceed.....70 kPa [10 psi]

In-Line-Type Fuel Injection Pumps B3.9 and B5.9 Engine

Maximum Inlet Restriction to the Fuel Transfer Pump **Must Not** Exceed.....100 mm Hg [4 in Hg]
Fuel Transfer Pump Minimum Output Pressure.....175 kPa [25 psi] at Rated rpm
Fuel Filter Restriction (maximum pressure drop across filters).....35 kPa [5 psi]
Fuel Pressure Gallery Pressure.....140 kPa [20 psi] at Rated rpm
Fuel Return Maximum Restriction.....518 mm Hg [20.4 in Hg]

REFERENCE ONLY

Lubricating Oil System

Specifications

Lubricating Oil Pressure at Idle (minimum allowable)..... 69 kPa [10 psi]
Lubricating Oil Pressure at Rated (minimum allowable).....207 kPa [30 psi]
Regulating Valve Opening Pressure..... 449 kPa [65 psi]
Lubricating Oil Capacity
Standard Pan Only
B3.9.....9.5 liters [10 qt]
B5.9..... 14.2 liters [15 qt]
Lubricating Oil Capacity
Total System - Liters [U.S. qt]
B3.9..... 11 liters [11.6 qt]
B5.9.....16.4 liters [17.3 qt]
Lubricating Oil Capacity
Low to High
B3.9.....0.9 liter [1 qt]
B5.9.....1.9 liters [2 qt]

NOTE: If the type/oil capacity of the oil pan in **not** known:

1. Contact a local Cummins Distributor/Dealer
2. Determine the capacity of the oil pan option for the engine being serviced by using QuickServe OnLine and the engine serial number
3. Fill the lubricating oil pan to the smallest oil pan capacity listed for the engine being serviced. Then add 0.95 liters [1 qt] of oil at a time until it reaches the high mark on the dipstick. Record the number of quarts added so that capacity is known the next time the oil is drained.

REFERENCE ONLY

Cooling System

Specifications

Coolant Capacity (engine only)
- B3.9.....7 liters [7.4 qt]
- B5.9.....10.5 liters [11.1 qt]

Standard Modulating Thermostat Range
- Start to Open.....83°C [181°F]
- Fully Open.....95°C [203°F]

Pressure Cap
- 104°C [220°F] Systems.....103 kPa [15 psi]
- 99°C [210°F] Systems.....48 kPa [7 psi]

REFERENCE ONLY

Air Intake System

Specifications

Maximum Allowable Intake Restriction

Clean Air Filter Element.....254 mm H_2O [10 in H_2O]
Dirty Air Filter Element.....635 mm H_2O [25 in H_2O

REFERENCE ONLY

Exhaust System

Specifications

Maximum Allowable Exhaust Restriction at Rated Speed and Loaded

1991 to 1993 EPA Certified.....114.3 mm Hg [4.5 in Hg]
1994 to 1998 EPA Certified (with oxidation catalyst).....152.4 mm Hg [6 in Hg]

REFERENCE ONLY

Electrical System

Specifications

Minimum Recommended Battery Capacity @ • 18°C [0°F]

12-VDC Starter
With Light Accessories(1)
B3.9.....625 CCA
B5.9.....800 CCA
12-VDC Starter
With Heavy Accessories(2)
B3.9.....800 CCA
B5.9.....950 CCA
24-VDC Starter
With Light Accessories(1)
B3.9.....400 CCA
B5.9.....400 CCA
24-VDC Starter
With Heavy Accessories(2)
B3.9.....400 CCA
B5.9.....475 CCA
Maximum Allowable Starting Circuit Resistance
12-VDC Starter
B3.9.....0.0012 ohms
B5.9.....0.0012 ohms
Maximum Allowable Starting Circuit Resistance
24-VDC Starter
B3.9.....0.0020 ohms
B5.9.....0.0020 ohms

1. Typical light accessories include alternator, small steering pump, and disengaged clutch.
2. Typical heavy accessories include hydraulic pump and torque converter.

Batteries (Specific Gravity)	
Specific Gravity at 27° C [80° F]	State of Change
1.260 to 1.280	100%
1.230 to 1.250	75%
1.200 to 1.220	50%
1.170 to 1.190	25%
1.140 to 1.130	Discharged

REFERENCE ONLY

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 should insist on products that the supplier has tested to meet Cummins high-quality standards.

Cummins can **not** be responsible for problems caused by nongenuine filters that do **not** meet Cummins performance or durability requirements.

Filter Part Numbers						
	Lubricating Oil Filter B3.9	**Lubricating Oil Filter B4.5**	**Lubricating Oil Filter B5.9**	**Fuel Filter B3.9**	**Fuel Filter B4.5**	**Fuel Filter B5.9**
Cummins Part Number	**3934429**	**3934429**	**3934430**	**3966139**	**3991250**	**3900632**
Fleetguard® Part Number	LF9100	LF9100	LF9098	FF9412	FS19608	FF9417

REFERENCE ONLY

Fuel Recommendations and Specifications

Fuel Recommendations

⚠CAUTION⚠

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

The viscosity of the fuel **must** be kept above 1.3 cSt at 40°C [104°F] to provide adequate fuel system lubrication.

The following chart lists acceptable alternative fuels for ISB Series engines.

Acceptable Substitute Fuels - Cummins ISB Fuel System									
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	A	A	A	A	A	**NOT** OK	**NOT** OK	**NOT** OK
• An "A" means OK **only** if fuel lubricity is adequate. This means the BOCLE number is 3100 or greater as measured with the US Army scuffing BOCLE test.									
• Any adjustment to compensate for reduced performance with a fuel system using alternate fuel is **not** warrantable.									
• Winter blend fuels, such as found at commercial fuel dispensing outlets, are combinations of Number 1D and Number 2D diesel and are acceptable.									

Additional information for fuel recommendations and specifications can be found in Fuel for Cummins Engines, Bulletin 3379001. See ordering information in the back of this manual.

REFERENCE ONLY

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 below.

NOTE: In areas where CG-4 or CH-4 lubricating oils are **not** available, CES20075 can be used, but, the lubricating oil change **must** be reduced by 50 percent of the Maintenance Schedule oil change interval.

Cummins Engineering Standard Classification (CES)	American Petroleum Institute Classification (API)	International Classifications	Comments
	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 CH-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		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.

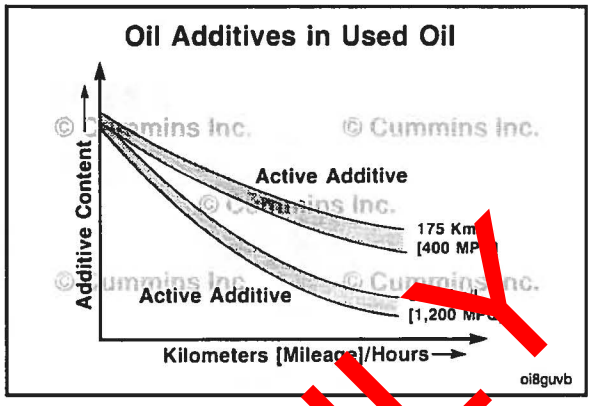
The lower half can contain words to describe oil energy-conserving features.

The center section identifies the SAE oil viscosity grade.

REFERENCE ONLY

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.

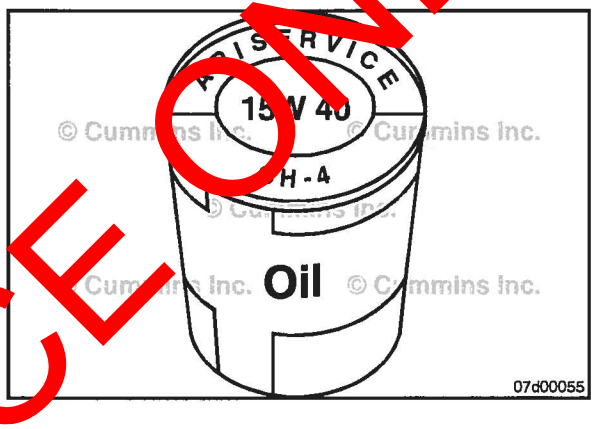
Extending oil and filter change intervals beyond the recommendations will decrease engine life due to factors such as corrosion, deposits, and wear.



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 Engine Manufacturers Association, Two North LaSalle Street - Suite 2200, Chicago, IL, U.S.A. 60602. The telephone number is (312) 827-8733.



Arctic Operation

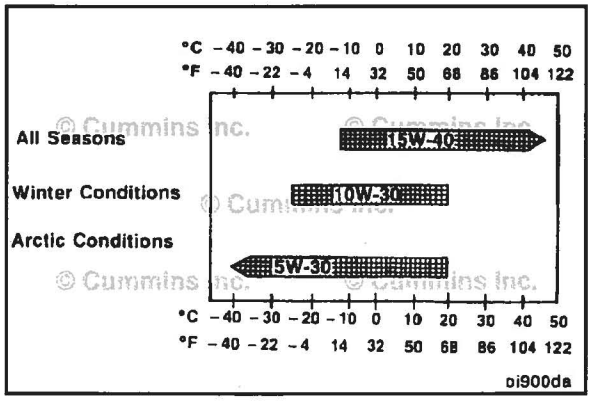
⚠CAUTION⚠

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.

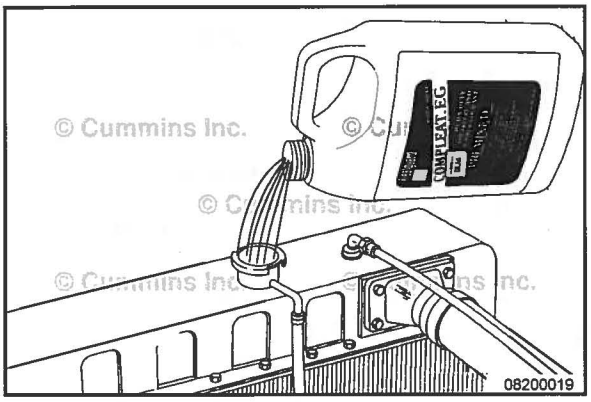
The use of low-viscosity oils, such as 10W or 10W-30, can be used to aid in starting the engine and in providing sufficient oil flow at ambient temperatures below -5°C [23° F]. However, continuous use of low viscosity oils can decrease engine life due to wear. Refer to the accompanying chart.

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.



REFERENCE ONLY



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)

REFERENCE ONLY

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).



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

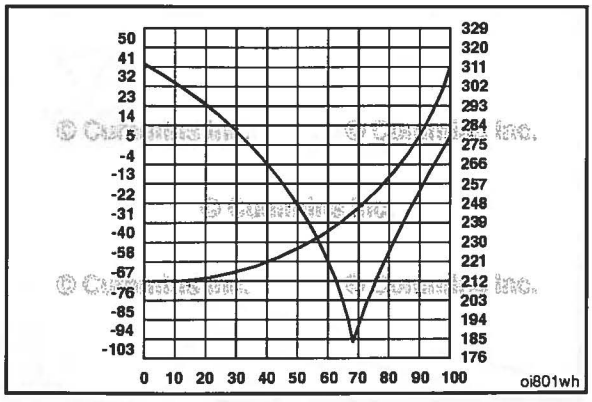
If the replacement coolant is Chevron Texaco, Shell Rotella® or their private label counterpart Extended Life OAT coolants, which do **not** meet the elastomer compatibility section of Cummins Engineering Standard 14603, then the coolant **must** be treated by adding 0.24 liters [8 oz] of liquid silicate 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:

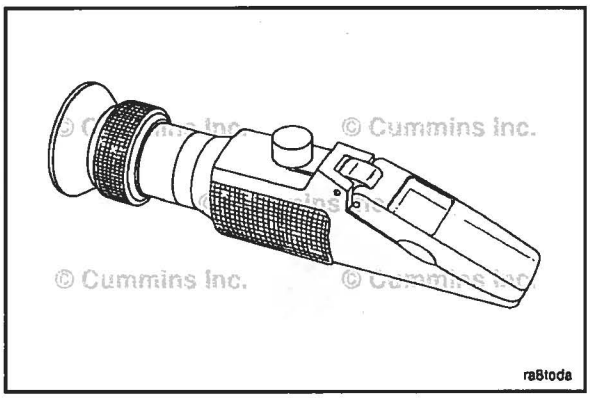
Silicate Fluid Order Program
P.O. Box 27388
Houston, TX
77277-7388
Phone: 800-346-9041
Fax: 800-876-5317

For further details and discussion of engine coolant for Cummins engines, refer to Cummins Coolant Requirements and Maintenance, Bulletin 3666132.

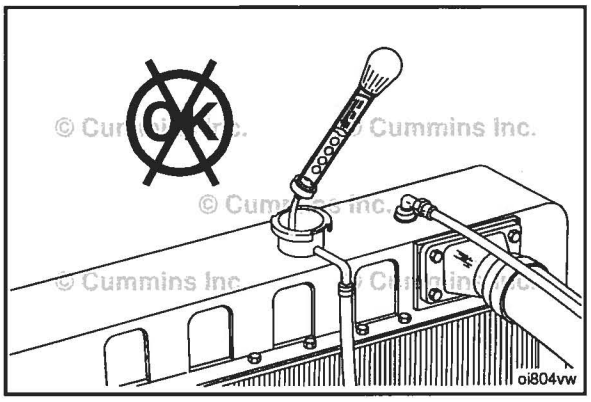
Fully formulated antifreeze **must** be mixed with good-quality water at a 50/50 ratio (40- to 60-percent working range). A 50/50 mixture of antifreeze and water gives a -36°C [-33°F] freezing point and a 108°C [226°F] boiling point, which is adequate for locations in North America. The actual lowest 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.



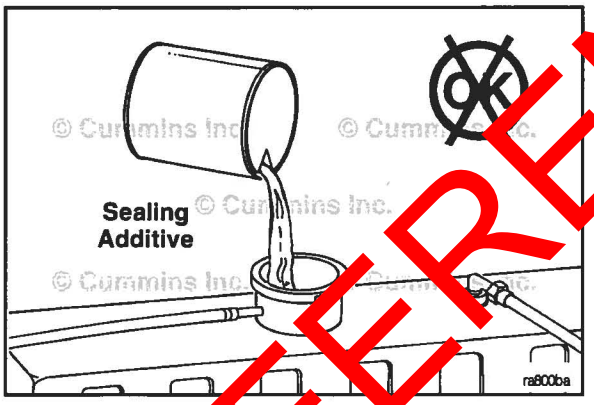
REFERENCE ONLY



A refractometer **must** be used to measure the freezing point of the coolant **accurately**. Use Fleetguard® refractometer, Part Number CC2800 or CC2806.



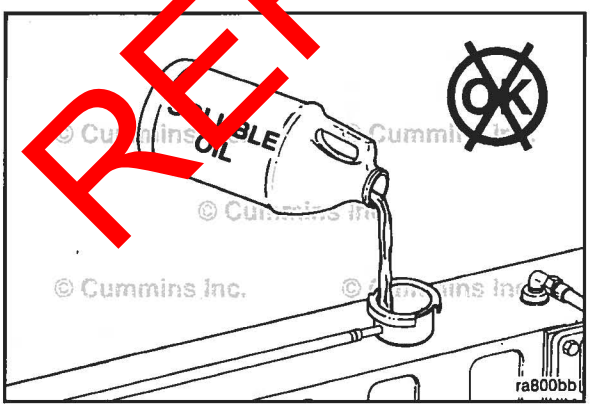
Do **not** use a floating ball hydrometer. Using floating ball hydrometers can give an incorrect reading.



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.

REFERENCE ONLY

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	270 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.

REFERENCE ONLY

Engine Component Torque Values

General Information

Component	Wrench Size	N•m	ft-lb or in-lb
Aftercooler Mounting	10 mm	24	18 ft-lb
Aftercooler Water Hose Clamp	8 mm	5	44 in-lb
Alternator Link (Delco 10-15 SI)	13 mm	24	18 ft-lb
Alternator Link (Delco 20-27 SI)	3/4 in	43	32 ft-lb
Alternator Mtg. Bolt 10-15 SI	15 mm	43	32 ft-lb
Alternator Mtg. 27 SI	18 mm	77	57 ft-lb
Alternator Support (Upper)	10 mm	24	18 ft-lb
Belt Tensioner Flat Bracket	Allen 5 mm	24	18 ft-lb
Belt Tensioner Mounting	15 mm	43	32 ft-lb
Crankshaft Damper and Pulley	15 mm	57	101 ft-lb
Crossover Clamp	5/16 in	5	44 in-lb
Tee Bolt Type Clamp	11 mm	8	71 in-lb
Exhaust Outlet Pipe, V Band Clamp	7/16 in		71 in-lb
Fan Bracket Mounting	10 mm	24	18 ft-lb
Fan Pulley	10 mm	24	18 ft-lb
Fan Pulley	13 mm	43	32 ft-lb
Fuel Filter	75 to 85 mm	Install as specified by filter manufacturer	
Fuel Filter Adapter Nut	24 mm	32	24 ft-lb
Lubricating Oil Filter	75 to 85 mm	3/4 Turn after Contact	
Lubricating Oil Cooler Assembly	10 mm	24	18 ft-lb
Lubricating Oil Pan Drain Plug (steel)	17 mm	80	59 ft-lb
Lubricating Oil Pan Drain Plug (aluminum)	17 mm	30	22 ft-lb
Lubricating Oil Pan Heater Plug	27 mm	80	59 ft-lb
Lubricating Oil Pressure Regulator Plug	19 mm	80	59 ft-lb
Starter Mounting	10 mm	43	32 ft-lb
Thermostat Housing	10 mm	24	18 ft-lb
Water Inlet Connection	15 mm	43	32 ft-lb
Water Pump Mounting	13 mm	24	18 ft-lb
Rocker Lever Cover	15 mm	24	18 ft-lb
Water-in-Fuel Sensor	19 mm	Hand-Tighten	
Top - Load Filter Lid	10 mm	Hand-Tighten	

REFERENCE ONLY

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)

REFERENCE ONLY

Capscrew Markings and Torque Values

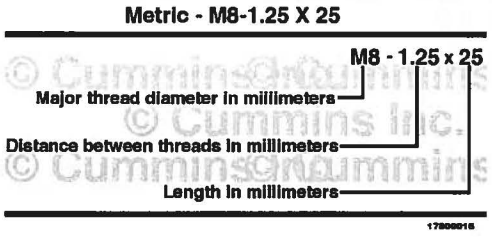
General Information

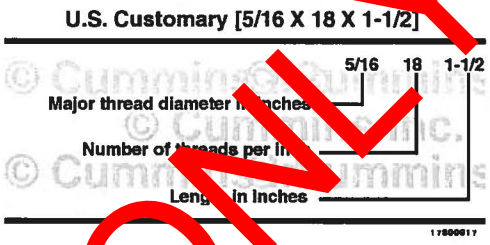
⚠CAUTION⚠

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:

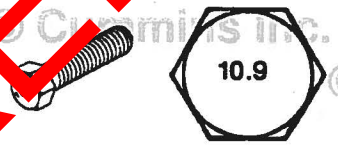
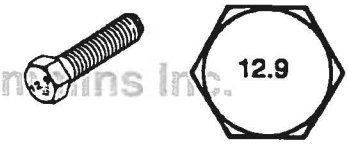




NOTES:

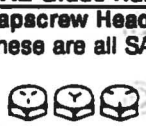
1. **Always** use the torque values listed in the following tables when specific torque values are **not** available.
2. Do **not** use the torque values in place of those specified in other sections of this manual.
3. The torque values in the table are based on the use of lubricated threads.
4. When 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	8.8				10.9				12.9			
Capscrew Head Markings												
Body Size Diameter mm	Torque Cast Iron N•m	Cast Iron ft-lb	Aluminum N•m	Aluminum ft-lb	Torque Cast Iron N•m	Cast Iron ft-lb	Aluminum N•m	Aluminum ft-lb	Torque Cast Iron N•m	Cast Iron ft-lb	Aluminum N•m	Aluminum 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

REFERENCE ONLY

SAE Grade Number	5	8
Capscrew Head Markings These are all SAE Grade 5 (3 line)		

© Cummins Inc.

Capscrew Body Size	Capscrew Torque - Grade 5 Capscrew				Capscrew Torque - Grade 8 Capscrew			
	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	4[illegible]	[illegible]	25
7/16 - 14	60	45	45	35	90	[illegible]	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	11[illegible]	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	11[illegible]	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	21[illegible]	515	380	285	210
7/8 - 9	490	360	3[illegible]	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

REFERENCE ONLY

Fraction, Decimal, Millimeter Conversions

Conversion Chart

Fraction	inch	mm	Fraction	inch	mm
1/64	0.0156	0.397	33/64	0.5156	13.097
1/32	0.0313	0.794	17/32	0.5313	13.494
3/64	0.0469	1.191	35/64	0.5469	13.891
1/16	0.0625	1.588	9/16	0.5625	4.288
5/64	0.0781	1.984	37/64	0.5781	.684
3/32	0.0938	2.381	19/32	0.5938	081
7/64	0.1094	2.778	39/64	0.6094	15.478
1/8	0.1250	3.175	5/8	0.625	5.875
9/64	0.1406	3.572	41/64	0.6406	16.272
5/32	0.1563	3.969	21/32		16.669
11/64	0.1719	4.366	43/64	0.67 9	17.066
3/16	0.1875	4.763	11/16	0. 875	17.463
13/64	0.2031	5.159	45/64	0.7 31	17.859
7/32	0.2188	5.556	23/32	7188	18.256
15/64	0.2344	5.953	47 64	0.7344	18.653
1/4	0.2500	6.350	3/4	0.7500	19.050
17/64	0.2656	6.747	49 4	0.7656	19.447
9/32	0.2813	7.144	25/32	0.7813	19.844
19/64	0.2969	7.541	51 64	0.7969	20.241
5/16	0.3125	7.938	/16	0.8125	20.638
21/64	0.3281	8.	53/64	0.8281	21.034
11/32	0.3438	8.73	27/32	0.8438	21.431
23/64	0.3594	9.128	55/64	0.8594	21.828
3/8	0.3750	.525	7/8	0.8750	22.225
25/64	0.3906	.92	57/64	0.8906	22.622
13/32	0.4063	10.319	29/32	0.9063	23.019
27/64	0.42 9	10.716	59/64	0.9219	23.416
7/16	4375	11.113	15/16	0.9375	23.813
29/64	0 531	11.509	61/64	0.9531	24.209
15/32	0.46 8	11.906	31/32	0.9688	24.606
31/64	0.4844	12.303	63/64	0.9844	25.003
1/2	0.5000	12.700	1	1.0000	25.400

Conversion Factor: 1 inch = 25.4 mm

REFERENCE ONLY

Newton-Meter to Foot-Pound Conversions

Conversion Chart

N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1	9 in-lb	55	41	155	114
5	44 in-lb	60	44	160	118
6	53 in-lb	65	48	165	122
7	62 in-lb	70	52	170	[illegible]
8	71 in-lb	75	55	175	129
9	80 in-lb	80	59	180	133
10	89 in-lb	85	63	185	136
11	97 in-lb	90	66	190	140
12	106 in-lb	95	70	195	144
14	124 in-lb	100	74	[illegible]	148
15	133 in-lb	105	77	205	151
16	142 in-lb	110	81	210	155
18	159 in-lb	115	85	[illegible]	159
20	15 ft-lb	120	[illegible]	220	162
25	18	125	[illegible]	225	165
30	22	130	96	230	170
35	26	135	[illegible]	235	173
40	30	140	[illegible]	240	177
45	33	145	107	245	180
50	37	[illegible]	111	250	184

NOTE: To convert from Newton-Meters to Kilogram-Meters divide Newton-Meters by 9.803.

REFERENCE ONLY

Pipe Plug Torque Values

Torque Table

Size		Torque		Torque	
Thread	Actual Thread O.D.	In Aluminum Components		In Cast Iron or Steel Components	
in	in	N•m	ft-lb	N•m	ft-lb
1/16	0.32	5	45 in-lb	15	10
1/8	0.41	15	10	20	15
1/4	0.54	20	15	25	20
3/8	0.68	25	20	35	25
1/2	0.85	35	25	55	40
3/4	1.05	45	35	75	55
1	1.32	60	45	[illegible]	70
1-1/4	1.66	75	55	[illegible]	85
1-1/2	1.90	85	65	135	100

REFERENCE ONLY

Tap-Drill Chart - U.S. Customary and Metric

General Information

NOTE ON SELECTING TAP-DRILL SIZES: The tap drill sizes shown on this card give the theoretical tap drill size for approximately 60% and 75% of full thread depth. Generally, it is recommended that drill sizes be selected in the 60% range as these sizes will provide about 90% of the potential holding power. Drill sizes in the 75% range are recommended for shallow hole tapping (less than 1 1/2 times the hole diameter) in soft metals and mild steel.

Tap Size		Drill
60%	75%	Size
		48
		1.95mm
		5/64
	3-48	47
		2.00mm
	M2.5x.45	2.05mm
		46
3-48	3056	45
		2.10mm
M2.5x.45	M2.6x.45	2.15mm
3-56	4-36	44
		2.20mm
M2.6x.45		2.25mm
4-36	4-40	43
		2.30mm
		2.35mm
4-40	4-48	42
		3/32
	M3x.6	2.40mm
4-48		41
		2.45mm
		40
M3x.6	M3x.5	2.50mm
		39
	5-40	38
M3x.5		2.60mm
5-40	5-44	37
		2.70mm
5-44	6-32	36
		2.75mm
		7/64
		35
		2.80mm
		34
6-32	6-40	33
	M3.5x6	2.90mm
		32
M3.5x6		3.00mm
6-40		31
		3.10mm
		1/8
		3.20mm
	M4x.75	3.25mm
		30
	M4x.7	3.30mm
M4x.75		3.40mm
M4x.7	8-32	29
		3.50mm
	8-36	28
8-32		9/
		3.60mm
8-36		27
		3.70mm
		26
	M4	3.75m
	1	25
		3.80mm
		24
M4.5x.7		3.9 mm
		5/32
-24		22
	M	4.00mm
	10-32	21
		20
	M5x.9	4.10mm
M5x1	M5x.8	4.20mm
10-32		19
M5x.9		4.25mm
M5x.8		4.30mm
		18
		11/64
		17

Tap Size		Drill
60%	75%	Size
		4.40mm
	12-24	16
		4.50mm
		15
	M5.5x.9	4.60mm
12-24	12-28	14
		13
		4.70mm
M5.5x.9		4.75mm
12-28		3/16
		12
		4.80mm
		11
		4.90mm
		10
		9
	M6x1	5.00mm
		8
		5.10mm
	1/4-20	7
		13/64
		6
M6x1		5.20mm
		5
	M6x.75	5.25mm
		5.30mm
1/4-20		4
M6x.75		5.40mm
	1/4-28	3
		5.50mm
		7/32
		5.[illegible]
1/4-28		2
		5.70[illegible]
		1
		5.75mm
		[illegible]0mm
		5.90mm
		A
		15/[illegible]
	M[illegible]1	[illegible]mm
		6.10mm
		C
M7x1		6.20mm
		D
	[illegible]x.75	6.25mm
		6.30mm
		E
		1/4
		6.40mm
		6.50mm
	5/16-18	F
		6.60mm
		G
		6.70mm
		17/64
	M8x1.25	6.75mm
5/16-18		H
		6.80mm
		6.90mm
	5.16-24	I
M8x1.25	M8x1	7.00mm
		J
		7.10mm
5/16-24		K
		9/32
M8x1		7.20mm
		7.25mm
		7.30mm
		L
		7.40mm
		M

Tap Size		Drill
60%	75%	Size
		7.50mm
		19/64
		7.60mm
		N
		7.70mm
	M9x1.25	7.75mm
		7.80mm
		7.90mm
	3/8-16	5/16
M9x1.25	M9x1	8.00mm
		O
		8.1[illegible]
M9x1		8.[illegible]mm
		[illegible]
		[illegible]5mm
		8.[illegible]mm
3/8-16	1/8-27NPT	21/[illegible]
		8.40m[illegible]
	[illegible]-24	Q
	M10x1.5	8.50mm
		8.60mm
		R
3/8-24		[illegible]0mm
1/[illegible]PT		11/32
	M1[illegible].25	8.75mm
M10x1.5		8.80mm
		S
		8.90mm
[illegible]0x1.25	[illegible]10x1	9.00mm
		T
		9.10mm
		23/64
[illegible]x1		9.20mm
		9.30mm
	7/16-14	U
		9.40mm
	M11x1.5	9.50mm
		3/8
		V
		9.60mm
		9.70mm
		9.75mm
M11x1.5		9.80mm
7/16-14		W
		9.90mm
	7/16-20	25/64
		10.00mm
7/16-20		X
	M12x1.75	10.20mm
		Y
		13/32
		Z
M12x1.75	M12x1.5	10.50mm
	1/2-13	27/64
M12x1.5	M12x1.25	10.75mm
M12x1.25		11.00mm
1/2-13		7/16
1/4-18NPT		
		11.25mm
		11.50mm
		29/64
		11.75mm
		11.50mm
	1/2-20	29/64
	9/16-12	15/32
	M14x2	12.00m
		12.25mm
9/16-12		31/64
M14x2	M14x1.5	12.50mm
	9/16-18	1/2
M14x1.5	M14x1.25	12.75mm
M14x1.25		13.00mm
9/16-18		33/64

Tap Size		Drill
60%	[illegible]	Size
		[illegible]5mm
	5/8-11	17/[illegible]
	M15x1.5	13.50mm
M15x1.[illegible]		13.75mm
5/8-11		35/64
	[illegible]6x2	14.00mm
		14.25mm
	5/8-[illegible]	9/16
	M16x1.5	14.50mm
5/8-16		37/64
		14.75mm
M[illegible]x1.5		15.00mm
		19.32
		15.25mm
		39/64
	M17x1.5	15.50mm
M17x1.5	M18x2.5	15.75mm
		5/8
M18x2.5	M18x2	16.00mm
M18x2		16.25mm
	3/4-10	41/64
	M18x1.5	16.50mm
3/4-10	M19x2.5	21/32
M18x1.5		16.75mm
M19x2.5		17.00mm
		43/64
		17.25mm
3/4-16	3/4-16	11/16
	M20x2.5	17.50mm
		17.75mm
		45/64
M20x2.5	M20x2	18.00mm
M20x2		18.25mm
		23/32
	M20x1.5	18.50mm
		47/64
M20x1.5		18.75mm
		19.00mm
		3/4
		19.25mm
	7/8-9	49/64
	M22x2.5	19.50mm
7/8-9		25/32
		19.75mm
M22x2.5	M22x2	20.00mm
	7/8-14	51/64
M22x2		20.25mm
	M22x1.5	20.50mm
7/8-14		13/16
		20.75mm
M22x1.5	M24x3	21.00mm
		53/64
		21/25mm
		27/32
M24x3		21.50mm
		21.75mm
		55/64
	M24x2	22.00mm
	1"-8	7/8
M24x2		22.25mm
	M24x1.5	22.50mm
1"-8		57/64
M24x1.5		22.75mm
	M25x2	23.00mm
	1"-12	29/32
M25x2		23.25mm
1"x12	1"-14	59/64
	M25x1.5	23.50mm
M20x1.5		23.75mm
1"-14		15/16

REFERENCE ONLY
© Cummins Inc.

17800013

Weights and Measures - Conversion Factors

Conversion Chart

Quantity	U.S. Customary		Metric		From U.S. Customary To Metric Multiply By	From Metric To U.S. Customary Multiply By
	Unit Name	Abbreviation	Unit Name	Abbreviation		
Area	sq. inch	in^2	sq. millimeters	mm^2	645.16	0.0015
			sq. centimeters	cm^2	6.452	
	sq. foot	ft^2	sq. meter	m^2	0.0929	10.764
Fuel Consumption	pounds per horsepower hour	lb/hp-hr	grams per kilowatt hour	g/kW-hr	608.277	0.001645
Fuel Performance	miles per gallon	mpg	kilometers per liter	km/l	0.4251	2.352
	gallons per mile	gpm	liters per kilometer	l/km	2.35	0.4251
Force	pounds force	lbf	Newton	N	4.482	0.224809
Length	inch	in	millimeters	mm	25.4	0.039370
	foot	ft	millimeters	mm	304.01	0.00328
Power	horsepower	hp	kilowatt	kW	0.746	1.341
Pressure	pounds force per sq. inch	psi	kilopascal	kPa	6.8948	0.145037
	inches of mercury	in Hg	kilopascal	kPa	3.3769	0.29613
	inches of water	in H_2O	kilopascal	kPa	0.2488	4.019299
	inches of mercury	in Hg	millimeters of mercury	mm Hg	25.40	0.039370
	inches of water	in H_2O	millimeters of water	mm H_2O	25.40	0.039370
	bars	bars	kilopascals	kPa	100.001	0.00999
	bars	bars	millimeters of mercury	mm Hg	750.06	0.001333
Temperature	fahrenheit	F	centigrade	°C	(°F-32) ÷ 1.8	(1.8 x °C) + 32
Torque	pound force per foot	lb	Newton-meter	N•m	1.35582	0.737562
	pound force per inch	in-lb	Newton-meter	N•m	0.113	8.850756
Velocity	miles/hour	mph	kilometers/hour	kph	1.6093	0.6214
Volume: liquid displacement	gallon (U.S.)	gal.	liter	l	3.7853	0.264179
	gallon (Imp*)	gal.	liter	l	4.546	0.219976
	cubic inch	in^3	liter	l	0.01639	61.02545
	cubic inch	in^3	cubic centimeter	cm^3	16.387	0.06102
Weight (mass)	pounds (avoir.)	lb	kilograms	kg	0.4536	2.204623
Work	British Thermal Unit	BTU	joules	J	1054.5	0.000948
	British Thermal Unit	BTU	kilowatt-hour	kW-hr	0.000293	3414
	horsepower hours	hp-hr	kilowatt-hour	kW-hr	0.746	1.341

REFERENCE ONLY

Section W - Warranty

Section Contents

	Page
All Engines United States and Canada School Bus	W-8
All Engines Worldwide All Bus (Except U.S./Canada Diesel Powered School Buses)	W-3
B5.9 & C8.3 Engines United States and Canada Recreational Vehicle	W-6
B/B Gas Plus/BLPG Plus/ISB Engines United States and Canada Automotive	W-1
California Emission Control System Warranty, On-Highway	W-11

REFERENCE ONLY

This Page Left Intentionally Blank

REFERENCE ONLY

B/B Gas Plus/BLPG Plus/ISB Engines United States and Canada Automotive

Coverage

Products Warranted

This warranty applies to new B and ISB series diesel, LPG, compressed or liquid natural gas fueled Engines sold by Cummins and delivered to the first user on or after October 1, 1996, that are used in automotive on-highway applications in the United States* or Canada with three exceptions. Cummins provides different warranty coverage for engines used in fire apparatus truck and crash truck, bus and coach, and recreational vehicle applications.

Base Engine Warranty

This warranty covers any failures of the Engine which result, under normal use and service, from a defect in material or factory workmanship (Warrantable Failure). This coverage begins with the sale of the engine by Cummins and ends two years (two years or 50,000 miles/80,468 kilometers for B3.9 whichever occurs first) after the date of delivery of the Engine to the first user.

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

Additional coverage is outlined in the Emission Warranty section.

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

Cummins Responsibilities

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

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

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

Cummins will pay reasonable costs for towing a vehicle disabled by a Warrantable Failure to the nearest authorized repair location for the first year from the date of delivery of the Engine to the first user or the duration of the warranty, whichever occurs first. In lieu of the towing expense, Cummins will pay reasonable costs for mechanics to travel to and from the location of the vehicle, including meals, mileage,and lodging when the repair is performed at the site of the failure.

Owner Responsibilities

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

Before the expiration of the applicable warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility. Except for Engines disabled by a Warrantable Failure during the first year from the date of delivery of the Engine to the first user or the duration of the warranty, whichever occurs first, Owner must also deliver the Engine to the repair facility. Locations in the United States and Canada are listed in the Cummins United States and Canada Sales and Service Directory.

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

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

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

Limitations

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, fuel or catalytic reagent or by water, dirt or other contaminants in the fuel, oil or catalytic reagent.

This warranty does not apply to accessories supplied by Cummins which bear the name of another company. This category includes, but is not limited to: alternators, starters, fans, air conditioning compressors, clutches, filters,

REFERENCE ONLY

transmissions, torque converters, vacuum pumps, engine exhaust brakes, power steering pumps, non-Cummins fan drives, and air compressors.

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

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

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

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

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

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

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

Emission Warranty

Products Warranted

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

Coverage

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

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

Limitations

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

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

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

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

REFERENCE ONLY

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

Coverage

Products Warranted

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

Base Engine Warranty

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

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

Extended Major Components Warranty

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

Bushing and bearing failures are not covered.

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

Emission Warranty

Additional coverage is outlined under the Emission Warranty.

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

Cummins Responsibilities

During The Base Engine Warranty

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

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

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

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

During The Extended Major Components Warranty

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

Owner Responsibilities

During The Base Engine Warranty

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

During The Extended Major Components Warranty

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

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

REFERENCE ONLY

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

During The Base Engine and Extended Major Components Warranties

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

Before the expiration of the applicable warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility. Except for Engines disabled by a Warrantable Failure during the Base Engine Warranty, the Owner must also deliver the Engine to the repair facility. Locations in the United States and Canada are listed in the Cummins United States and Canada 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 and for "downtime" expenses, fines, cargo damage, 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, fuel or catalytic reagent or by water, dirt or other contaminants in the fuel, catalytic reagent or oil.

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, fan, air conditioning compressors, clutches, filters, transmissions, torque converters, vacuum pumps, power steering pumps and air compressors.

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

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

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

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

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

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

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

Emission Warranty

Products Warranted

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

Coverage

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

REFERENCE ONLY

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

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

Limitations

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

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

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

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

REFERENCE ONLY

B5.9 & C8.3 Engines United States and Canada Recreational Vehicle

Coverage

Products Warranted

This warranty applies to new B5.9 and C8.3 series diesel Engines sold by Cummins Engine Company, Inc., hereafter "Cummins", and delivered to the first user on or after March 15, 1998, that are used in recreational vehicle* applications in the United States** or Canada.

Base Engine Warranty

The Base Engine Warranty covers any failures of the Engine which result, under normal use and service, from a defect in material or factory workmanship (Warrantable Failure). This coverage begins with the sale of the Engine by Cummins and ends seven years or 150,000 miles (241,402 kilometers), whichever occurs first, after the date of delivery of the Engine to the first user.

Emission Warranty

Additional coverage is outlined in the Emission Warranty on the back page.

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

Cummins Responsibilities

During The Base Engine Warranty

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

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

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

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

Owner Responsibilities

During The Base Engine Warranty

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

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

Before the expiration of the applicable warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility. Except for Engines disabled by a Warrantable Failure during the first year from the date of delivery of the Engine to the first user, Owner must also deliver the Engine to the repair facility. Locations in the United States and Canada are listed in the Cummins United States and Canada 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 and for "downtime" expenses, 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.

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

REFERENCE ONLY

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

Excessive oil consumption for B series Engines is covered for the duration of the coverage or 150,000 miles (241,402 km) or 10,000 hours after the date of delivery of the Engine to the first user, whichever of the three occurs first. Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failures of belts and hoses supplied by Cummins are not covered beyond the first 12 months after the date of delivery of the Engine to the first user or the expiration of the applicable Base Warranty, whichever occurs first.

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

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

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

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

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

Emission Warranty

Products Warranted

This emission warranty applies to new Engines marketed by Cummins that are used in the United States* in vehicles designed for transporting persons or property on a street or highway. This warranty applies to Engines delivered to the first user on or after January 1, 1998.

Coverage

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

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

Limitations

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

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

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

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

* A 'recreational vehicle' for this warranty is defined as a Class A Motorhome which is a vehicular unit built on a self-propelled motor vehicle chassis, primarily designed or altered to provide temporary living quarters for recreational, travel or camping use. The living unit has been entirely constructed on a bare, specially-designed motor vehicle chassis.

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

REFERENCE ONLY

All Engines United States and Canada School Bus

Coverage

Products Warranted

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

Base Engine Warranty

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

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

Extended Major Components Warranty

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

Bushing and bearing failures are not covered.

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

Emission Warranty

Additional coverage is outlined in the Emission Warranty on the back page.

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 in the United States terminate concurrently with the expiration of the express warranties applicable to such products. 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, belts, hoses and other maintenance items that are not reusable due to the Warrantable Failure.

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

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

During The Extended Major Components Warranty

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

Owner Responsibilities

During The Base Engine Warranty

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

REFERENCE ONLY

During The Extended Major Components Warranty

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

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

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

During The Base Engine and Extended Major Components Warranties

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

Before the expiration of the applicable warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility. Except for Engines disabled by a Warrantable Failure during the first 2 years from the date of delivery of the Engine to the first user, Owner must also deliver the Engine to the repair facility. Locations in the United States and Canada are listed in the Cummins United States and Canada 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 and for "downtime" expenses, passenger delays, 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, fuel or catalytic reagent or by water, dirt or other contaminants in the fuel, oil or catalytic reagent.

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

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

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

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

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

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

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

Emission Warranty

Products Warranted

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

REFERENCE ONLY

Coverage

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

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

Limitations

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

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

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

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

* A vehicle used to transport students to and from school and school-related events. Vehicle must have warning lights and the words "SCHOOL BUS" written on the front and rear roof caps.

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

REFERENCE ONLY

California Emission Control System Warranty, On-Highway

Products Warranted

This Emission Control System Warranty applies to diesel engines (hereafter, engines) certified with the California Air Resources Board beginning with the year 1991, marketed by Cummins, and registered in California for use in automotive on-highway applications.

Your Warranty Rights and Obligations

The California Air Resources Board and Cummins Inc., are pleased to explain the emission control system warranty on your 1991 and subsequent model year diesel engine. In California, new motor vehicle 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 diesel engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your diesel engine.

Your emission control system may include parts such as the fuel injection system and engine electronic control module. Also included may be hoses, connectors and other emission-related assemblies.

If an emission-related part on your engine is found to have a defect in material or factory workmanship that produces a measurable increase in emissions (Warrantable Condition), the part will be repaired or replaced by Cummins. This is your emission control system defects warranty.

Manufacturer's Warranty Coverage

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

Where a Warrantable Condition exists, Cummins will repair your engine at no cost to you including diagnosis, parts and labor.

Owner's Warranty Responsibilities

As the engine owner, you are responsible for the performance of the required maintenance listed in your Cummins Operation and Maintenance Manual.

You are responsible for presenting your engine to a Cummins dealer as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

As the engine owner, you should also be aware that Cummins may deny you warranty coverage if your engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

If you have any questions regarding your warranty rights and responsibilities, you should contact Cummins Customer Relation Department or the California Air Resources Board at 9528 Telstar Avenue, El Monte, CA 91731.

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

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

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

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

REFERENCE ONLY

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

REFERENCE ONLY

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 and subsequent failures resulting from such service or parts will not be covered under this emission control system warranty, except for Emergency Repairs as described below.

Cummins Responsibilities

The warranty coverage begins when the engine is delivered to the first user.

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 or by any individual using any replacement parts. A part not being available within 30 days or a repair not being complete within 30 days constitutes an emergency. Cummins will reimburse the Owner for expenses (including diagnosis), not to exceed the manufacturer's suggested retail price for all warranted parts replaced and labor charges based on the manufacturer's recommended time allowance for the warranty repair and the geographically appropriate hourly labor rate. Replaced parts and paid invoices must be presented at a Cummins authorized repair facility as a condition of reimbursement for emergency repairs not performed by a Cummins distributor, authorized dealer, or other repair location approved by Cummins.

Warranty 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 cooling, lubricating or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications to 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.

Cummins is not responsible for failures resulting from improper repair or the use of parts which are not genuine Cummins or Cummins approved parts.

Cummins is not responsible for the material and labor costs of emission control parts and assemblies replaced during Scheduled Maintenance of the engine as specified in Cummins Operation and Maintenance Manuals.

THIS WARRANTY, TOGETHER WITH THE EXPRESS COMMERCIAL WARRANTIES ARE THE SOLE WARRANTIES MADE BY CUMMINS. THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

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.

REFERENCE ONLY

Notes

REFERENCE ONLY

About the Manual i-2
General Information i-2
Acronyms and Abbreviations i-14
General Information i-14
Additional Service Literature L-1
General Information L-1
Air Cleaner Restriction 4-4
Maintenance Check 4-4
Air Compressor 4-5
Finishing Steps 4-6
Maintenance Check 4-5
Preparatory Steps 4-6
Air Compressor Discharge Lines 7-6
General Information 7-6
Maintenance Check 7-6
Air in Fuel A-1
General Information A-1
Air Intake Piping 4-4
Maintenance Check 4-4
Air Intake System V-5
Specifications V-5
All Engines United States and Canada School Bus W-8
All Engines Worldwide All Bus (Except U.S./Canada Diesel Powered School Buses) W-3
Alternator A-19
Initial Check A-19
Install A-21
Preparatory Steps A-20
Remove A-20
Test A-19
Alternator Not Charging or Insufficient Charging TS-3
B5.9 & C8.3 Engines United States and Canada Recreational Vehicle W-6
B/B Gas Plus/BLPG Plus/ISB Engines United States and Canada Automotive W-1
Batteries 4-7
Inspect 4-7
Belt Tensioner, Automatic (Alternator) A-23
Install A-23
Preparatory Steps A-23
Remove ..... A-
California Emission Control System Warranty, On-Highway W-11
Capscrew Markings and Torque Values V-18
Capscrew Markings and Torque Values - Metric V-18
Capscrew Markings and Torque Values - U.S. Customary V-18
General Information 18
Charge-Air Cooler 4-4
Maintenance Check 4-4
Charge-Air Cooler 17
Clean A-18
General Information A-17
Initial Check A-17
Cold Weather Starting 1-5
Ether Starting Aids 1-5
General Information 1-5
Grid Heater 1-5
With Mechanical or Electrical Metering Equipment (Ether) 1-5
Component Manufacturers' Addresses M-1
Air Compressors M-1
Air Cylinders M-1
Air Heaters M-1
Air Starting Motors M-1
Alternators M-1
Auxiliary Brakes M-1
Belts M-1
Catalytic Converters M-1
Coolant Level Switches M-1
Clutches M-1
Coolant Heaters M-2
Drive Plates M-2
Electric Starting Motors M-2
Electronic Switches M-2
Engine Protection Controls M-2
Fan Clutches M-2
Fans M-2
Fault Lamps M-2
Filters M-2
Flexplates M-2
Fuel Coolers M-2
Fuel Pumps M-2
Fuel Warmers M-2
Gauges M-3
Governors M-3
Heat Sleeves M-3
Hydraulic and Power Steering Pumps M-3
In-Line Connectors M-3
Oil Heaters M-3
Prelubrication Systems M-3
Radiators M-3
Throttle Assemblies M-3
Torque Converters M-3
Coolant Contamination TS-4
Coolant Level 3-5
Maintenance Check 3-5
Coolant Loss TS-5
Coolant Recommendations and Specifications V-12
Cooling System Sealing Additives V-14
Cooling System Soluble Oils V-14
Fully Formulated Coolant/Antifreeze V-12
Coolant Temperature Above Normal TS-7
Coolant Temperature Below Normal TS-6
Coolant Thermostat A-3
Finishing Steps A-9
Initial Check A-3
Inspect for Reuse A-6
Install A-7
Preparatory Steps A-5
Remove A-5
Cooling Fan Belt Tensioner 5-5
Maintenance Check 5-5
Cooling Fan Belt Tensioner A-16
Inspect for Reuse A-16
Install A-16
Remove A-16
Cooling System 7-2
Drain 7-2
Fill 7-5
Flush 7-3
Cooling System V-4
Specifications V-4
Cooling System Hoses A-17
Maintenance Check A-17
Marine and Industrial Applications A-17
Cummins Customized Parts Catalog L-3
General Information L-3
Ordering the Customized Parts Catalog L-3
Ordering by Telephone L-3
Ordering On-Line L-3
Cummins Fleetguard® Filter Specifications V-8
General Information V-8
Daily Maintenance Procedures - Overview 3-1
Engine Operation Report 3-1
General Information 3-1
Unusual Engine Noise 3-1
Distributors - International S-33
Locations S-33
Distributors and Branches S-4
Australia S-24
Canada S-19
China, People's Republic S-22
New Zealand S-28
United States S-4
Division and Regional Offices S-2
Locations S-2
Drive Belt Tension V-15
Tension Chart V-15
Drive Belt, Cooling Fan A-1
Inspect for Reuse A-2
Install A-2
Remove A-1
Drive Belts 3-3
Maintenance Check 3-3
Poly-Vee Belt 3-3
Cogged Belt 3-3
Drive Belts 6-5
Test 6-5
Electrical System V-7
Specifications V-7
Emergency and Technical Service S-1
General Information S-1
Engine Component Torque Values V-16
General Information V-16
Engine Coolant Antifreeze 5-7
Maintenance Check 5-7
Engine Diagrams E-5
Engine Views E-5
Engine Difficult to Start or Will Not Start (Exhaust Smoke) TS-9
Engine Difficult to Start or Will Not Start (No Exhaust Smoke) TS-11
Engine Identification E-1
Cummins® Engine Nomenclature E-2
Engine Dataplate E-1
Fuel Injection Pump Dataplate E-2
Bosch® Rotary E-2
Bosch® In-line E-3

REFERENCE ONLY

CAV Rotary....E-3
Stanadyne Rotary....E-3
Denso In-line....E-3
Engine Mounts....A-24
Inspect for Reuse....A-24
Engine Noise Excessive....TS-13
Engine Operating Range....1-9
General Information....1-9
Engine Power Output Low....TS-14
Engine Runs Rough at Idle, Warm Engine....TS-17
Engine Runs Rough or Misfires....TS-18
Engine Shutdown....1-9
General Information....1-9
Engine Speed Surges at Low or High Idle....TS-19
Engine Starts But Will Not Keep Running....TS-20
Engine Vibration Excessive....TS-21
Engine Will Not Crank or Cranks Slowly....TS-22
Engine Will Not Reach Rated Speed (RPM)....TS-23
Engine Will Not Shut Off....TS-25
Exhaust Smoke Excessive Under Load....TS-26
Exhaust System....V-6
Specifications....V-6
Fan Spacer and Pulley....A-9
Inspect for Reuse....A-10
Install....A-10
Preparatory Steps....A-9
Remove....A-9
Fan, Cooling....3-4
Inspect for Reuse....3-4
Flow Diagram, Air Intake System....D-18
Flow Diagram....D-18
Flow Diagram, Compressed Air System....D-32
Flow Diagram....D-32
Flow Diagram, Cooling System....D-14
Flow Diagram....D-14
Flow Diagram, Exhaust System....D-26
Flow Diagram....D-26
Flow Diagram, Fuel System....D-2
Flow Diagram....D-2
Automotive Applications....D-2
Flow Diagram, Lubricating Oil System....D-6
Flow Diagram....D-6
Automotive Applications....D
Fraction, Decimal, Millimeter Conversions....V-20
Conversion Chart....V-20
Fuel Filter (Spin-On Type)....
Drain....5-1
Finishing Steps....5
Install....5
Preparatory Steps....5-1
Prime....5-3
General Information....5-3
Remove....5-1
Fuel Knock....TS-28
Fuel or Lubricating Oil Leaking From Exhaust Manifold....TS-29
Fuel Recommendations and Specifications....V-9
Fuel Recommendations....V-9
Fuel System....V-2
Specifications....V-2
Fuel-Water Separator....3-2
Drain....3-2
Canister Type....3-2
Spin-on Type....3-2
General Cleaning Instructio....i-9
Abrasive Pads and Ab...sive ...r....i-9
Definition of Clean....i-9
Fuel System....i-12
Gasket Surface....i-10
Plastic Bead Clea...g....i-11
Solvent a...id Cl...ing....i-10
Steam C...eanin...g....i-11
General Repair I...structio....i-8
Gen...l Info...i-8
Weldin... a Vehicle with an Electronic Controlled Fuel System....i-8
General Sa... Instructions....i-6
Important S...ty Notice....i-6
General Engine....V-1
Specifications....V-1
How to Use the Manual....i-3
General Information....i-3
Illustrations....i-5
General Information....i-5
Lubricating Oil and Filters....4-1
Drain....4-1
Fill....4-3
Install....4-2
Remove....4-2
Lubricating Oil Contaminated....TS-30
Lubricating Oil Level....3-4
Maintenance Check....3-4
Lubricating Oil Loss....TS-31
Lubricating Oil Pressure High....TS-32
Lubricating Oil Pressure Low....TS-33
Lubricating Oil Recommendations and Specifications....V-10
Arctic Operation....V-11
General Information....V-10
New Engine Break-in Oils....V-11
Lubricating Oil System....V-3
Specifications....V-3
Maintenance Guidelines - Overview....2-1
General Information....2-1
Maintenance Procedures - Overview....4-1
General Information....4-1
Maintenance Procedures - Overview....5-1
General Information....5-1
Maintenance Procedures - Overview....6-1
General Information....6-1
Maintenance Procedures - Overview....7-1
General Information....7-1
Maintenance Record Form....2-6
Maintenance Data....2-6
Maintenance Schedule....2-3
General Information....2-3
Oil Drain Intervals....2-3
Newton-Meter to Foot-Pou... Conv...ions....V-21
Conversion Chart....V-21
Normal Starting Procedur.......1-2
General Information....1-2
Jump Starting....1-4
Operating Instructions - Ove.......1-1
General Info...ation....1-1
Operating th... Engine....1-6
Ambient Tempera...re....1-7
0 to -3...C [3... to -25°F]....1-7
-32 to -5... [-25 to -...°F]....1-7
Cold Weather...1-7
Normal....1-6
Winterfront... and Shutters....1-8
C...erhead Set....6-1
...djust....6-2
...9, and B4.5 Engines....6-2
Finishing Steps....6-4
...stall....6-4
...3.9, B5.9, and B4.5 Engines....6-4
Preparatory Steps....6-1
Remove....6-2
B3.9, B5.9, and B4.5 Engines....6-2
Pipe Plug Torque Values....V-22
Torque Table....V-22
Problem Solving....S-1
General Information....S-1
Regional Offices - International....S-29
Locations....S-29
Routine Service and Parts....S-1
General Information....S-1
Sealants....V-17
General Information....V-17
Service Literature Ordering Location....L-2
Contact Information....L-2
Smoke, White — Excessive....TS-35
Starting Motor....A-21
Finishing Steps....A-22
Install....A-22
Preparatory Steps....A-21
Remove....A-22
Starting Procedure After Extended Shutdown or Oil Change....1-6
General Information....1-6
Symbols....i-4
General Information....i-4
System Diagrams - Overview....D-1
General Information....D-1
Tap-Drill Chart - U.S. Customary and Metric....V-23
General Information....V-23
To the Owner and Operator....i-1
General Information....i-1
Tool Requirements....2-2
General Information....2-2
Troubleshooting Procedures and Techniques....TS-1
General Information....TS-1
Troubleshooting Symptoms Charts....TS-2
General Information....TS-2
Vibration Damper, Rubber....7-1
Inspect....7-1
Vibration Damper, Viscous....7-2

REFERENCE ONLY

Inspect....7-2
Water Pump....A-10
Fill....A-15
Inspect for Reuse....A-11
Install....A-14
Preparatory Steps....A-10
Remove....A-11
Weights and Measures - Conversion Factors....V-24
Conversion Chart....V-24

REFERENCE ONLY

REFERENCE ONLY

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.

REFERENCE ONLY

Cummins Inc.
Box 3005
Columbus, Indiana, U.S.A., 47202

Registered Office
Cummins Ltd.
49-51 Gresham Road,
Staines,
Middlesex TW18 2BD,
England
Registration 573951 England

Copyright© 2009
Cummins Inc.

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

REFERENCE ONLY

Bulletin 3810205
Printed in U.S.A. 21-APRIL-2009