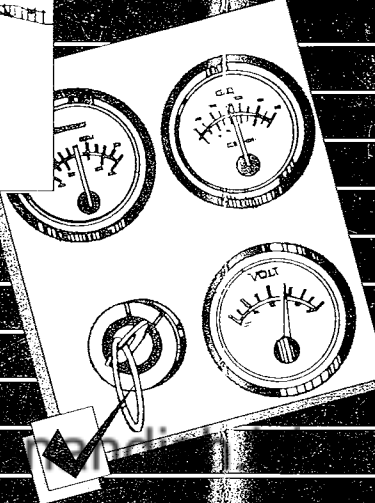
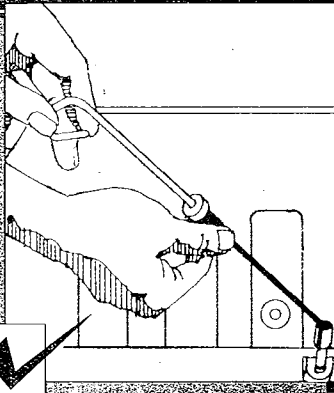
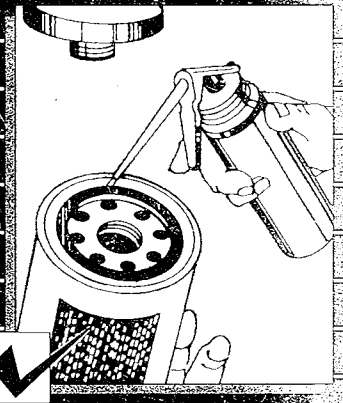
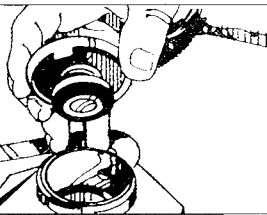
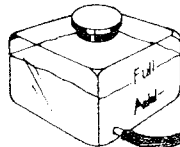




Operation and Maintenance Manual QSC8.3 and QSL9 Engine



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



NO POSTAGE
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IF MAILED
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UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 15, COLUMBUS INDIANA

—POSTAGE WILL BE PAID BY ADDRESSEE—

Cummins Inc.
Product Registration Dept. (CAC)
P O Box 3005 M/C 91200
Columbus, IN 47202-3005



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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 # _____

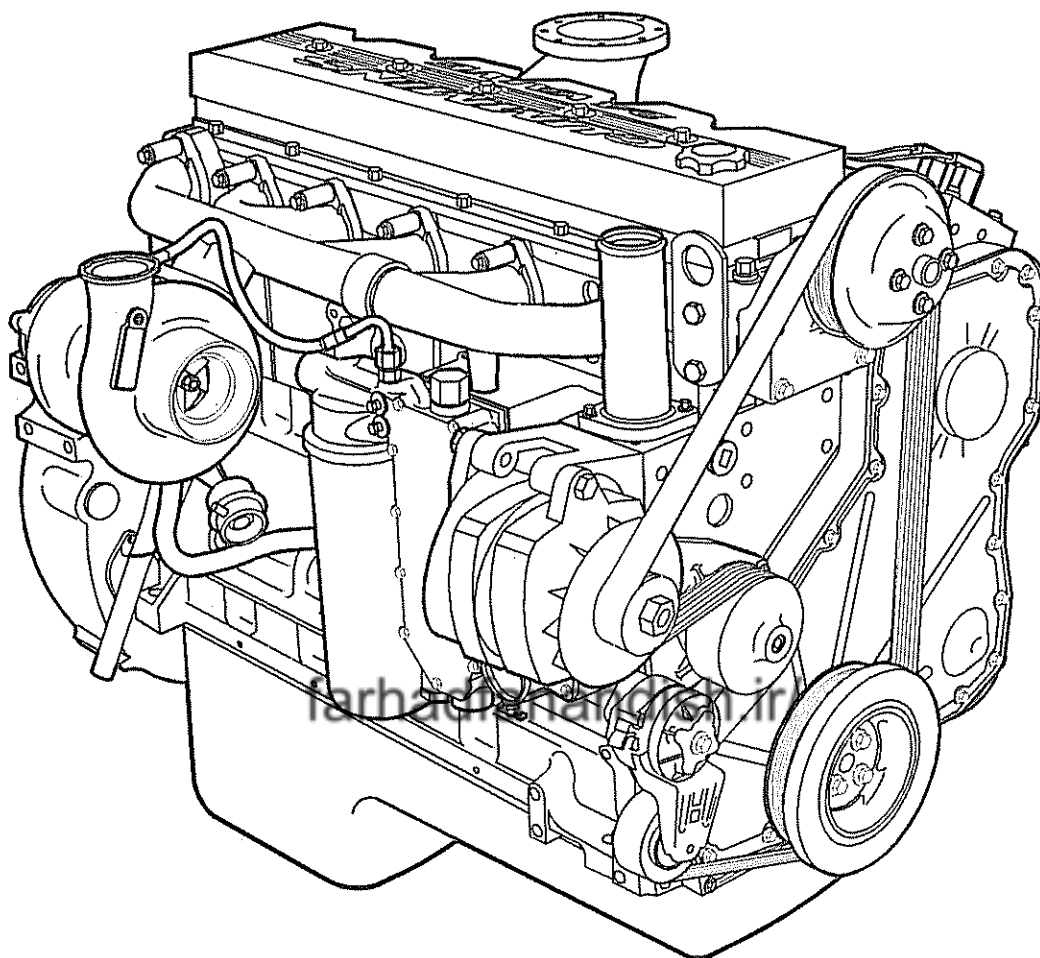
THANK YOU!!

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Operation and Maintenance Manual QSC8.3 and QSL9 Engine



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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. These parts can be identified by the following trademarks:



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

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Important Reference Numbers

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

Part Name	Part Number	Part 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 Filter		
• Fuel		
• Fuel-Water Separator		
• Coolant		
• Remote Gas		
Governor Control Module (GCM) (if applicable)		
Belt Part Numbers:		
•		
•		
•		
Clutch or Marine Gear (if applicable):		
• Model		
• Serial Number		
• Part Number		
• Oil Type		
• Sea Water Pump		
- Model		
- Part Number		



Section i - Introduction

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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).

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.

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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.

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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).

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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.

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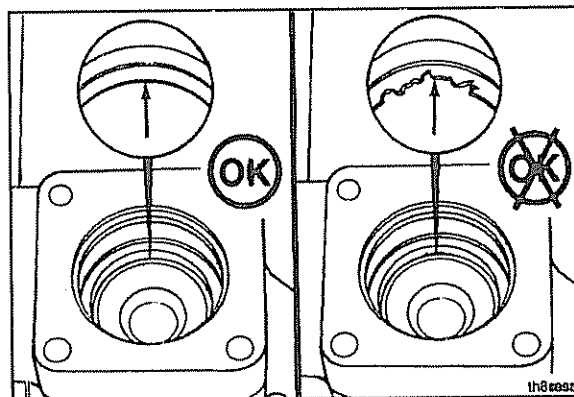
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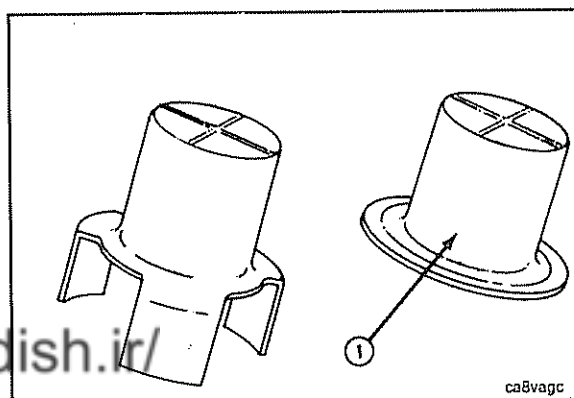
Illustrations

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.



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General Safety Instructions

Important Safety Notice



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

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

- Work in an area surrounding the product that is dry, well lit, ventilated, free from clutter, loose tools, parts, ignition sources and hazardous substances. Be aware of hazardous conditions that can exist.
- **Always** wear protective glasses and protective shoes when working.
- Rotating parts can cause cuts, mutilation or strangulation.
- Do **not** wear loose-fitting or torn clothing. Remove all jewelry when working.
- Disconnect the battery (negative [-] cable first) and discharge any capacitors before beginning any repair work. Disconnect the air starting motor if equipped to prevent accidental engine starting. Put a "Do Not Operate" tag in the operator's compartment or on the controls.
- Use **ONLY** the proper engine barring techniques for manually rotating the engine. Do **not** attempt to rotate the crankshaft by pulling or prying on the fan. This practice can cause serious personal injury, property damage, or damage to the fan blade(s) causing premature fan failure.
- If an engine has been operating and the coolant is hot, allow the engine to cool before slowly loosening the filler cap to relieve the pressure from the cooling system.
- **Always** use blocks or proper stands to support the product before performing any service work. Do **not** work on anything that is supported **ONLY** by lifting jacks or a hoist.
- Relieve all pressure in the air, oil, fuel, and cooling systems before any lines, fittings, or related items are removed or disconnected. Be alert for possible pressure when disconnecting any device from a system that utilizes pressure. Do **not** check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.
- To reduce the possibility of suffocation and frostbite, wear protective clothing and **ONLY** disconnect liquid refrigerant (Freon) lines in a well ventilated area. To protect the environment, liquid refrigerant systems **must** be properly emptied and filled using equipment that prevents the release of refrigerant gas (fluorocarbons) into the atmosphere. Federal law requires capturing and recycling refrigerant.
- To reduce the possibility of personal injury, use a hoist or get assistance when lifting components that weigh 23 kg [50 lb] or more. Make sure all lifting devices such as chains, hooks, or slings are in good condition and are of the correct capacity. Make sure hooks are positioned correctly. **Always** use a spreader bar when necessary. The lifting hooks **must not** be side-loaded.
- Corrosion inhibitor, a component of SCA and lubricating oil, contains alkali. Do **not** get the substance in eyes. Avoid prolonged or repeated contact with skin. Do **not** swallow internally. In case of contact, immediately wash skin with soap and water. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. **IMMEDIATELY CALL A PHYSICIAN. KEEP OUT OF REACH OF CHILDREN.**
- Naptha and Methyl Ethyl Ketone (MEK) are flammable materials and **must** be used with caution. Follow the manufacturer's instructions to provide complete safety when using these materials. **KEEP OUT OF REACH OF CHILDREN.**
- To reduce the possibility of burns, be alert for hot parts on products that have just been turned off, 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.
- Liquified petroleum gas is heavier than air and can accumulate near the floor, in sumps, and low-lying areas.
- Natural gas is lighter than air and can accumulate under hood and awnings.
- To reduce the possibility of suffocation and frostbite, wear protective clothing and **ONLY** disconnect natural gas and liquified petroleum gas lines in a well ventilated area.
- Coolant is toxic. If **not** reused, dispose of in accordance with local environmental regulations.

General Repair Instructions

General Information

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

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

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



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



General Cleaning Instructions

Definition of Clean

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

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

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

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

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

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

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

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

Abrasive Pads and Abrasive Paper

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



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

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

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

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

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

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

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

WARNING

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

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

Gasket Surfaces

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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

Remove all the gasket material, o-rings, and the deposits of sludge, carbon, etc., with a wire brush or scraper before putting the parts in a cleaning tank. Be careful to **not** damage any gasket surfaces. When possible use hot high pressure water or steam clean the parts before putting them in the cleaning tank. Removing the heaviest dirt before placing in the tank will allow the cleaner to work more effectively and the cleaning agent will last longer.

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

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

Steam Cleaning

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



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

Plastic Bead Cleaning

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

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



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.



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

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

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

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

⚠CAUTION⚠

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

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

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

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

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

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

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



Acronyms and Abbreviations

General Information

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

API	American Petroleum Institute
ASTM	American Society of Testing and Materials
°C	Celsius
CARB	California Air Resources Board
C.I.D.	Cubic Inch Displacement
CNG	Compressed Natural Gas
CPL	Control Parts List
cSt	Centistokes
ECM	Electronic Control Module
EGR	Exhaust Gas Recirculation
EPA	Environmental Protection Agency
°F	Fahrenheit
FMI	Failure Mode Identifier
GVW	Gross Vehicle Weight
LPG	Liquified Petroleum Gas
Hg	Mercury
hp	Horsepower
H ₂ O	Water
ICM	Ignition Control Module
km/l	Kilometers per Liter
kPa	Kilopascal
LNG	Liquid Natural Gas
LTA	Low Temperature Aftercooling
MPa	Megapascal
mph	Miles Per Hour
mpq	Miles Per Quart
N•m	Newton-meter
NG	Natural Gas
OEM	Original Equipment Manufacturer
PID	Parameter Identification Descriptions
ppm	Parts Per Million
psi	Pounds Per Square Inch
PTO	Power Takeoff
rpm	Revolutions Per Minute
SAE	Society of Automotive Engineers
SCA	Supplemental Coolant Additive
STC	Step Timing Control
SID	Subsystem Identification Descriptions
VS	Variable Speed
VSS	Vehicle Speed Sensor



Section E - Engine Identification

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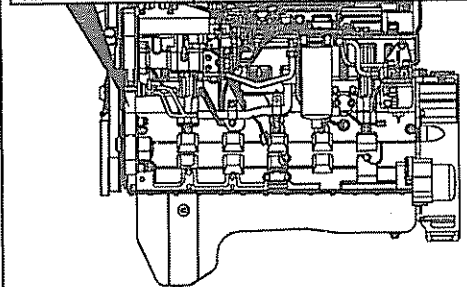


Engine Identification

Engine Dataplate

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


 Cummins Engine Company, Inc. 616 20th St. Columbus, Indiana 47223-2028 WARNING: Read and understand the engine and fuel system specifications and limitations before use. Cummins Inc. is not responsible for any damage or injury caused by misuse of the engine. Date of Issuance: _____ Made in U.S.A.	Engine Cyl. ID	Cyl. L	Series	CPL	Engine Serial No.
	Timing TO				Injection PTH
	Valve Lash (in)	Int.	Exh.		Cool. Spd.
	Pumping Order				Rated HP
	Low Idle RPM		Z.C.S.		at _____
					min. 2400 RPM



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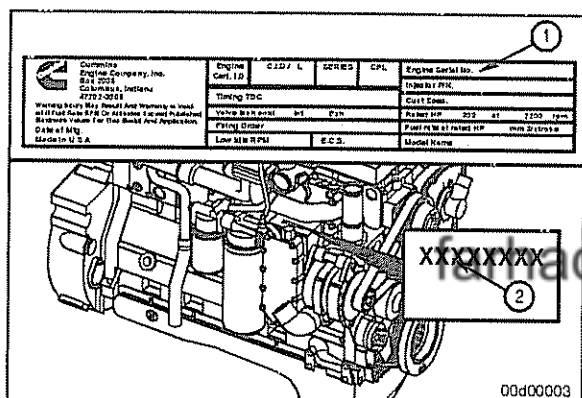
 Cummins Engine Company Inc. Columbus, Indiana 47202-3095 <small>Warning: Injury May Result And Warranty Is Voided If Fuel Rate Or Altitudes Exceed Published Maximum Values For This Model And Application. Date of Mfg. 19951130 Made In U.S.A. 3905610</small>	Engine Cert. I.D.	C.I.D./ L	SERIES	CPL	Engine Serial No. 45275188
		359 5.9	403	2079	
	Timing TDC				Cust. Spec.
	Valve lash cold 0.010 Int. 0.020 Exh.				Rated HP 0 at 0 rpm
	Firing Order 1 5 3 6 2 4				Fuel rate at rated HP 0mm 3/stroke
Low Idle RPM 800		E.C.S.		Fuel rate at rated HP 0mm 3/stroke	

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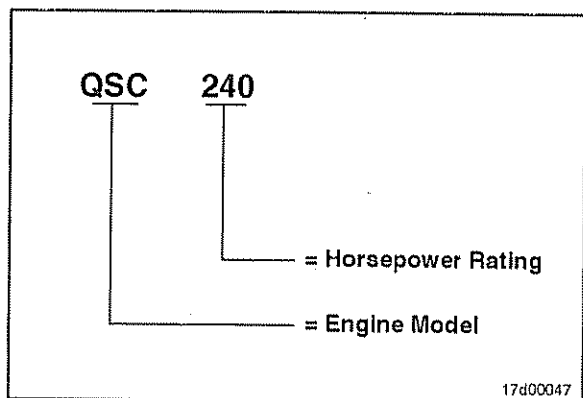
The dataplate is located on the top side of the gear housing.

Have the following engine data available when communicating with a Cummins Authorized Repair Location:

1. Engine serial number (ESN)
2. Control parts list (CPL)
3. Model
4. Horsepower and rpm rating.



NOTE: If the engine dataplate (1) is **not** readable, the ESN (2) can be found on the engine block on top of the lubricating oil cooler housing. Additional engine information is on the electronic control module (ECM) dataplate.



Cummins Engine Nomenclature

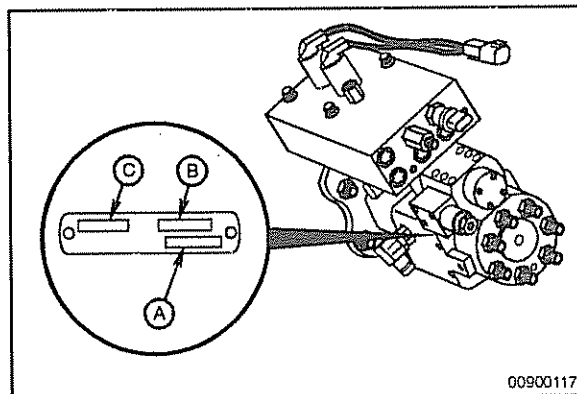
The Cummins engine nomenclature provides the engine model and horsepower rating.



Fuel Injection Pump Dataplate

The Cummins Accumulator Pump System (CAPS) fuel injection pump dataplate is located on the side of the injection pump. The dataplate contains the following information:

- A. Cummins part number
- B. Pump serial number
- C. Factory code.

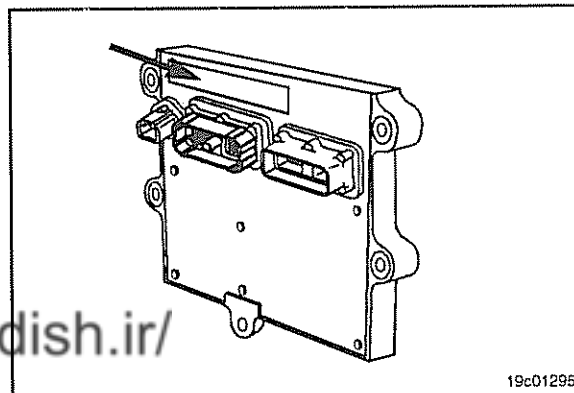


ECM Dataplate

The ECM dataplate is located on the front of the ECM.

The following information is found on the ECM dataplate:

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



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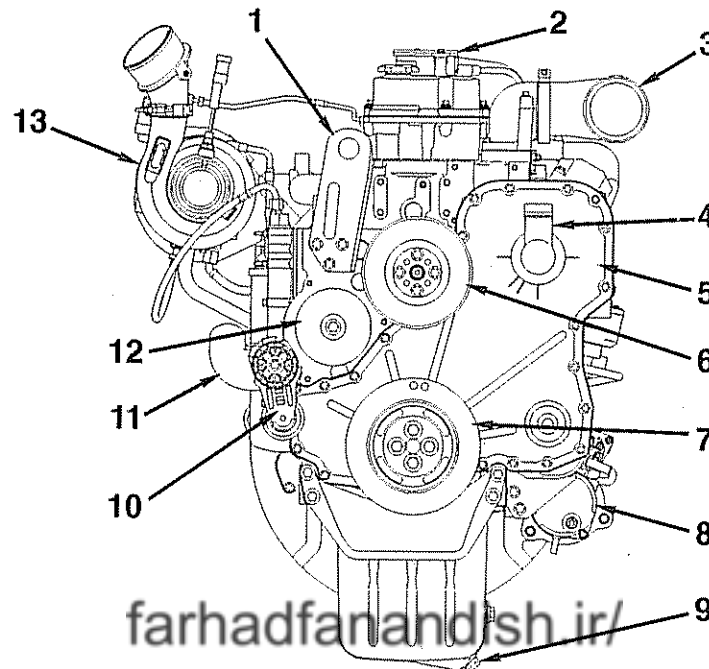


Engine Diagrams

Engine Views

The following illustrations provide 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.



Front Engine View (CM850 Electronic Control Module)

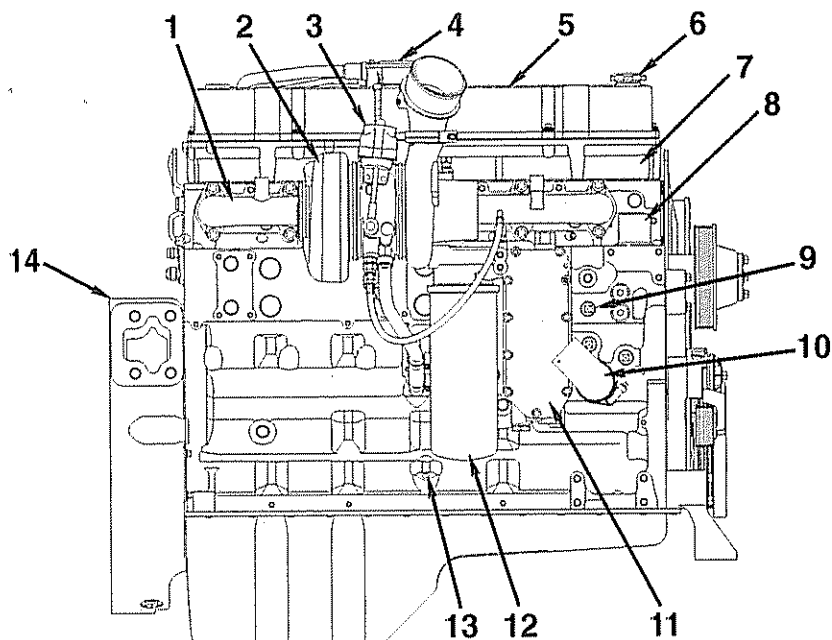
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1. Engine lifting bracket
2. Crankcase breather
3. Air intake connection
4. Engine oil fill
5. Front gear cover
6. Fan pulley
7. Vibration Damper
8. Starter
9. Engine oil pan drain plug
10. Automatic belt tensioner
11. Coolant inlet connection
12. Water pump
13. Turbocharger (VGT shown)



Engine Diagrams

Engine Views



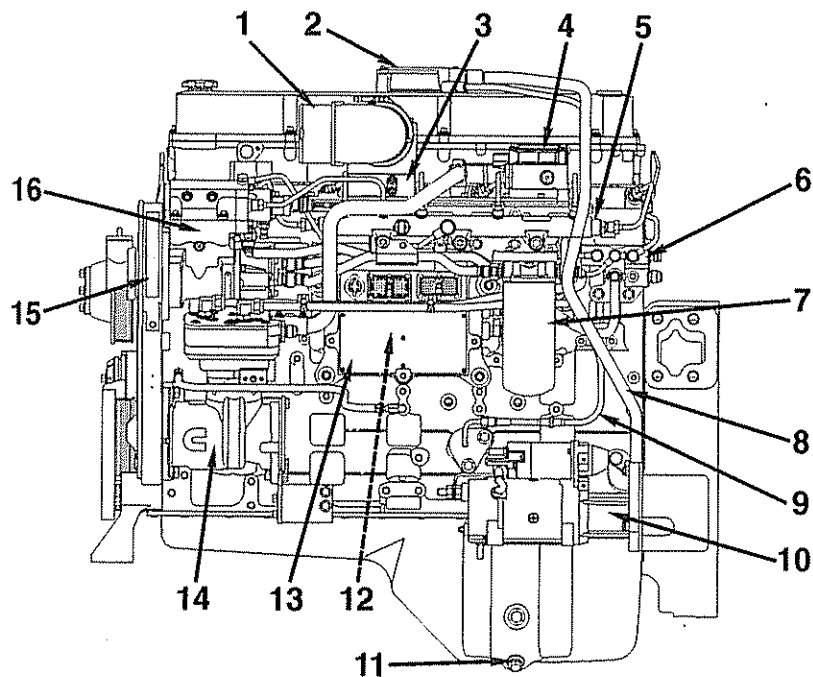
Exhaust Side Engine View (CM850 Electronic Control Module)

1. Exhaust manifold
2. Turbocharger (VGT shown)
3. Variable geometry turbocharger actuator
4. Crankcase breather
5. Rocker lever cover
6. Engine oil fill
7. Rocker lever housing
8. Coolant outlet connection
9. Coolant heater port
10. Coolant inlet connection
11. Lubricating oil cooler
12. Lubricating oil filter
13. Dipstick location
14. Flywheel housing



Engine Diagrams

Engine Views



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Intake Side Engine View (CM850 Electronic Control Module)

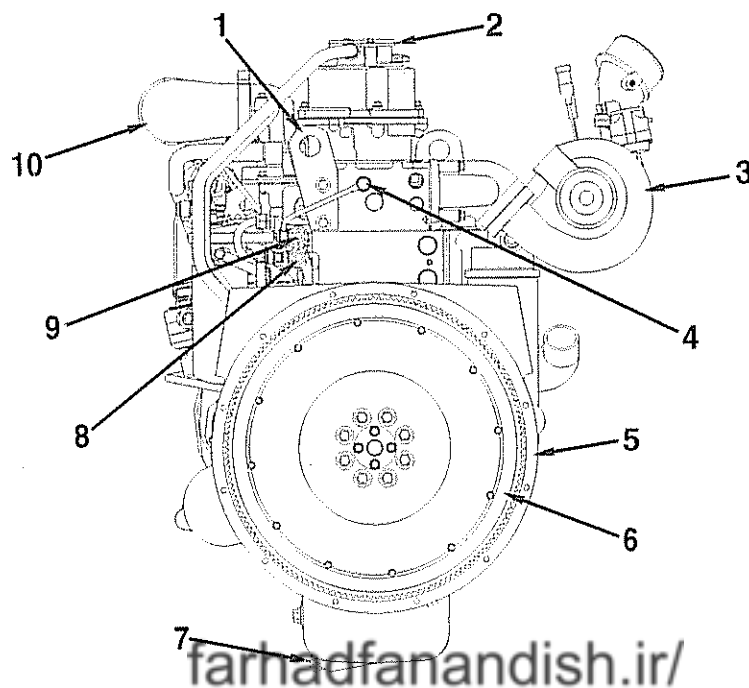
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1. Air intake connection
2. Crankcase breather
3. Intake air heater
4. Turbocharger control valve
5. Fuel rail
6. Fuel drain manifold
7. Fuel filter
8. Crankcase breather draft tube
9. Crankcase breather oil drain tube
10. Starter
11. Engine oil drain plug
12. Fuel lift pump
13. Electronic control module (ECM)
14. Air compressor
15. Engine data plate
16. High-pressure pump



Engine Diagrams

Engine Views



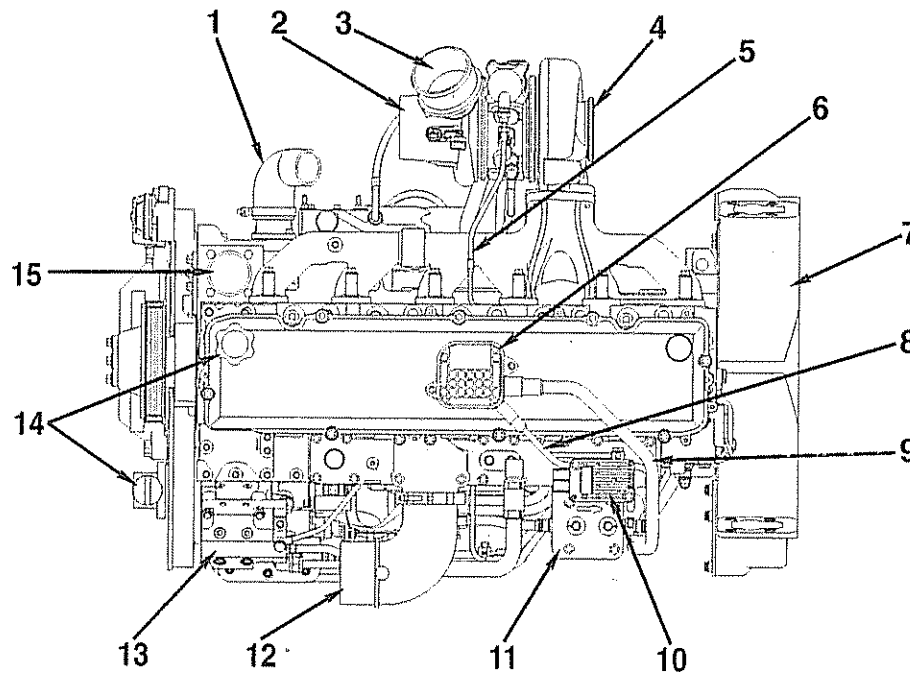
Rear Engine View (CM850 Electronic Control Module)

1. Engine lifting bracket
2. Crankcase breather
3. Turbocharger (VGT shown)
4. Injector drain line connection
5. Flywheel housing
6. Flywheel
7. Engine oil drain plug
8. OEM fuel supply line connection
9. OEM fuel drain line connection
10. Air intake connection



Engine Diagrams

Engine Views



Top Engine View (CM850 Electronic Control Module)

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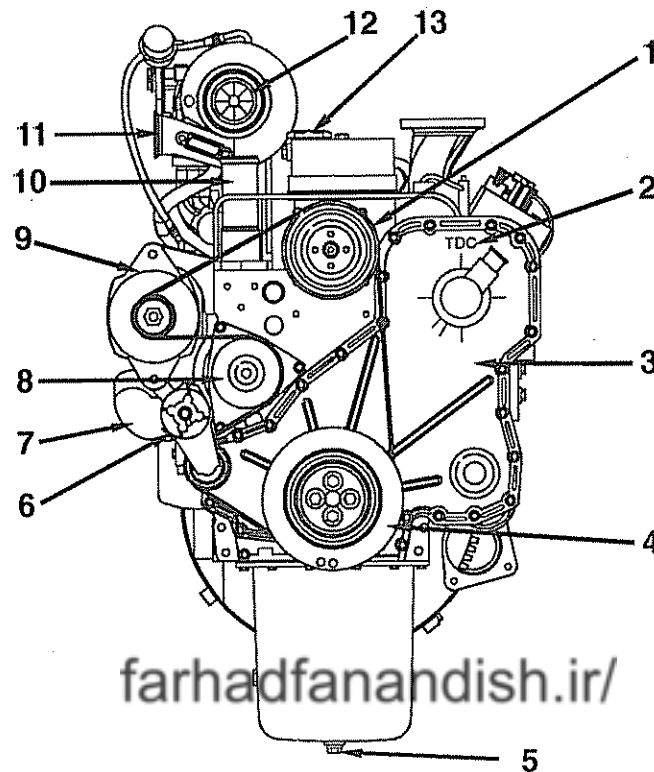
1. Coolant inlet connection
2. Turbocharger air inlet
3. Turbocharger air outlet
4. Turbocharger exhaust outlet
5. Turbocharger actuator air line
6. Crankcase breather
7. Flywheel housing
8. Crankcase breather oil drain tube
9. Crankcase breather draft tube
10. Turbocharger control valve
11. Fuel filter bracket
12. Air inlet connection
13. High-pressure pump
14. Engine oil fill
15. Coolant outlet connection

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Engine Diagrams

Engine Views



Front View (Without CM850 Electronic Control Module)

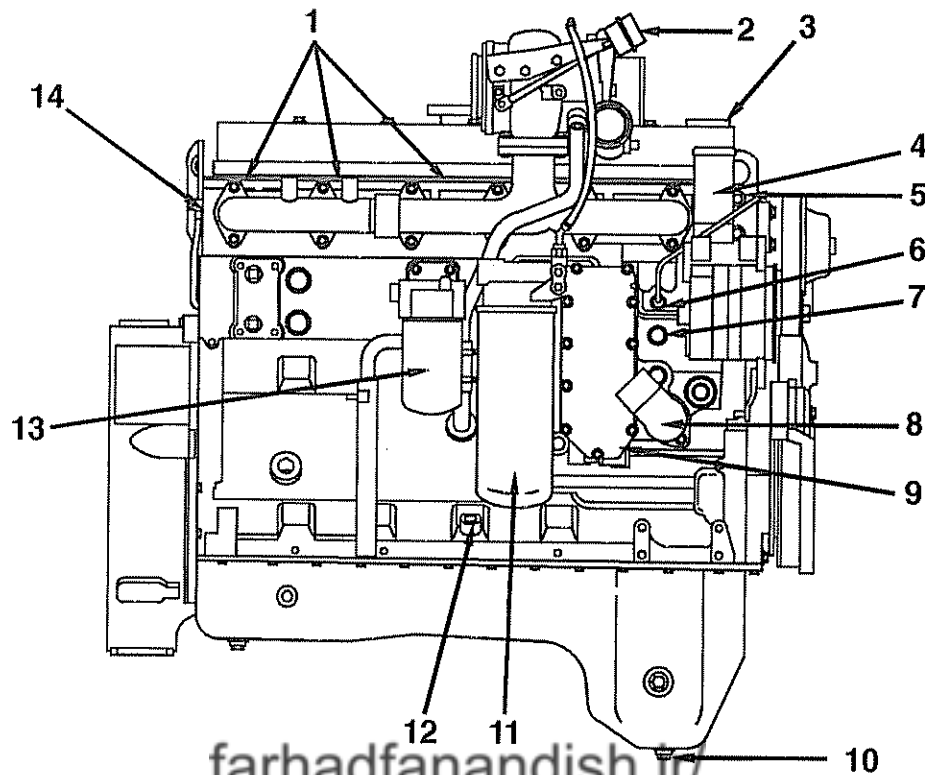
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1. Fan pulley
2. Top dead center (TDC) mark
3. Front gear cover
4. Vibration damper
5. Engine oil pan drain plug
6. Automatic belt tensioner
7. Water inlet
8. Water pump
9. Alternator
10. Water outlet
11. Turbocharger air outlet
12. Turbocharger air inlet
13. Engine oil fill



Engine Diagrams

Engine Views



Exhaust Side View (Without CM850 Electronic Control Module)

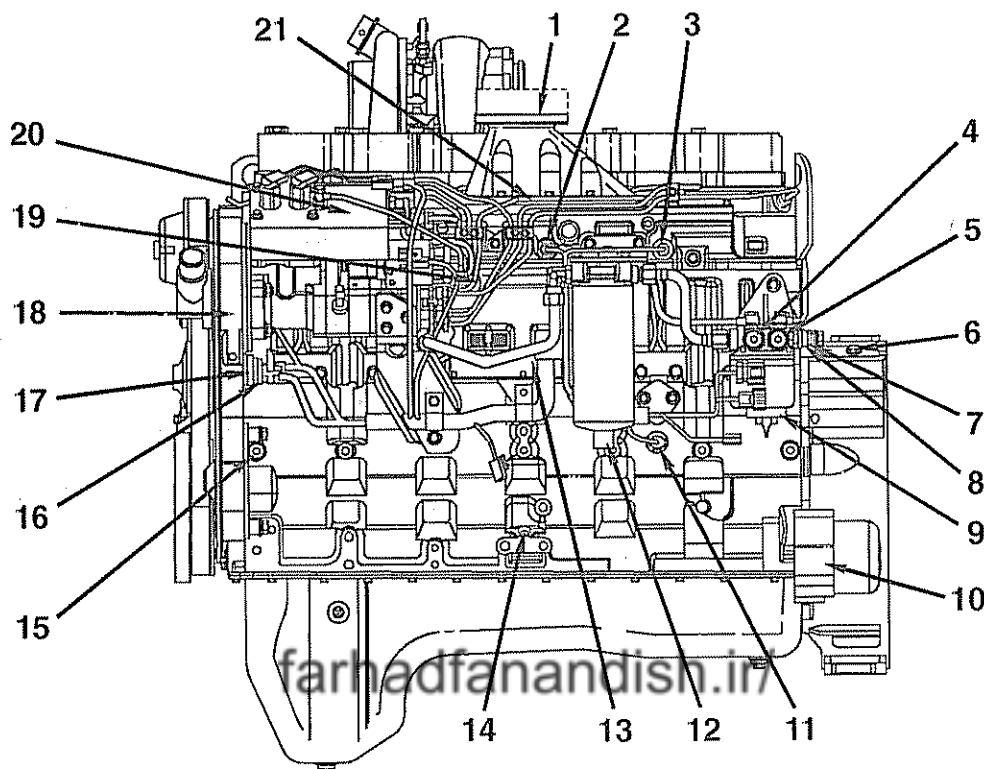
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1. 1/2-inch (NPTF) coolant taps
2. Turbocharger wastegate actuator
3. Engine oil fill
4. Coolant outlet
5. Front engine lifting bracket
6. Coolant temperature sensor
7. Coolant heater port
8. Coolant inlet
9. Lubricating oil cooler
10. Engine oil pan drain plug
11. Lubricating oil filter
12. Dipstick location
13. Coolant filter
14. Injector drain fuel outlet connection



Engine Diagrams

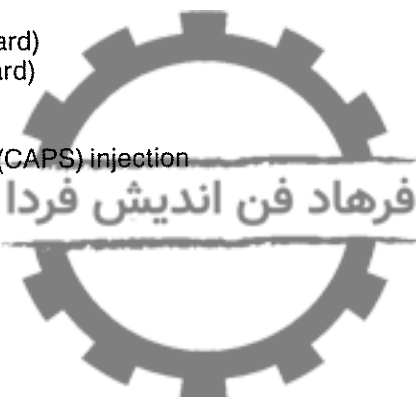
Engine Views



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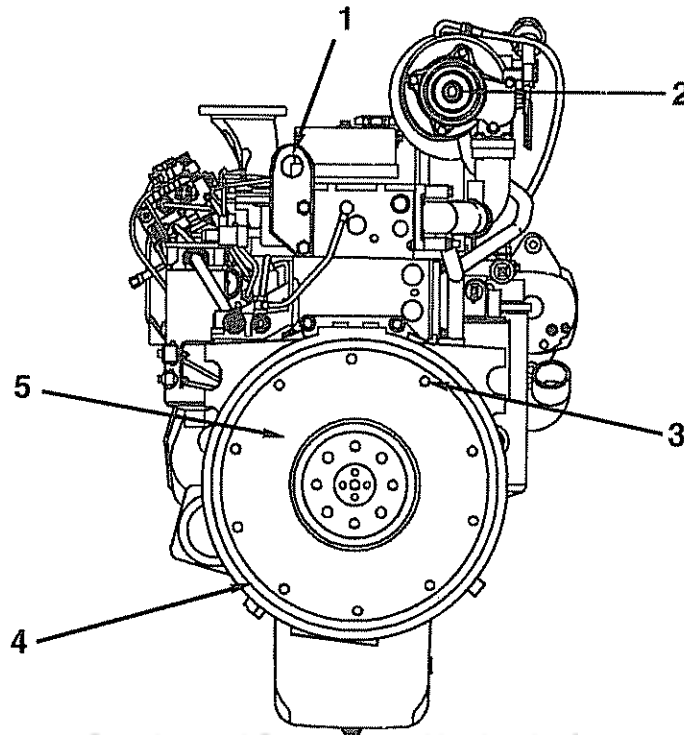
Fuel Pump Side View (Without CM850 Electronic Control Module)

1. Engine air inlet
2. Intake manifold pressure sensor
3. Intake manifold temperature sensor
4. M10 (STOR) fuel pressure after-lift pump
5. M10 (STOR) fuel pressure before-lift pump
6. Magnetic pickup location 3/4-16 UNF
7. Fuel return connection
8. Fuel inlet connection
9. Fuel lift pump
10. Starter mounting flange
11. Oil pressure sensor
12. Fuel filter/water separator
13. Electronic control module (ECM)
14. Dipstick location
15. M10 (STOR) oil pressure port
16. Engine position sensor (EPS) - (inboard)
17. Engine speed sensor (ESS) - (outboard)
18. Engine dataplate
19. High-pressure fuel lines
20. Cummins Accumulator Pump System (CAPS) injection pump
21. Intake air heater



Engine Diagrams

Engine Views



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Rear View (Without CM850 Electronic Control Module)

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1. Rear engine lifting bracket
2. Turbocharger exhaust outlet
3. Clutch mounting holes
4. Flywheel housing
5. Flywheel



Section FB - Industrial Features

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Switchable (Alternate) Torque

Feature Description

Switchable (Alternate) Torque provides derated torque curves other than the 100 percent torque curve. These torque curves are normally used to help limit the torque output of the engine and helps to protect driveline components such as axles and transmissions and in some cases can help protect the engine from damage.

Driver Activation/Deactivation

The operator can activate or deactivate the alternate torque curves through an OEM supplied switch.

Interaction with other Features and Parameters

None

Disadvantages

Possible operator complaints of low power

Visual Aids

None

Automatic Boost Power

Feature Description

Boost Power is a torque curve that is calibrated for a higher torque/horsepower than the normal engine rating and is available on QSB, QSC, CELECT™ Plus, QSM11, QSX15, QSK19, QSK45, and QSK60 industrial engines. The Electronic Control Module (ECM) will monitor engine speed, intake manifold temperature, and coolant temperature to determine if Boost Power can be activated. If Boost Power is available, the operator can activate Boost Power using a dash-mounted switch. The engine will switch to the higher torque curve or power rating for a limited period of time. The higher torque curve or power rating is calibrated for an intermittent or non-continuous torque or power rating which is higher than the normal torque or power rating for the engine. Boost power is **not** available if coolant temperature or intake manifold temperatures are above calibrated thresholds. If engine speed is below a calibrated threshold, then Boost Power will **not** be time limited.

Automatic Boost Power will provide the operator with enhanced torque or power for a fraction of the operating period. The ECM will monitor engine speed, intake manifold temperature, percent load, and coolant temperature to determine if automatic Boost Power can be activated. If automatic Boost Power is available, the engine will switch to the enhanced torque or power rating for a limited period of time. The Original Equipment Manufacturer (OEM) equipment users manual will document the time periods that automatic Boost Power is available, since it is application specific. Automatic Boost Power is **not** available if coolant temperature or intake manifold temperatures are above calibrated thresholds. If engine speed or percent load is below a calibrated threshold, automatic Boost Power will **not** be available. If coolant temperature or intake manifold temperature rise above calibrated threshold, then automatic Boost Power will be deactivated. Automatic Boost Power is available on QSB, QSC, QSM11, and QSX15 industrial engines.

Driver Activation/Deactivation

To activate Boost Power, the operator **must** turn on a dash-mounted switch. To deactivate Boost Power, the operator **must** turn the switch off. Boost power will engage if the engine operating conditions are There is no operator interaction to activate or deactivate automatic Boost Power.

Interaction with other Features and Parameters

Boost power **must** be enabled in order to enable automatic Boost Power.

Disadvantages

Boost Power **must not** engage due to the Boost Power load threshold is set above the highest load experienced during normal engine operation

Visual Aids

None

Cruise Control

Feature Description

NOTE: Functionality varies depending on engine product.

Cruise Control provides the driver with foot-off-throttle cruise operation with the ability to adjust and maintain a desired road speed. Cruise Control and its capabilities vary according to its operation mode. There are two switches used to operate Cruise Control, the Cruise Control ON/OFF switch and the Cruise Set/Resume-Coast/Accelerate switch. The Cruise Control ON/OFF switch allows the operator to turn the Cruise Control on and off. The Set/Resume-Coast/Accelerate switch allows the driver to set and resume the Cruise Control function and decrement or increment by one-mile-per hour by bumping (briefly enabling) the coast or accelerate switch.

Three basic operation modes of Cruise Control are possible, each dependent on switch settings and operating conditions: Off, Standby, and Active:

Off - Cruise Control does **not** affect engine operation, nor can it be activated. The Cruise Control ON/OFF switch is OFF.

Standby - The Cruise Control ON/OFF switch is ON, but Cruise Control has been deactivated and does **not** affect engine operation. Cruise Control will remain on standby when the Cruise Control ON/OFF switch is initially placed ON until a request for activation is made by the driver using the Cruise Set/Resume switch by either setting a desired speed or resuming to a desired speed. Activation will be allowed if all of the following requirements are met:

- Vehicle speed **must not** be below 30 mph
- Engine speed **must not** be below 1,000 rpm
- Brake pedal **must not** be depressed
- Clutch pedal **must not** be depressed
- A vehicle speed sensor fault **must not** be present.

Active - Cruise Control is controlling engine fueling to maintain the desired road speed. Once activated, a Cruise Control reference speed will be calculated by using information for the Cruise Control Maximum Vehicle Speed, Driver Rewards reward (refer to Driver Reward feature description), and the Cruise Control Set Speed. Cruise Control will maintain vehicle speed at the Cruise Control set speed unless an interaction occurs with any one of the following:

- Maximum Torque Curve
- Programmable Droops
- Accelerator
- Maximum Vehicle Speed (Road Speed Governor Limit).

Maximum torque curve is the maximum fueling allowed at an engine speed versus revolution per minutes (RPM) for the horsepower rating of the engine. Cruise Control can **not** achieve vehicle speeds that will require fueling exceeding the maximum torque curve of the engine.

Two programmable droops are available: an upper and a lower droop.

The upper droop causes vehicle speed to decrease slightly below the Cruise Control reference speed at high engine loads, such as when climbing a grade.

The lower droop allows vehicle speed to increase slightly above the Cruise Control reference speed at low engine loads, such as when at the bottom of a grade.

For example: When climbing a steep grade in Cruise Control and the upper droop (uphill droop) is set to zero mph with Cruise Control speed set at 62 mph, the engine will maintain vehicle speed at 62 mph as long as the maximum torque curve is **not** exceeded. However, if the upper droop is set to another choice, such as two mph, the Cruise Control will allow vehicle speed to drop 60 mph. After dropping down to 60 mph, Cruise Control will maintain vehicle speed at 60 MPH. As the vehicle nears the top of the grade and accelerates toward 62 mph, Cruise Control will slightly limit vehicle speed between 60 and 62 mph.

When nearing the bottom of a steep grade in Cruise Control and the lower droop (downhill droop) is set to zero mph with Cruise Control speed set at 62 mph, the engine will maintain vehicle speed at 62 mph. However, if the lower droop is set to two mph, Cruise Control will allow vehicle speed to roll out to 64 mph.

The accelerator can be used to increase vehicle speed temporarily, above the Cruise Control set speed but below the Global Maximum vehicle speed. When the accelerator is released, Cruise Control will automatically resume to the Cruise Control set speed.

Road Speed Governor Override - Depending on the status of Gear Down Protection, Cruise Control can or will **not** be able to cruise at vehicle speeds greater than Road Speed Governor reference speed. If Gear Down Protection is active, then the Cruise Control governor can **not** exceed Road Speed Governor reference speed. If Gear Down Protection is **not** active, then the Cruise Control governor can cruise at speeds higher than Road Speed Governor reference speed, up to a maximum vehicle speed.

Cruise Control will allow vehicle cruise speeds higher than the maximum Cruise Control speed if the Driver Reward feature is enabled (refer to Driver Reward feature description for additional explanation). Cruise Control will compare the Cruise Set Speed and the Driver Reward cruise speed. The lesser speed of the two will then be used as the Cruise Control speed.

Cruise Control Auto Resume will automatically deactivate and reactivate during Top 2 and manual shifts. If Top 2 performs a shift, Cruise Control will automatically deactivate and reactivate, with no additional programming required. When a manual shift is performed, Cruise Control will deactivate by depressing the clutch and will automatically reactivate after the ECM detects an out-of-gear condition has been detected and the in-gear condition resumes in a different gear than the previous gear.

Engine brake in Cruise Control can be used to apply the engine brakes during Cruise Control use. Engine braking effort is determined by vehicle speed, the Cruise Control reference speed, Cruise Control speed for initial engine brake, and Cruise Control speed for maximum engine brake. In order for the Cruise Control to activate engine brakes, engine brake **must** be enabled, and all engine brake activation conditions **must** be met (refer to Engine Brake Options feature description).

If vehicle speed exceeds the Cruise Control reference speed for initial engine brake, Cruise Control will request the engine brakes to activate. If all requirements are met, the engine brakes will go on at the minimum level. If vehicle speed exceeds Cruise Control reference speed for maximum engine brake, the engine brakes will go on at their maximum level. Engine brakes will **not** increase beyond the level set by the engine brake level switch. Engine brakes will automatically deactivate as vehicle speed approaches the Cruise Control reference speed.

Driver Activation/Deactivation

NOTE: Functionality varies depending on engine product.

To activate Cruise Control, turn the Cruise Control ON/OFF switch ON. Press the Set switch when the desired cruise speed is achieved.

To put Cruise Control in standby mode, depress the brake pedal or clutch pedal. Cruise Control will automatically go to standby when vehicle speed falls below 30 mph, engine speed is too low, or a vehicle speed sensor error occurs.

To deactivate Cruise Control turn the cruise ON/OFF switch to the off position.

Interaction with other Features and Parameters

NOTE: Functionality varies depending on engine product.

- Driver Reward
- Engine Brakes (**Not** used by Gas Plus)
- Gear Down Protection
- Maximum Accelerator Vehicle Speed Limit.

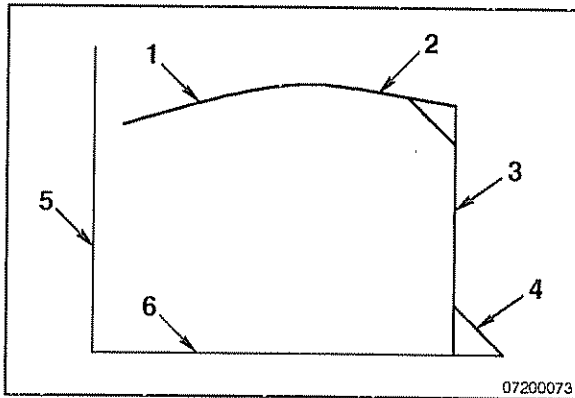
This feature interacts with the vehicle speed feature. If vehicle speed sensor type is set to none and Cruise Control is then disabled, the user will **not** be able to enable Cruise Control until the vehicle speed sensor type is changed to another type other than none.

Disadvantages

Possible customer complaints

Low Power - Upper droop settings greater than zero will lessen the engine's grade climbing and accelerating performance near the maximum Cruise Control speed.

Cruise Control does **not** operate at set speed, but can be caused by Driver Reward setting, maximum accelerator override setting, or droop settings.



Visual Aids

1. . Maximum Torque Curve
2. . Cruise Control upper droop adjustable mph decrease
3. . Cruise Set Speed, no droop
4. . Cruise Control lower droop adjustable mph roll out
5. . Increasing Torque Axis
6. . Increasing MPH Axis

Engine Protection

Feature Description

This feature monitors critical engine operating conditions (Examples: Coolant temperature, oil pressure, coolant level, intake air temperature, intake manifold pressure). When an operating condition is outside of calibrated limits, a speed or power derate will result in combination with illumination of the red stop and or amber warning lamps. All calibrations with the exception of Fire Truck, Fire Pumps, and marine are equipped with the Engine Protection feature that derates the engine if an Engine Protection value is out of range.

In operation, the ECM monitors engine operating conditions while the engine is running. If one of the critical operating conditions exceeds the engine protection limit, as defined in the calibration, a derate will occur and a amber warning lamp will be illuminated. If the condition is more severe, a red lamp and more severe derate will occur.

For some products (beginning in 2002) a very slight derate can occur for slight coolant temperature or intake manifold temperature events without lamp illumination. In such cases a fault code will be stored in the ECM memory and the information will also be stored in the Engine Protection History database. The degree of a slight derate will **not** be noticeable to a driver or equipment operator. If the temperature event persists during the slight derate, then a more severe derate will occur in combination with the red lamp.

The severity of the Engine Protection derate will vary according to which engine operating condition has exceeded its engine protection limit. Also, the severity of the derate can vary in relation to the severity of the event (Example: Intake Manifold Temperature slightly above a threshold for a short period of time will result in a mild derate. By comparison, if Intake Manifold Temperature is over a threshold for a longer time or if the condition becomes more severe, a more severe derate can occur). If the condition persists and Engine Protection Shutdown is enabled, the red lamp will flash 30 seconds prior to the engine shutting down. This is done to warn the vehicle operator of the impending shutdown event.

Some (**not** all) engine families allow selection of Restart Inhibit. If Restart Inhibit is selected, the keyswitch **must** be turned off prior to restarting the engine following any Engine Protection Shutdown event. Once restarted, the engine will continue to operate at the derated condition. Also, a limited number of restarts (varies by engine family) is available.

Driver Activation/Deactivation

If Shutdown Manual Override is available in the calibration and has been enabled with the INSITE™ service tool and the OEM has installed a switch in the cab, the driver can reset the shutdown timer any time after the red light begins flashing by activating the OEM installed switch. Resetting the timer will provide an additional 30 seconds of engine run time before automatic engine shutdown due to the engine protection condition. There are no limits on how many times the timer can be reset. If Shutdown Manual Override is **not** available in the calibration, there is no driver interaction with this feature.

Interaction with other Features and Parameters

A coolant level sensor **must** be installed and connected to the ECM through the engine harness if the engine protection feature is expected to protect the engine for low coolant level. Refer to the wire schematic found in the Troubleshooting and Repair Manual for proper ECM connection of the coolant level sensor.

Disadvantages

If a driver reports that there is low power, look at the engine protection history to determine if an engine protection limit was temporarily exceeded.

Visual Aids

None

Fan Control

Feature Description

Various fan control features are available and while **not** all aspects of fan control are available on all engines, most (but **not** all) electronic controlled engines have some Electronic Control Module (ECM) fan control capability.

Fan control capability means that the ECM is able to turn the fan on or off in response to any of the following inputs:

- Engine operating conditions (coolant temperature, intake manifold temperature, etc.)
- Control of fan overspeed
- Air conditioner operation
- Manual fan switch
- Engine performance requirements (Example: engine braking)

NOTE: Many Industrial engines have fan controls as part of the ECM calibration that can **not** be adjusted using the service tool.

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Driver Activation/Deactivation

The driver can override the ECM to turn the fan on, using the manual fan switch installed in the cab by the vehicle manufacturer. When the driver places the manual fan switch in the ON position, the fan will be on regardless of other engine operating conditions. When the manual fan switch is in the OFF position, the fan will operate according to engine operating conditions and according to how the fan control parameters are configured.

Interaction with other Features and Parameters

ISB and ISC have a single pin on the ECM that provides Pulse Width Modulation. This pin can be used to send a kick-down signal to an automatic transmission, in which case it **must not** be used to operate a variable speed fan.

Disadvantages

Due to heat rejection, the fan on during engine braking feature will appear inconsistent to some vehicle operators (Example: Consider an ISX calibration setting that the fan will engage 15 seconds after engine braking starts. It will be possible for the fan to sometimes come on sooner in response to air intake temperatures, coolant temperatures, or the air conditioner pressure switch).

Visual Aids

1. Fan Type
2. Drive Ratio
3. Maximum Fan Speed
4. Air Conditioner Speed Control
5. Fan On During Engine Braking
6. Minimum Fan On Time for Air Conditioner Pressure Switch
7. Manual Fan Switch
8. Air Conditioner Pressure Switch
9. Pulse Width Modulation Frequency
10. Clutch Logic
11. Fan Clutch 2 Enable



Hot Shutdown Monitor

Feature Description

The Hot Shutdown Monitor will log a fault in the Electronic Control Module (ECM) if the engine is shutdown, either by the key switch or by the engine protection feature or other Original Equipment Manufacturer (OEM) devices, while still hot. The engine is considered hot if the load on the engine is above the hot shutdown minimum load set by Cummins INSITE™ service tool. Hot shutdown monitor is available on QSB, QSC, QS9, QSM11, QSL9, QSL15, QSL30, QSL45, QSL60 industrial engines.

For example: If the hot shutdown load percent is set at 60 percent, every time the engine is shut down when the calculated engine load is over 60 percent, a hot shutdown fault will be logged. There are two fault codes associated with hot shutdown monitor.

Fault Code 299 will be logged if the engine is shutdown while hot by the engine protection feature or other OEM devices. Fault Code 611 will be logged if the engine is shut down while hot by the key switch. The hot shutdown load percent is based on the duty cycle load factor that is determined from engine fueling levels.

Driver Activation/Deactivation

There is no operator activation or deactivation for hot shutdown monitor.

Interaction with other Features and Parameters

The engine protection shutdown **must** be enabled for hot shutdown monitor to log Fault Code 299 as a result of engine protection shutting the engine down. Fault Code 299 will still be logged if the engine is shut down by an OEM device and engine protection is **not** enabled.

Disadvantages

None

Visual Aids

None

Intermediate Speed Control (ISC)

Feature Description

Industrial applications use an engine speed control feature called Intermediate Speed Control.

Up to three Intermediate Speed Control Set Speeds (1, 2, or 3) can be selected depending on Original Equipment Manufacturer (OEM) availability. To support this feature, a multi-position switch, or three toggle switches **must** be installed by the OEM.

Additionally, up to five Variable Intermediate Speed Control Set speeds (1, 2, 3, 4, or 5) can be selected and the operator can select these speeds using an OEM installed accelerator lever.

The Intermediate Speed Control set speeds will interact with the accelerator pedal in one of three different ways (modes A, B and C); the interaction between Intermediate Speed Control set speeds and the accelerator pedal is **not** adjustable, this interaction is determined by the OEM and built into the ECM calibration.

Mode A - Intermediate Speed Control set speed acts as low speed governor. In this mode, the Intermediate Speed Control set speed becomes the Minimum Engine Speed. The operator can use the accelerator pedal to increase the speed above the Intermediate Speed Control set speed.

Mode B - Intermediate Speed Control set speed acts as high speed governor. In this mode, the Intermediate Speed Control set speed becomes the Maximum Engine Speed. The operator can use the accelerator pedal to control engine speed up to the Intermediate Speed Control set speed.

Mode C - Intermediate Speed Control Constant Speed. In this mode, the Intermediate Speed Control runs at constant speed and accelerator pedal input is ignored.

The three Preset Intermediate Speed Control speeds can be adjusted with an increment or decrement switch and are INSITE™ service tool adjustable, but can **not** exceed the low or high idle governor engine speed limits.

The five Intermediate Speed Control Variable Speed Control set speeds are **not** adjustable with the increment or decrement switch, but are adjustable with the INSITE™ service tool.

Only one droop setting is available for all Intermediate Speed Control speeds.

One of the switch inputs can be used as a validation input (if used, the ECM pin for Intermediate Speed Control 3 will be used). If this is the case, the ECM calibration will use the ECM pin used for Intermediate Speed Control 3 as a validation input and **only** 2 Intermediate Speed Control speeds will be available while the five variable Intermediate Speed Control inputs will **not** be available.

If more than one Intermediate Speed Control switches is turned ON; the lowest speed turned ON will take priority.

Driver Activation/Deactivation

Using the Intermediate Speed Control Switched Set Speeds

The operator can operate the engine using the Intermediate Speed Control Set Speeds with OEM installed Intermediate Speed Control Switches, or an equivalent OEM installed device. Activating Intermediate Speed Control can or can **not** cause Accelerator Pedal inputs to be ignored.

Using the Intermediate Speed Control Variable Speed Set Points

The operator can operate the engine using the Intermediate Speed Control Variable Speeds; Intermediate Speed Control Variable Speeds are selected with an Accelerator Lever or an equivalent switching device that is installed by the OEM. This device can contain a potentiometer that sends a variable signal to the ECM. Based on the output of the potentiometer, the engine will be controlled to one of five Intermediate Speed Control Variable Speeds. Refer to the figure below for visual reference. It is recommended that all five speeds be chosen and entered in a sequential order so that as the operator increases the position of the hand throttle, the engine speed will change accordingly.

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Interaction with other Features and Parameters

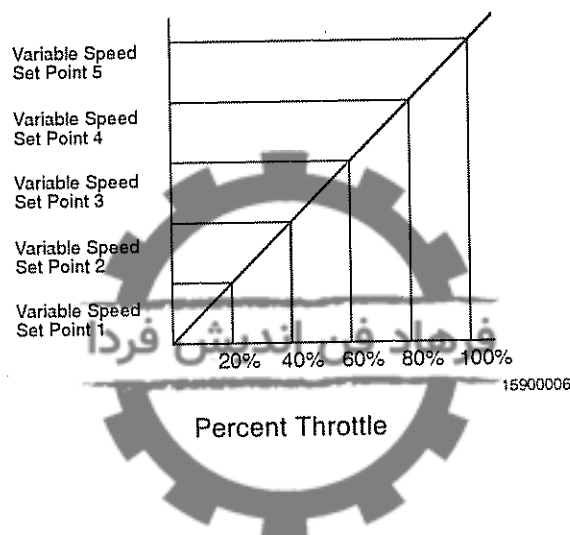
Intermediate Speed Control and Cruise Control can **not** be active at the same time. If the cruise control on/off switch is on, then Intermediate Speed Control is disabled. If the cruise on/off switch is off then Intermediate Speed Control will remain off until an Intermediate Speed Control switch transitions from off to on.

Remote Throttle and Variable Speed Intermediate Speed Control **must not** both be used on the same engine.

Disadvantages

Using the service tool, it is **not** possible to display the interaction between Intermediate Speed Control and the throttle pedal.

Visual Aids



Maintenance Monitor

Feature Description

This feature, when enabled, will cause the engine control module to illuminate a maintenance lamp alerting the operator when it is time to service the engine. This feature is intended to illuminate a maintenance lamp in conjunction with engine oil and oil filter service. This feature can be adjusted to illuminate the maintenance lamp based on ECM measured distance or engine running time. Once the ECM determines the maintenance interval has expired, it will illuminate the maintenance lamp following the very next key-on.

NOTE: Not all engines (example: CELECT™) are equipped with a separate maintenance lamp. In these cases, the engine can utilize another method (Example: CELECT™ engines alert the operator by flashing the engine protection lamp through five, three-flash cycles approximately 12 seconds after key-on). Refer to the engine Operation and Maintenance manual for a description of how the operator is alerted when this feature is enabled.

Further, the feature can be customized (using Cummins INSITE™) to illuminate the lamp at some time prior to the end of the maintenance interval (Example: The feature can be adjusted to illuminate the lamp at any point when 50 to 100 percent of the maintenance interval has expired. This is accomplished by selecting an appropriate value for Alert Percentage.).

Finally, some applications (specifically ISM and ISX) can have the ECM determine the maintenance interval using the Auto mode of the Maintenance Monitor. In these instances, the user **must** enter an Interval Factor (using Cummins INSITE™). The Interval Factor will be based on the trucks duty cycle and engine oil grade. Afterwards, the ECM will calculate the end of the maintenance interval based on engine operating conditions.

Driver Activation/Deactivation

This feature is enabled using Cummins INSITE™.

The **only** driver or user interaction is to reset the warning lamp manually. Refer to the engine Operation and Maintenance manual for proper manual lamp reset methods. Otherwise, Cummins INSITE™ can be used to reset the maintenance lamp.

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Interaction with other Features and Parameters

Not all engines (example: CELECT™) are equipped with a separate maintenance lamp. In these cases, the engine can utilize another method (Example: CELECT™ engines alert the operator by flashing the engine protection lamp through five, three-flash cycles approximately 12 seconds after key-on). Refer to the engine Operation and Maintenance manual for a how the operator is alerted when this feature is enabled.

Maintenance Monitor will **not** be enabled if Centinel™ is installed on the vehicle.

Disadvantages

Applications that do **not** utilize a separate maintenance lamp can illuminate engine warning lamps which result in false service complaints if drivers are **not** trained to use the maintenance monitor feature.

Visual Aids

None

Multiple Unit Synchronization

Feature Description

The multi unit synchronization feature allows two or more engines (up to a maximum of 11) to be controlled by a single throttle signal and run at a similar speed (See visual aids section). There is three engine configurations available with this feature: soft-coupled, hard-coupled, and soft-coupled marine.

The soft-coupled configuration has all secondary engines in parallel with each other. The primary engine outputs a throttle signal to all secondary engines. This setup allows all engines to remain running if a secondary engine stops running.

The hard-coupled configuration has the primary and all secondary engines in series with each other (See visual aids section). The primary engine outputs a throttle signal, which is received by the first secondary engine. This secondary

engine then outputs the throttle signal to the next secondary engine in the series. This process repeats until the primary engine receives the throttle signal.

The soft-coupled marine configuration has all secondary engines in parallel with each other (See visual aids section). The primary engine outputs a throttle signal on the J1939 datalink to all secondary engines.

Driver Activation/Deactivation

This feature can **not** be activated or deactivated by the driver except in the case of the soft-coupled marine configuration. In this case, Multi Unit Synchronization is turned on or off by a user activated switch.

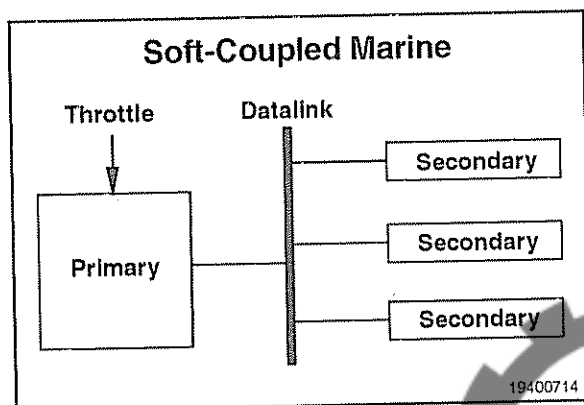
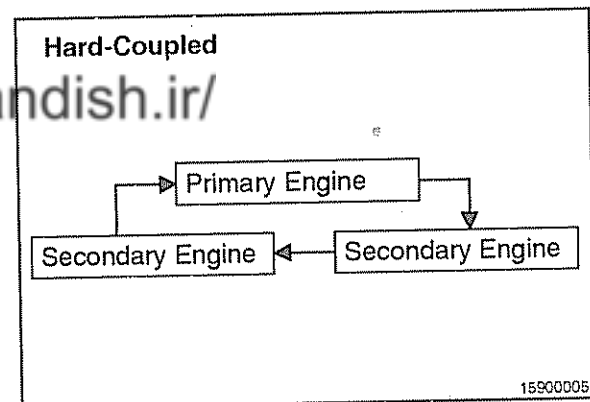
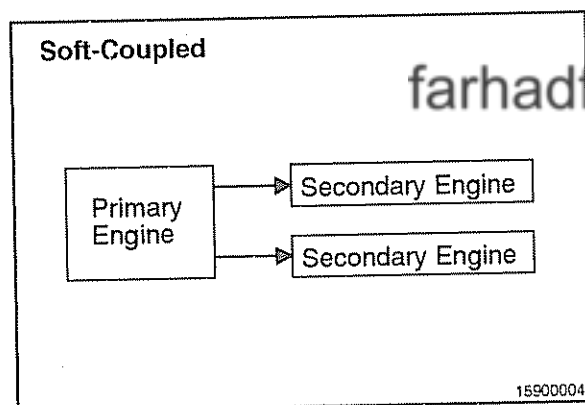
Interaction with other Features and Parameters

None

Disadvantages

In the hard-coupled configuration, if one engine in the series stops running, then the remaining engines in the circuit will also stop running.

Visual Aids



فرهاد افشاری فردا Alternate Droop

Feature Description

Alternate Droop allows the droop characteristics to be changed for the automotive (minimum or maximum) and for Variable Speed (VS) governor or All Speed Governor. In general less governor droop (lower percentage) provides a more responsive governor for more precise engine control. More governor droop (higher percentage) provides smoother shifting and smoother mechanical clutch engagement. This feature, depending on Original Equipment Manufacturer (OEM) availability, provides the user the ability to select multiple breakpoint speeds and the droops

Alternate Droop is calibration activated (except for CELECT™ Plus), but uses a switch to toggle between the alternate droop settings. Depending on the application the alternate droop switch can be a 2 or 3 position switch. Toggling the switch into the 2nd and 3rd positions will activate the 2nd and 3rd droop settings accordingly.

The Vehicle Speed Droop feature uses the droop settings for this feature.

- Driver complains of low power.
- Driver complains of poor or unexpected throttle reaction.



1. . Torque
2. . Engine Speed (RPM)
3. . Low Idle Speed
4. . Maximum Torque Curve
5. . High speed Break Point
6. . Normal Droop
7. . Alternate Droop
8. . Alternate Droop (available)

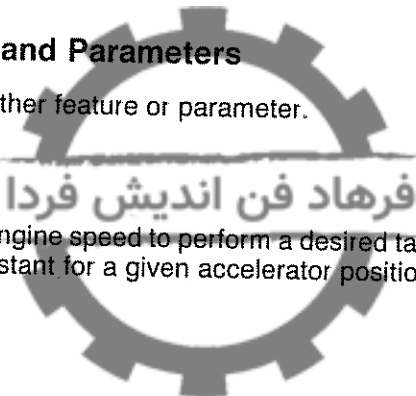
This feature allows the user to determine the type of engine governor control. The two types available are the automotive (minimum or maximum) and Variable Speed or All Speed Governor types. The automotive governor provides a constant fueling for a given accelerator position. With the automotive governor selected the engine speed can vary with changes in engine loading for a constant accelerator position.

The Variable Speed governor provides a constant engine speed for a given accelerator position. With the Variable Speed governor selected the engine speed will remain constant with changes in engine loading for a constant accelerator position. The Variable Speed governor is an option. It is best suited for applications where a constant engine speed is desired to perform a desired task where engine or power take-off speed **must** remain constant.

The selection of the governor type can be accomplished two ways. If the vehicle is equipped with a cab-mounted switch, the driver can activate this switch to select between the automotive or Variable Speed governor. If the cab switch is **not** available the INSITE™ service tool can be used to select the desired governor type.

This feature does **not** interact with any other feature or parameter.

For applications that require a constant engine speed to perform a desired task, the automotive governor will **not** hold the engine or Power Take-Off speed constant for a given accelerator position.



Visual Aids

None

Integrated Idle Management

Feature Description

Idle speed can reduce the amount of fuel burned or decreased cab noise and vibration, INSITE™ electronic service tool is used to set the desired low idle speed, however the driver can override the preset value by using an OEM-supplied idle speed adjustment switch.

Idle shutdown reduces the amount of fuel burned and increases engine life by shutting down the engine after a period of engine idling with no driver activity. Before the shutdown occurs a flashing warning lamp warns the driver of an impending shutdown. The driver can override shutdown by depressing the service brake, clutch, or accelerator pedal during the warning period. Idle shutdown operates when the engine is in Intermediate Speed Control mode unless a specific load threshold is exceeded. Idle shutdown can be automatically overridden during cold ambient temperatures if equipped with an OEM-supplied ambient air temperature sensor.

Driver Activation/Deactivation

Idle Shutdown can **only** be activated or deactivated by INSITE™ electronic service tool. However the driver can adjust the idle speed if an OEM-supplied idle adjustment switch is available in the cab.

To manually override an automatic idle shutdown, Manual Override **must** be enabled in INSITE™ electronic service tool and the driver **must** activate the brake, clutch or accelerator pedal during the 30-second period prior to shutdown. A flashing warning lamp notifies the driver that engine shutdown is pending. If the override is successful the warning lamp will flash every half second for two minutes.

Interaction with other Features and Parameters

Idle Shutdown can cause the engine to shutdown when in Intermediate Speed Control mode.

Disadvantages

Incorrect adjustment of the low idle speed can cause excessive vehicle vibration or slightly decreased fuel economy.

Idle Shutdown will **not** activate if Fault Code 241 is active.

When stopped in traffic for extended periods the engine will be shutdown.

Visual Aids

None.

Vehicle Speed

Feature Description

This feature provides a collection of setup parameters associated with vehicle speed.

Driver Activation/Deactivation

The driver can **not** activate or deactivate any Vehicle Speed feature parameters. This feature can **only** be activated or deactivated by the Cummins INSITE™ service tool.

Interaction with other Features and Parameters

None

Disadvantages

None

Visual Aids

None

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Section 1 - Operating Instructions

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Operating Instructions - Overview



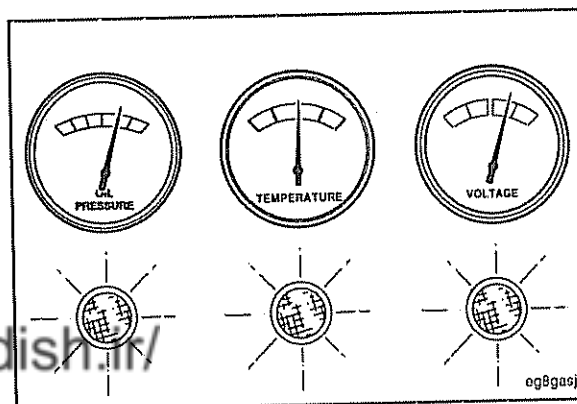
General Information

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

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

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

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

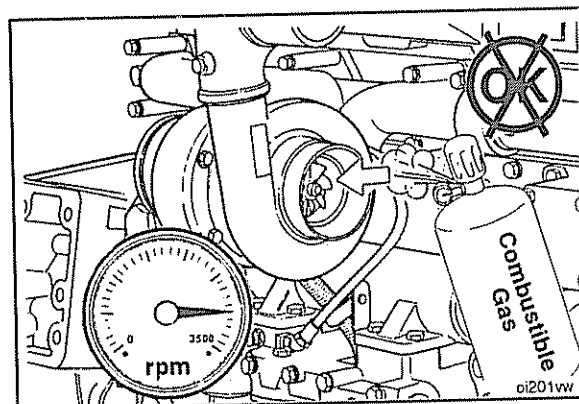


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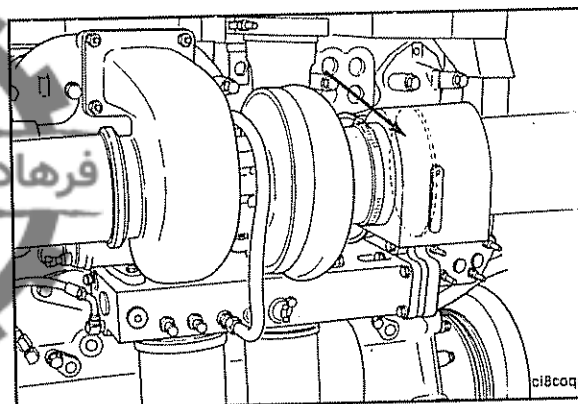
WARNING

DO NOT OPERATE A DIESEL ENGINE WHERE THERE ARE OR CAN BE COMBUSTIBLE VAPORS. The vapors can be sucked through the air intake system and cause engine acceleration and overspeeding that can result in a fire, an explosion, and extensive property damage. Numerous safety devices are available, such as air intake shutoff devices, to minimize the risk of overspeeding where an engine, due to its application, due to a fuel spill or gas leak. Remember, Cummins has no way of knowing the use you have for your engine. **THE EQUIPMENT OWNER AND OPERATOR ARE RESPONSIBLE FOR SAFE OPERATION IN A HOSTILE ENVIRONMENT. CONSULT YOUR CUMMINS AUTHORIZED REPAIR LOCATION FOR FURTHER INFORMATION.**



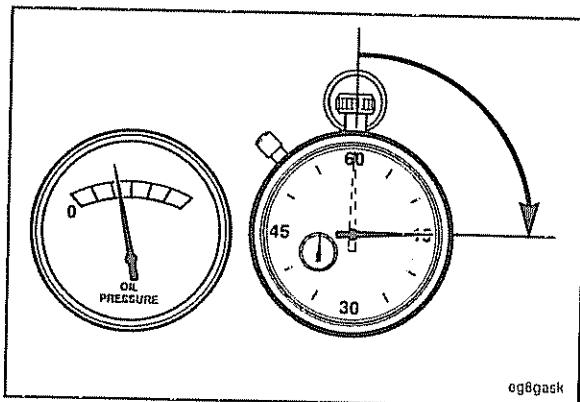
Cummins recommends the installation of an air intake shutoff device or a similar safety device to minimize the risk of overspeeding where an engine, due to the vehicle, vessel or equipment being operated in a combustible environment, such as due to a fuel spill or gas leak.

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⚠ CAUTION ⚠

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

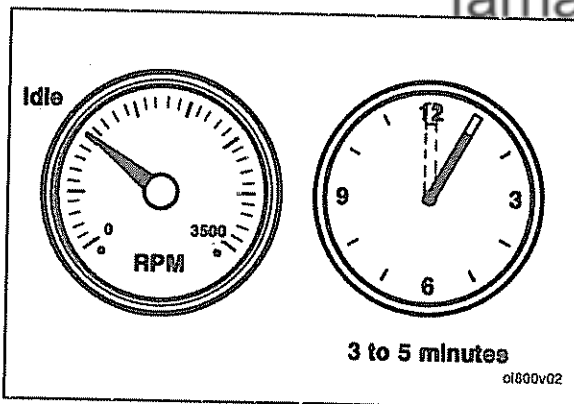


Normal Starting Procedure General Information

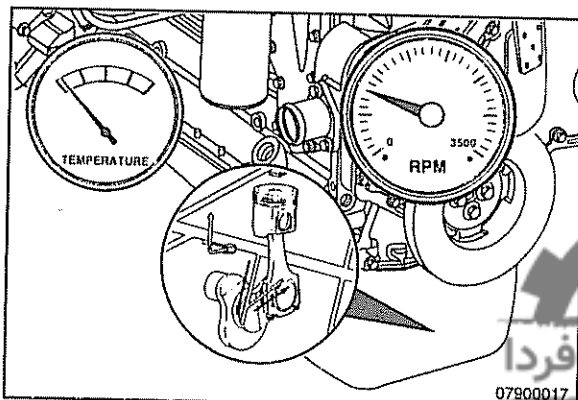
⚠ CAUTION ⚠

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

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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.

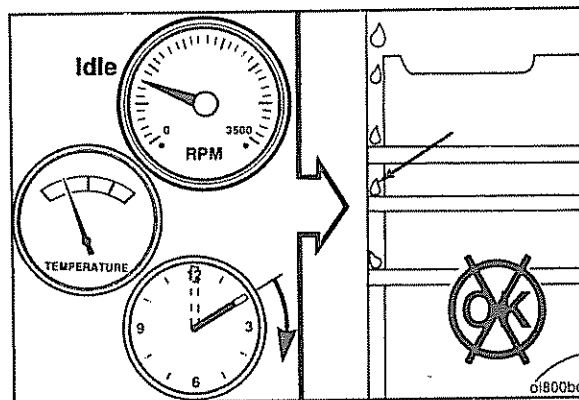
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⚠ CAUTION ⚠

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

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



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.

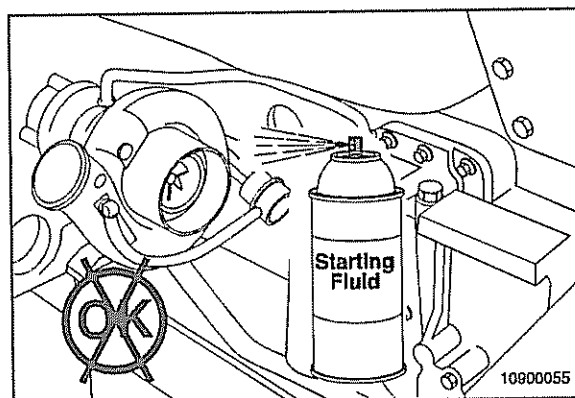
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Using Starting Aids

⚠ WARNING ⚠

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

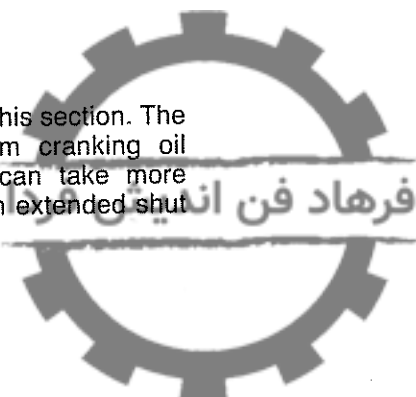
Cold weather starting aids are available for your engine. Contact the local Cummins Authorized Repair Location for more information.

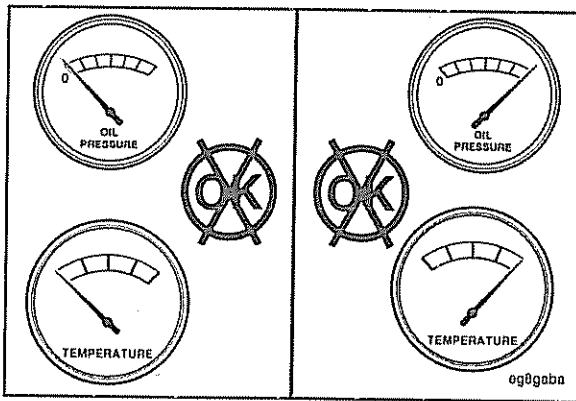


Starting Procedure After Extended Shutdown or Oil Change

General Information

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

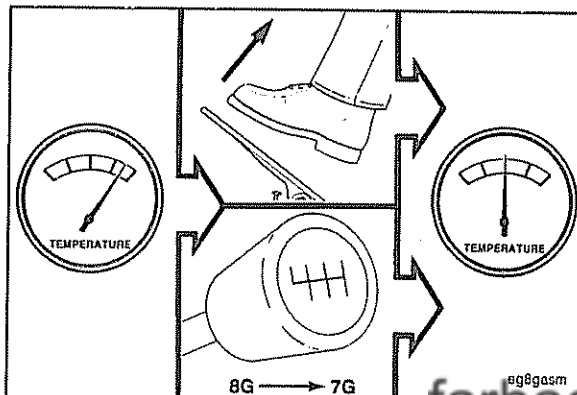




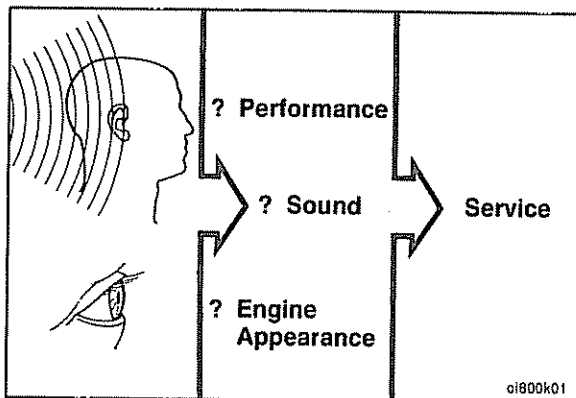
Operating the Engine Normal

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

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



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



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

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

Cold Weather

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

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

Ambient Temperature

0 to -32°C [32 to -25°F]

Use 50-percent ethylene glycol antifreeze and 50-percent water for the engine coolant mixture.

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

The Diesel fuel must have maximum cloud and pour points 6°C [10°F] lower than the ambient temperature in which the engine operates.

-32 to -54°C [-25 to -65°F]

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

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

The Diesel fuel must have maximum cloud and pour points 6°C [10°F] lower than the ambient temperature in which the engine operates.

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

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

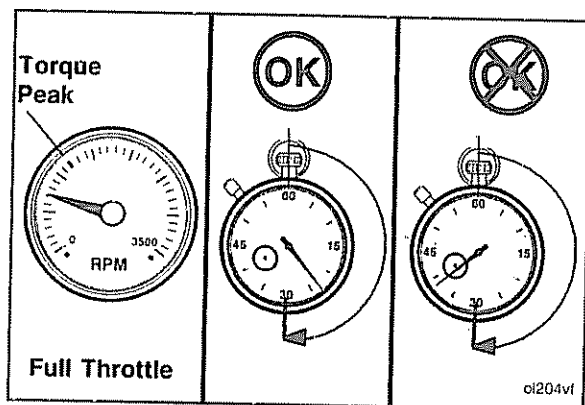
* Required dependent upon viscosity/pour point

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Winterfronts and Shutters

Winterfronts and shutters can be used on a vehicle or equipment to reduce air flow through the radiator core into the engine compartment. This can reduce the time required to warm the engine and help maintain the engine coolant temperature. The engine coolant temperature specifications are in the Maintenance Specification (Section V).





Engine Operating Range General Information

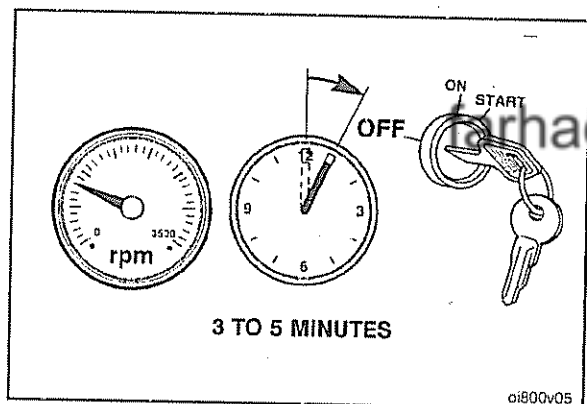
⚠CAUTION⚠

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

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

⚠CAUTION⚠

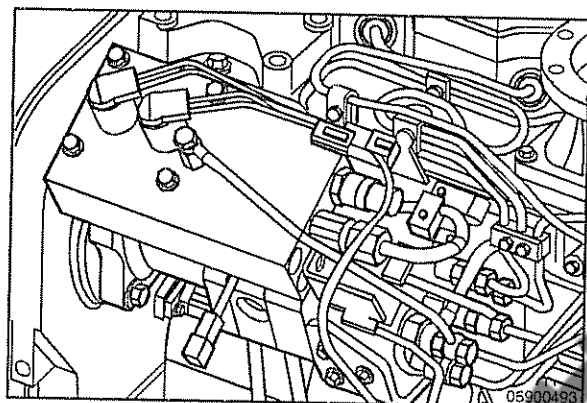
Do not operate the engine beyond the maximum engine speed. Operating the engine beyond the maximum engine speed can cause severe engine damage. Use proper operating techniques for the vehicle, vessel, or equipment to prevent engine overspeed. The maximum engine speed specification is listed in Maintenance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



Engine Shutdown General Information

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

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



Electronic Controlled Fuel System General Information

The QSC8.3 engine control system is electronically controlled and also provides many operator and vehicle or equipment features.

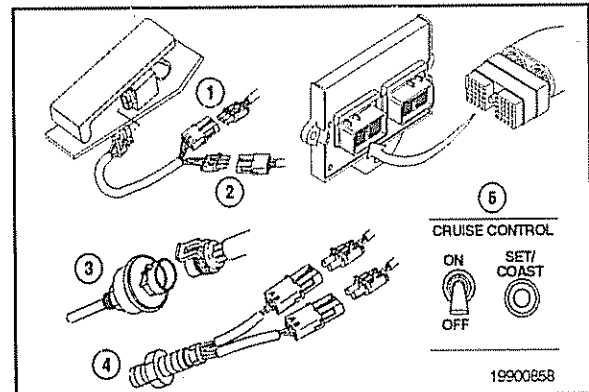
The base functions of the control system include fueling and timing control, limiting the engine speed operating range between the low- and high-idle set points, and reducing exhaust emissions while optimizing engine performance.

QSC8.3 and QSL9 Engines
Section 1 - Operating Instructions

Electronic Controlled Fuel System
Page 1-7

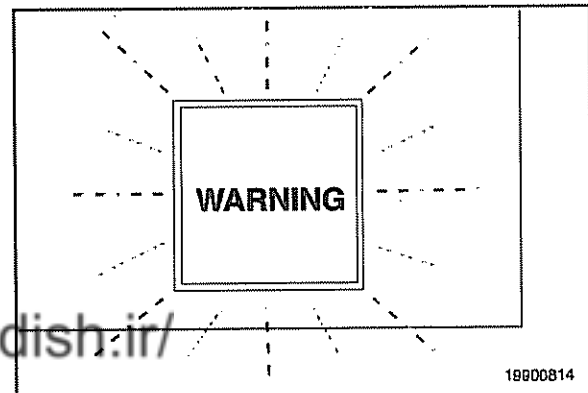
The control system uses inputs from the operator and engine sensors to determine the fueling and timing required to operate at the desired engine speed.

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



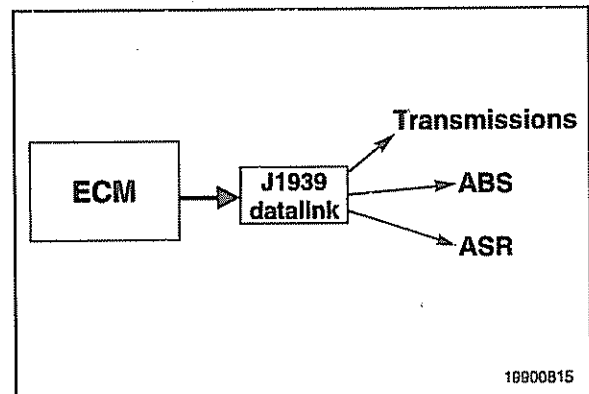
The electronic control module (ECM) performs diagnostic tests on most of its circuits and will activate a fault code if a problem is detected in one of these circuits. Along with the fault code identifying the problem, a snapshot of engine operating parameters at the time of fault activation is stored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

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



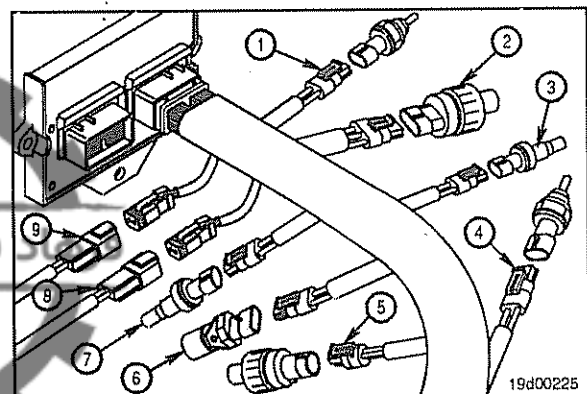
The ECM communicates with service tools and other vehicle controllers such as the transmission, antilock brake system (ABS), and anti-slip reduction through an SAE J1939 datalink.

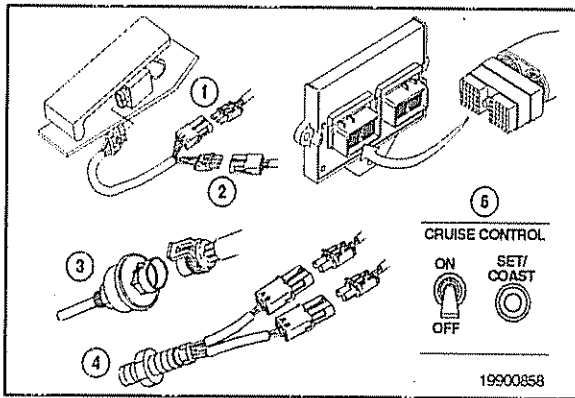
Some vehicles and equipment will have J1939 networks that link many of the "smart" controllers together. Vehicle control devices can temporarily command engine speed or torque to perform one of its functions such as transmission shifting or antilock braking.



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

1. Coolant Temperature Sensor
2. Oil Pressure Sensor
3. Water-in-Fuel Sensor
4. Intake Air Temperature Sensor
5. Intake Manifold Pressure Sensor
6. Engine Speed and Position Sensors
7. Cummins Accumulator Pumping System (CAPS) Accumulator Pressure Sensor
8. Injection Control Valve
9. Pumping Control Valves.

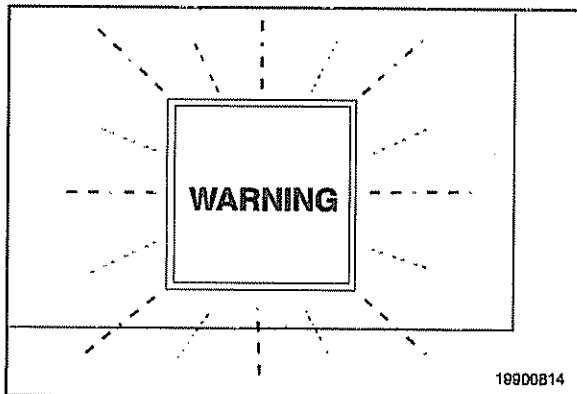




The following inputs are provided by original equipment manufacturer (OEM)-selected devices:

1. Accelerator pedal position sensor
2. Idle validation switch
3. Coolant level sensor
4. Vehicle speed sensor (VSS)
5. Feature control switches such as cruise control, power take off (PTO), and fan clutch control
6. Accelerator interlock (**not** shown)
7. OEM pressure sensor (**not** shown).

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



Engine Protection System



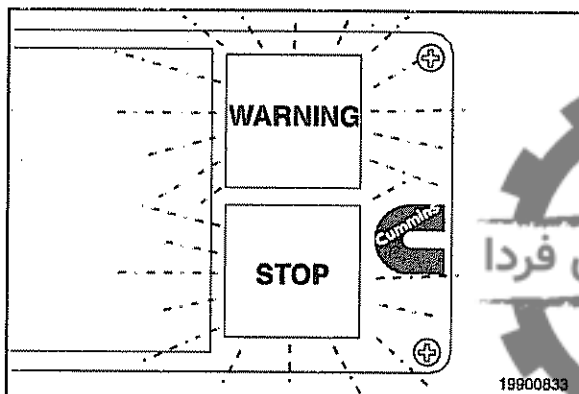
When the red **STOP** lamp is illuminated, the driver must pull to the side of the road, once it is safe to do so, to reduce the possibility of engine damage.

The QSC8.3 engines are equipped with an engine protection system. The system monitors critical engine temperatures and pressures, and will log diagnostic faults when an over or under normal operation condition occurs. If an out-of-range condition exists, and engine derate action is to be initiated, the operator will be alerted by an in-cab **WARNING** lamp. The **WARNING** lamp will blink or flash when out-of-range conditions continue to get worse. When the red **STOP** lamp is illuminated, the driver **must** pull to the side of the road, when it is safe to do so, to reduce the possibility of engine damage.

The engine protection system monitors the following data:

- Coolant temperature
- Coolant level (optional)
- Oil pressure
- Intake manifold temperature
- Engine overspeed
- Fuel temperature
- OEM pressure (optional)

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



Engine Protection Shutdown

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

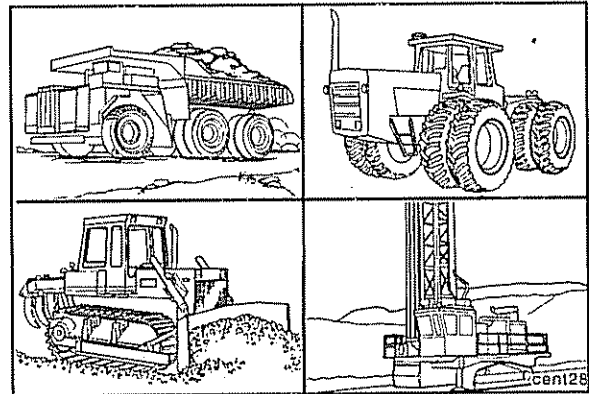
The red "STOP" lamp in the cab will flash for 30 seconds prior to shutdown to alert the driver.

The engine protection shutdown feature can be enabled or disabled using the INSITE™ electronic service tool if the feature is available in the calibration.

Programmable Features

The electronic control system can provide many features that are integrated into the vehicle's operation. Some of these features can be adjusted or turned on and off with a service tool, but some are set at the factory and can **not** be changed.

The following section describes the functionality of each feature and whether an available feature in a given application is calibration-dependent.



Maintenance Monitor Data

Using the INSITE™ service tool, the following maintenance data can be viewed or printed from the ECM:

- Percent of current interval consumed (by time or fuel burned)
- Time since last reset
- Fuel burned since last reset
- Current maintenance monitor mode.

Maintenance Monitor Data

Percent of Current Maintenance Interval	XXX.X%
Time Since Last MM Reset	XXXXX Hrs.
Fuel Burned Since Last MM Reset	XXXX Gal.
Current MM Mode	XXXX

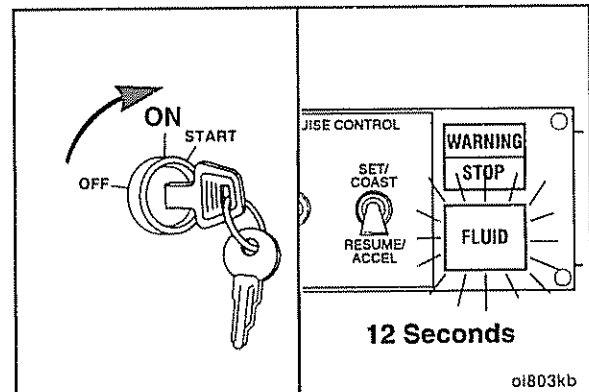
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Alerting the Operator

The maintenance monitor will alert the operator of the need to change oil by flashing the FLUID lamp for approximately 12 seconds after keyswitch is turned on. The flashing sequence will be three quick flashes followed by a pause. This flash sequence will go through five cycles in the 12-second period. This sequence will occur every time the keyswitch is turned on until the maintenance monitor has been reset.

NOTE: The diagnostic switch **must** be in the OFF position for the flashing sequence to occur.



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Maintenance Monitor Reset Log

The maximum threshold is entered by the user either directly using the time mode, or by entering the interval factor in the automatic mode.

The adjusted threshold is the new threshold set automatically by the maintenance monitor when the automatic mode is selected, and it automatically reduces the maintenance intervals.

The "interval reset at" is the interval time and fuel recorded by the ECM at the time the maintenance monitor was reset.

Maintenance Monitor Reset Log 1

	Maximum Threshold	Adjusted Threshold	Interval Reset@
Fuel:	XXXX	XXXX	XXXX
Time:	XXXX	XXXX	XXXX

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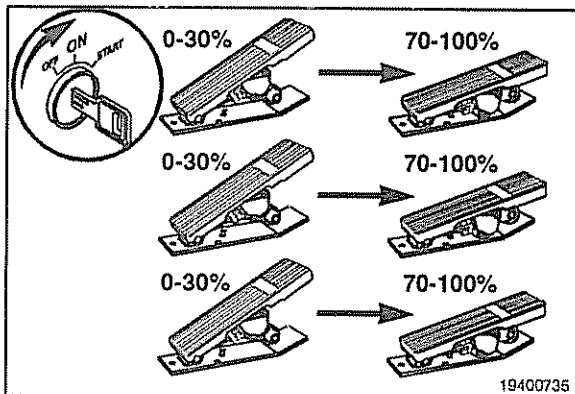
Maintenance Monitor Reset Log 2

	Cumulative Reset @	Possible Error
Fuel:	XXXX	XXXX
Time:	XXXX	XXXX

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The "cumulative reset at" is the total time and fuel recorded by the ECM at the time the maintenance monitor was reset.

The possible error will contain an "X" next to a row of data that can be inaccurate due to a system fault. The "X" will be triggered when a vehicle speed sensor fault or power-down fault occurs. These faults can cause data to either **not** accumulate or accumulate inaccurately.



Maintenance Monitor Reset

The maintenance monitor reset can be accomplished by clicking the reset button on the maintenance monitor screen using the INSITE™ service tool, or using one of the following procedures:

1) Procedure for applications **with** a throttle pedal.

- Turn the keyswitch to the ON position (but do **not** start the engine) and turn the diagnostic switch to the ON position.
- Fully depress the throttle pedal (100 percent) for at least 3 seconds and then release it.
- Fully depress the throttle pedal (100 percent), twice, for less than 3 seconds each time.
- Fully depress the throttle pedal (100 percent) for at least 3 seconds and then release it.

2) Procedure for applications **without** a throttle pedal.

- Turn the keyswitch to the ON position (but do **not** start the engine).
- Turn the diagnostic switch to the ON position for at least 3 seconds and then turn it to the OFF position.
- Turn the diagnostic switch to the ON position (for less than 3 seconds) and then to the OFF position, twice, with less than 3 seconds between each switching.
- Turn the diagnostic switch to the ON position for at least 3 seconds and then turn it to the OFF position.

NOTE: Procedure **must** be completed within 20 seconds after initiating steps 1) a through d or steps 2) a through d or the data will **not** reset.

NOTE: The WARNING lamp will flash three times to indicate that the reset has been completed.



Trip Information System

The trip information system records fuel consumption and time information for the engine during normal operation, and in certain operating modes such as intermediate speed control and idle. Either data can be displayed using the INSITE™ service tool. Some data can **not** be reset and reflect the performance of the engine over its lifetime. Other data, as well as trip data, can be reset using the INSITE™ service tool.

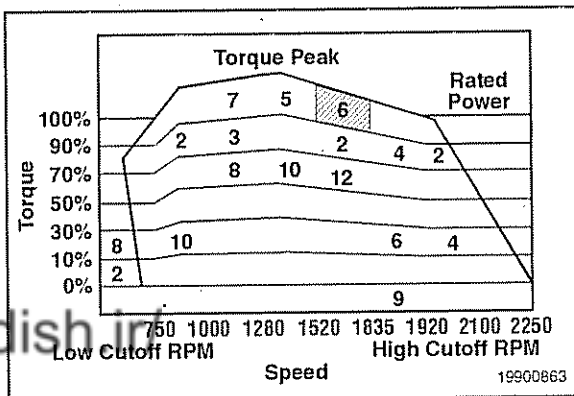
Trip Information System

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Duty Cycle Monitor

With this feature the ECM tracks engine load and speed. These data are stored in the ECM, and the INSITE™ electronic service tool is used to display the data. The INSITE™ electronic service tool display shows a duty cycle "map" that shows the whole engine's operating range in terms of speed and load. This "map" is divided into fifty regions. The percent of the engine operating time spent in each region is shown on the display.

The ECM contains duty cycle data for the whole life of the engine and for two 500-hour operating periods. The two 500-hour maps can be reset with the INSITE™ service tool.



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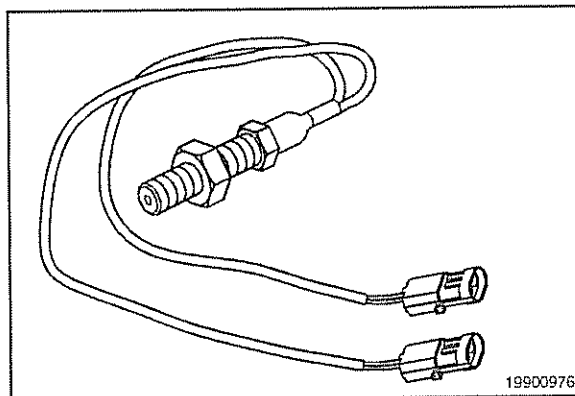
Vehicle Speed Sensor Type

The vehicle speed sensor (VSS) indicates the type of vehicle speed sensor being used with the ECM.

The vehicle speed sensor type can be adjusted with the INSITE™ service tool.

The sensor type is one of the following:

1. . None
2. . Magnetic
3. . J1939 datalink
4. . Other.

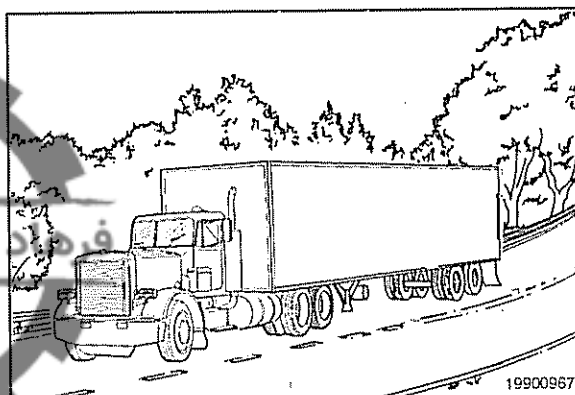


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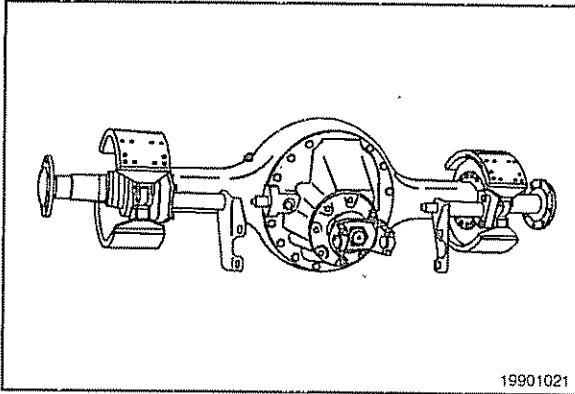
Tire Revolutions per Mile

This parameter indicates to the ECM how many times the tire will turn a full revolution in one mile.

Tire revolutions per mile can be adjusted using the INSITE™ service tool.



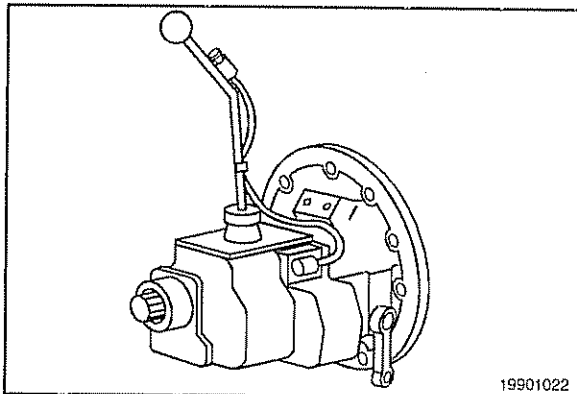
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Rear Axle Ratio

This parameter indicates to the ECM the gear ratio of the rear axle.

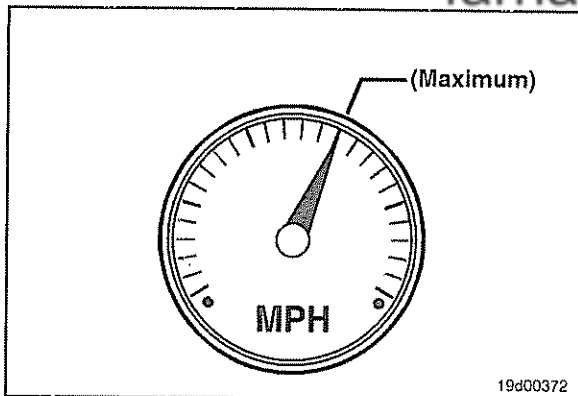
Rear axle ratio can be adjusted using the INSITE™ service tool.



Number of Transmission Tailshaft Gear Teeth

This parameter indicates to the ECM the number of gear teeth on the transmission tailshaft.

The number of transmission tailshaft gear teeth can be adjusted using the INSITE™ service tool.



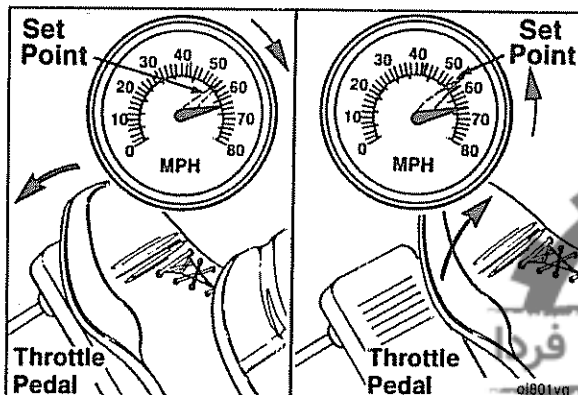
Road Speed Governor

The road speed governor limits the maximum road speed of the vehicle in top gear.

The maximum vehicle speed in top gear is the maximum road speed for the vehicle. This speed **must** be greater than or equal to the maximum cruise speed if the cruise control feature is enabled.

The maximum road speed in top gear can be adjusted by using the INSITE™ service tool.

NOTE: The auxiliary governor needs to be disabled to utilize the road speed governor.



Cruise Control



Do not use cruise control when the road is slippery, in heavy traffic, or when the weather is inclement. Loss of vehicle control can result.

The cruise control feature gives the driver the capability of a foot-off accelerator cruise operation. It is similar to an automobile's cruise control.

The cruise control feature can be enabled or disabled using the INSITE™ service tool.

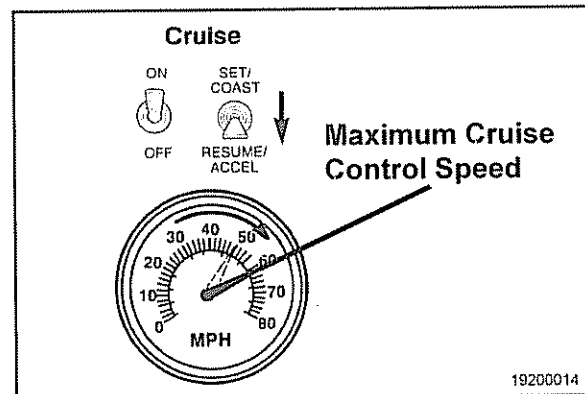
NOTE: Both cruise control and intermediate speed control can **not** be active at the same time.

Maximum Cruise Control Speed

This speed is the maximum allowable cruise set speed.

The maximum cruise control speed can be adjusted using the INSITE™ service tool.

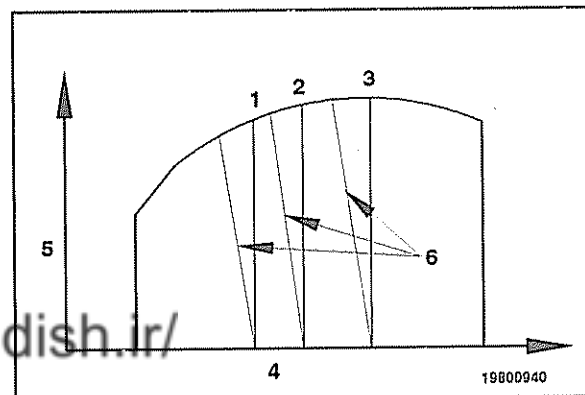
NOTE: The maximum cruise control speed can **not** exceed the maximum vehicle speed in top gear setting.



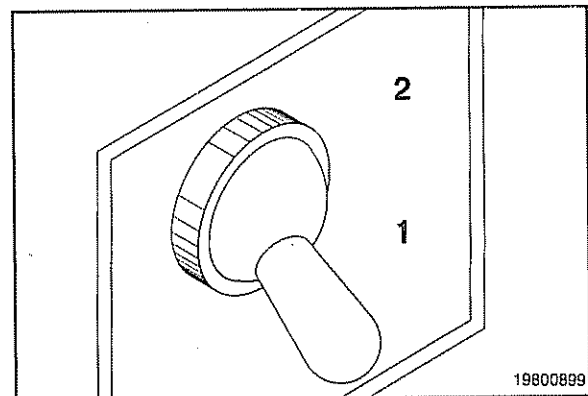
Intermediate Speed Control

The intermediate speed control feature controls the engine at a constant rpm. Up to three intermediate speed control set speeds (1, 2, and 3) can be selected depending on original equipment manufacturer (OEM) availability (the axis 4 equals engine speed and 5 equals engine torque).

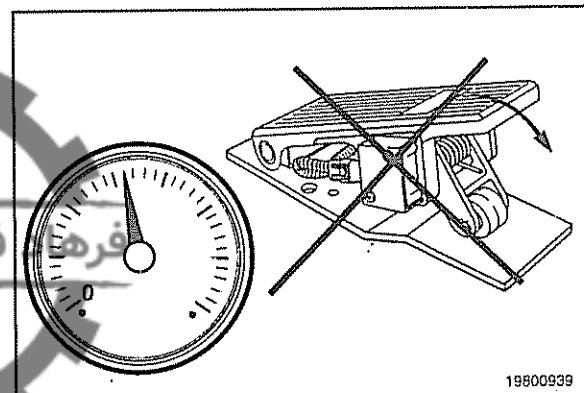
NOTE: An additional five set speeds can be obtained through use of the variable intermediate speed input signal.

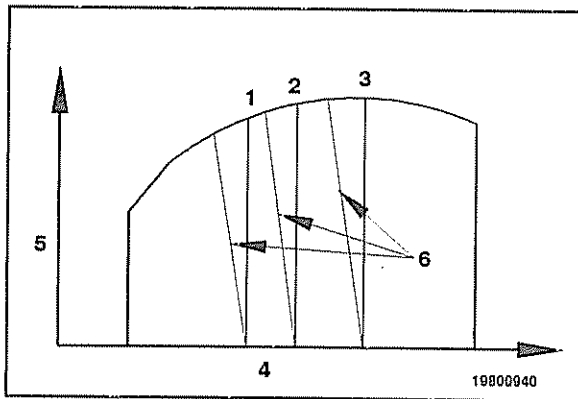


The intermediate speed control feature provides the ability to select an intermediate speed control set speed by an original equipment manufacturer (OEM)-provided switch (1 is the OFF position and 2 is the ON position), depending on original equipment manufacturer availability.

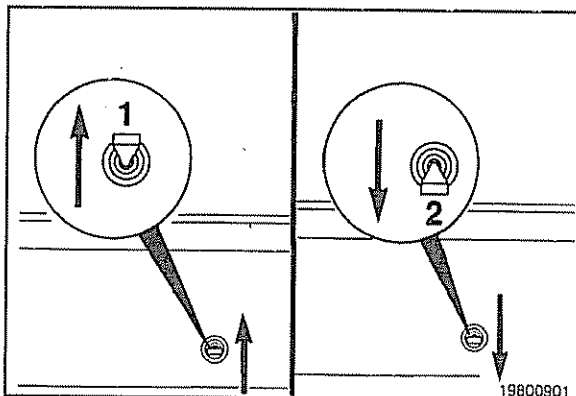


This feature will override the throttle and control the engine speed to the intermediate speed control speed setting. This feature allows throttle control above the set speed or below the set speed, according to the calibration setup.



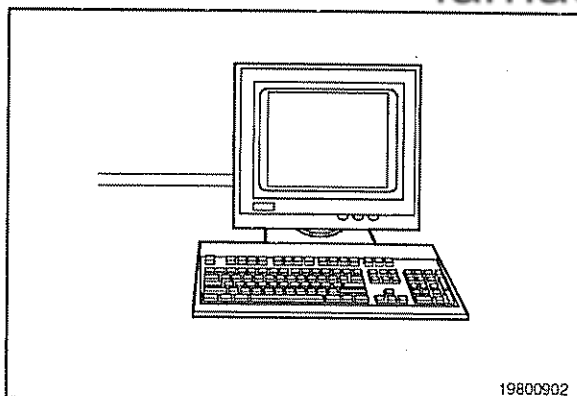


The intermediate speed control feature provides a single droop (6) for up to three intermediate speeds (1, 2, and 3). An additional five set speeds can be obtained through use of the variable intermediate speed input signal. This droop is independent of all other selectable droops and is enforced during intermediate speed control operation **only** (the axis 4 equals engine speed and 5 equals engine torque).

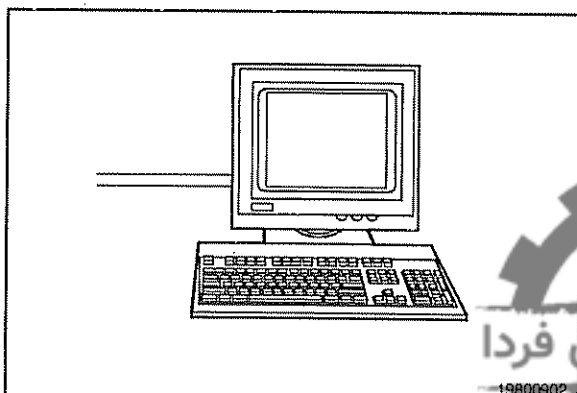


The intermediate speed control set speed can be adjusted by the intermediate speed control increment/decrement switch. Set speed changes using this switch will be saved to the electronic control module (ECM) when the keyswitch is turned to the OFF position.

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The intermediate speed control feature can be enabled or disabled using the INSITE™ electronic service tool if this feature is available in the calibration. The intermediate speed control set speeds (1, 2, and 3) can be adjusted using the INSITE™ electronic service tool along with the intermediate speed control droop.



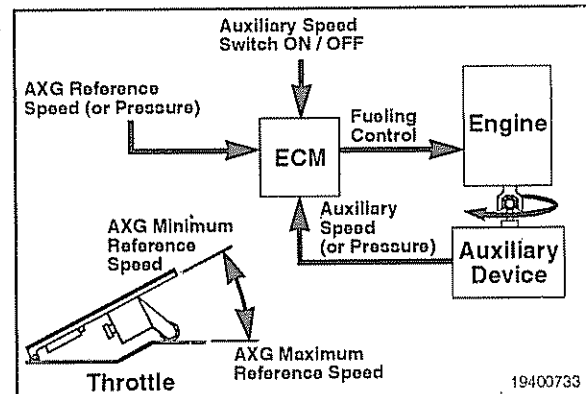
Hybrid Governor

The hybrid governor can be enabled or disabled with the INSITE™ electronic service tool if the feature is available in the calibration. The hybrid governor feature uses calibrated torque curves instead of the 100-percent throttle torque curve to limit fueling at partial-throttle auxiliary speed governor, and therefore achieves partial-throttle operation with the same power and torque rise characteristics of the full-throttle operation. It will allow the application to be operated in a more fuel-efficient manner and with a greater capability of driving at partial throttle.

Auxiliary Speed Governor

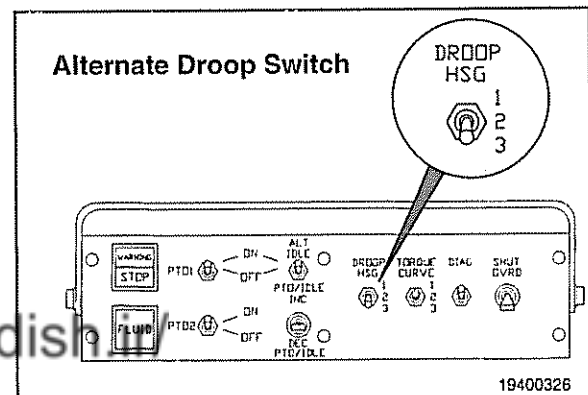
The auxiliary speed governor is an application-specific feature that allows the engine to be governed by either an auxiliary speed or pressure signal. The feature uses a manual switch input to turn the governor operation on and off.

NOTE: The switch **must** go from OFF to ON position while the engine is running to activate this feature. It can **not** be on all the time.

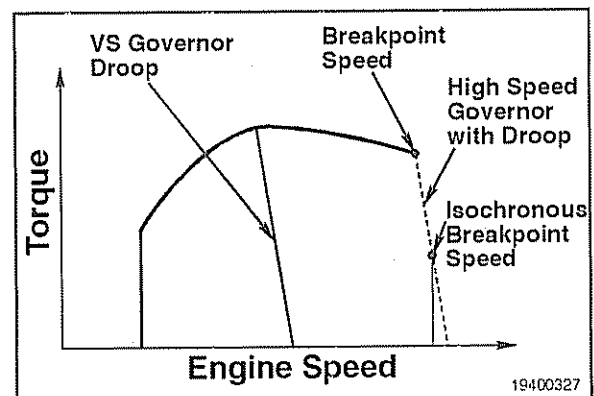


Depending on original equipment manufacturer (OEM) availability the alternate droop feature provides the ability to select up to two additional alternate droop settings by an original equipment manufacturer (OEM) provided switch.

The type of droop switch (position 1, position 2, and position 3) can be adjusted using the INSITE™ service tool.

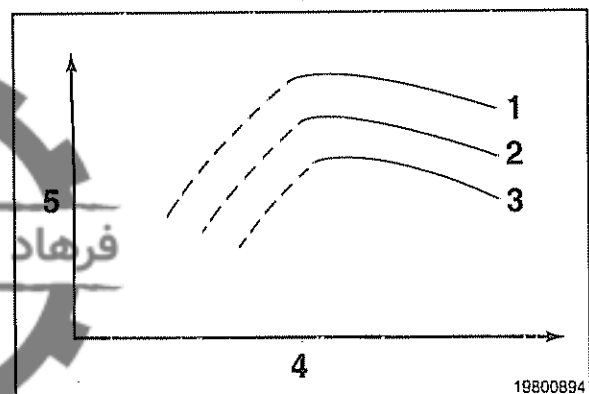


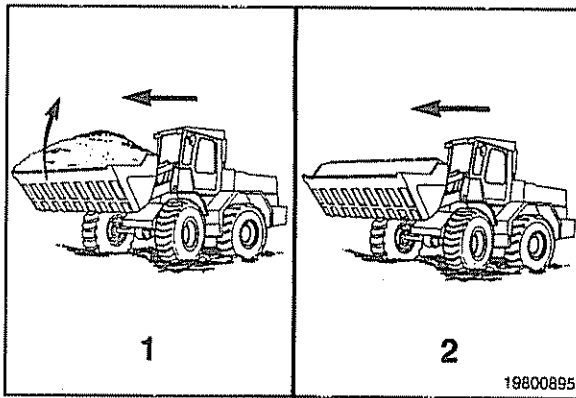
Each alternate droop setting provides the ability to select the high speed governor break point speed and droop percent. Droop percent at minimum and maximum throttle for the vehicle speed (VS) governor is also adjustable. The break point speed determines the position on the engine torque curve where high speed governor will start to limit engine torque output. Selection of the alternate droop feature is accomplished by using the INSITE™ electronic service tool if the alternate droop feature is available in the calibration.



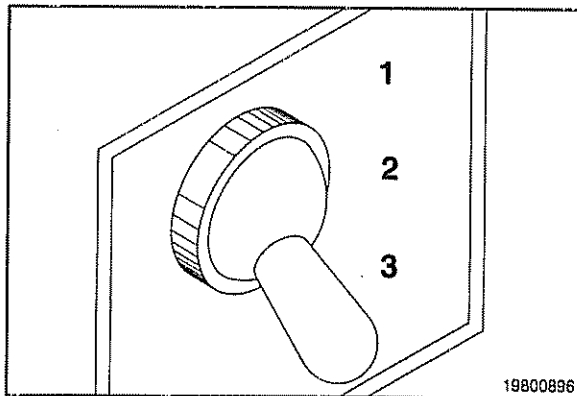
Switched Torque

The switched torque feature allows the operator to switch between the 100-percent throttle torque curve (1) and up to two derated torque curves (2 and 3). (The axis 4 is engine speed and 5 is engine torque.)

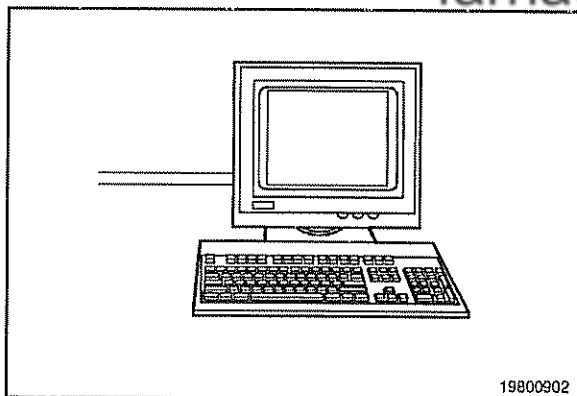




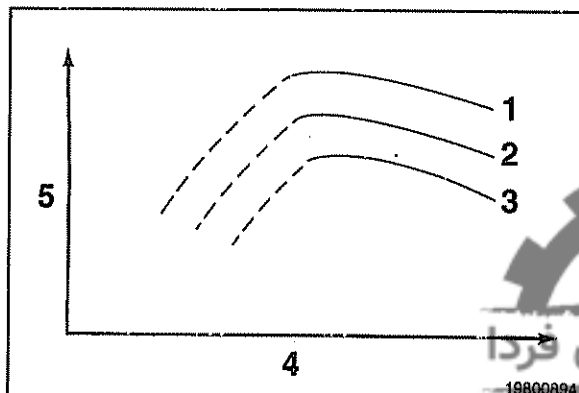
This feature improves operating efficiency in loaded (1) versus unloaded (2), as well as protecting the transmission and drivetrain.



Depending on original equipment manufacturer (OEM) availability the switched torque feature provides the ability to select two additional derated torque curves with an original equipment manufacturer (OEM)-provided switch.



This feature can be enabled or disabled by using the INSITE™ electronic service tool if the alternate torque feature is available in the calibration.



Boost Power

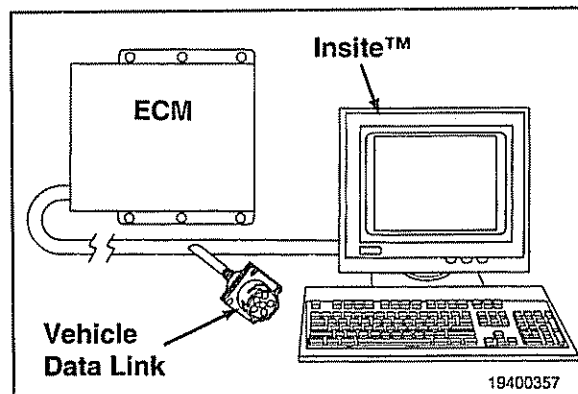
The boost power feature provides the operator with enhanced torque and power for a fraction of the operating period. If the feature is enabled, boost power can be engaged by a cab-mounted switch or automatically if the automatic boost power feature is enabled. The additional power is limited by a calibrated time period, thresholds for intake manifold temperature, coolant temperature, and engine speed.

NOTE: Boost power is **not** available continuously.

The INSITE™ electronic service tool can enable or disable the boost power feature if the feature is available in the calibration. The electronic service tool can also monitor the cab-mounted boost power switch.

If the boost power feature is enabled, the boost power can be engaged by using a cab-mounted switch. When the automatic boost power feature is enabled, it automatically switches the engine to boost power curve based on the engine operating conditions, and no manual switch is needed.

The automatic boost power feature can be enabled or disabled using the INSITE™ service tool.

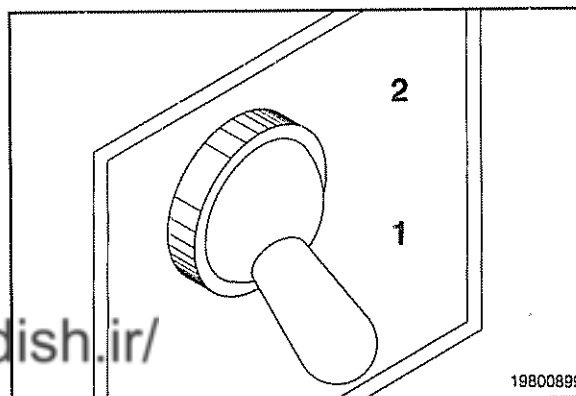


Remote Throttle

The remote throttle feature allows the operator to control the engine from a position other than the driver's seat. This feature is selected by the operator through an original equipment manufacturer (OEM) cab-mounted switch.

There are four modes available for the remote throttle feature. These modes can be adjusted using the INSITE™ service tool.

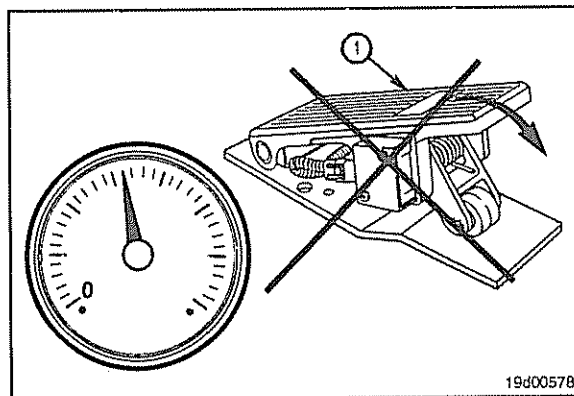
The remote throttle feature, if allowed, can be enabled or disabled using the INSITE™ electronic service tool if the feature is available in the calibration.



Remote Throttle Mode One (default)

This mode will override the primary throttle (1) control and control the engine speed with the remote throttle setting.

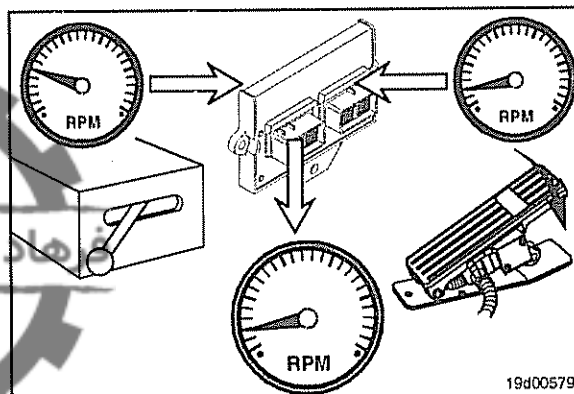
NOTE: Remote throttle mode one does **not** employ idle validation and is intended for stationary applications, **only**.

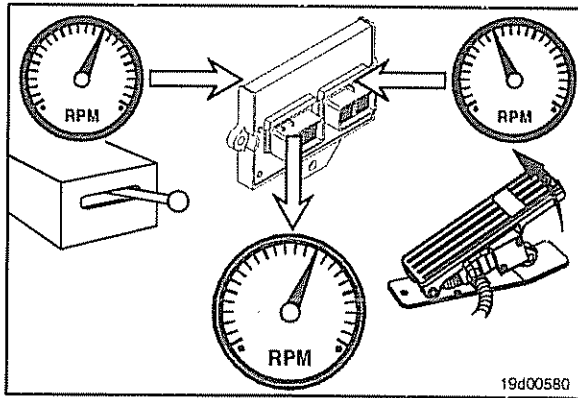


Remote Throttle Mode Two (select minimum)

Remote mode two throttle is a select minimum throttle using two different throttles. One example is equipment that uses a hand throttle as your primary throttle and a foot throttle as a decelerating remote throttle. Remote mode two throttle is enabled when a minimum throttle value is sensed between the primary throttle and the remote throttle.

NOTE: Remote throttle mode two does **not** employ idle validation.

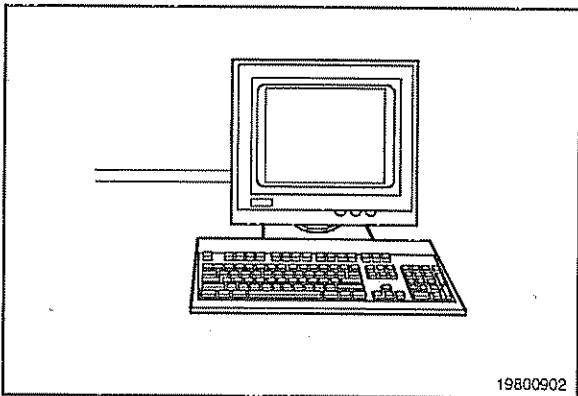




Remote Throttle Mode Three (select maximum)

Remote mode three throttle is a select maximum throttle using two different throttles. One example is, equipment using a hand throttle as your primary throttle and a foot throttle as an accelerating remote throttle. Remote mode three throttle is enabled when a maximum throttle value is sensed between the primary throttle and the remote throttle.

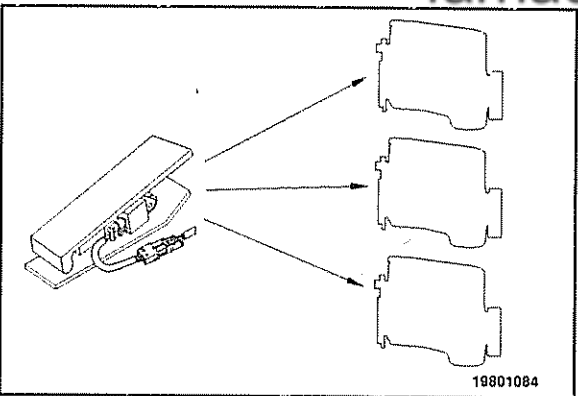
NOTE: Remote throttle mode three does **not** employ idle validation.



Frequency Throttle

The frequency throttle feature converts a filtered throttle frequency input into a requested throttle percentage. The frequency throttle feature is applicable in industrial and marine applications in which a position (electronic or log signal) is **not** appropriate. The frequency throttle feature supports idle validation.

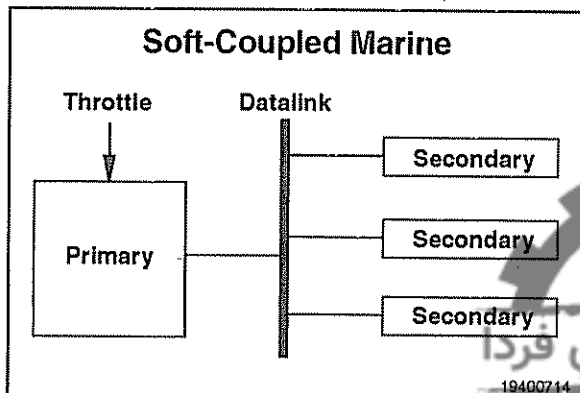
The frequency throttle feature can be enabled or disabled using the INSITE™ electronic service tool if the feature is available in the calibration.



Multiple Unit Synchronization

The multiple unit synchronization feature allows two or more engines to be controlled by a single throttle signal. There are three engine configurations available with this feature. They are soft-coupled, hard-coupled, and soft-coupled marine.

The multiple unit synchronization feature can be enabled or disabled using the INSITE™ electronic service tool if the feature is available in the calibration.



All soft-coupled marine configuration engines are connected to a J1939 datalink.

Pulse-Width Modulate Output

This feature allows the electronic control module to output an analog signal that is proportional to either engine speed, engine load, engine torque output, or throttle input.

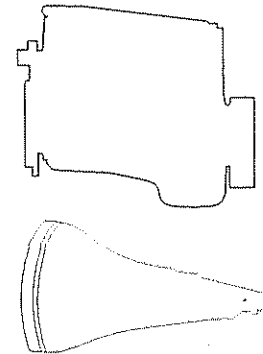
PWM Output Signal

- Engine Speed
- Engine Load
- Engine Torque
- Throttle Input

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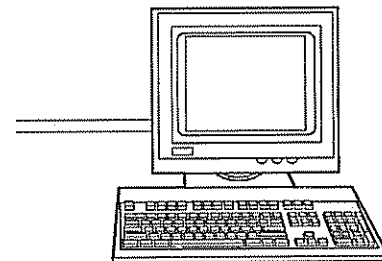
The pulse-width modulate output signal is intended to be used to control an engine or transmission that relies on an analog signal input. This signal can also be configured as an on/off signal where the signal is either 12 VDC (v battery) or open, depending on the load.

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The pulse-width modulate output feature can be adjusted using the INSITE™ electronic service tool if the feature is adjustable in the calibration.

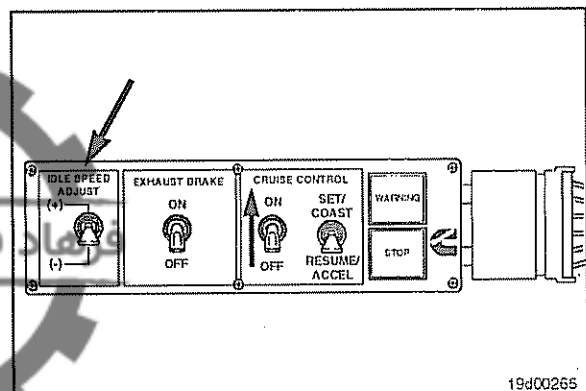


19800902

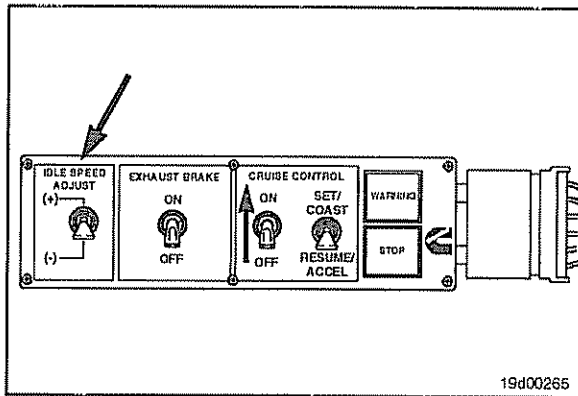
Low-Idle Speed

This parameter is the engine speed at which the engine will idle. This speed can be adjusted by a cab switch if the switch is installed and the low-idle adjustment feature is enabled.

Low-idle speed can be adjusted using the INSITE™ service tool.

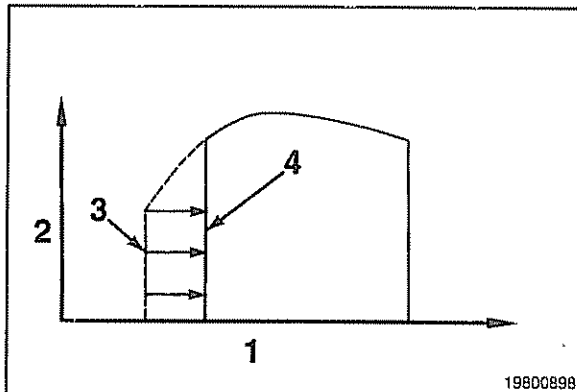


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Low-Idle Adjustment

This feature allows the idle speed range to be increased or decreased in 25-rpm standard increments with the in-cab increment or decrement switch. Depending on the calibration, the rpm increment could **not** be 25-rpm. There are limits on how high or low the low-idle speed can be adjusted. The allowable adjustment range for a QSC8.3 engine is 600 to 1200 rpm.

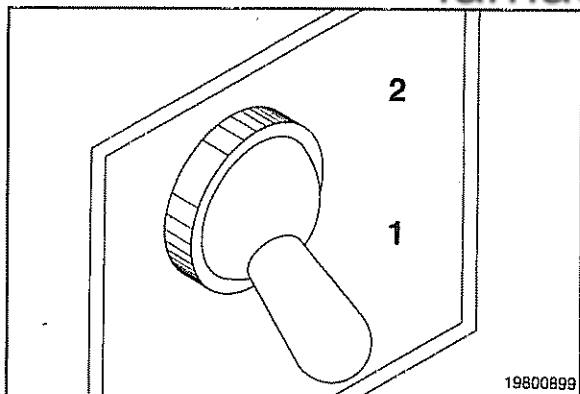


Alternate Low-Idle Speed Control

This feature allows the operator to switch between the low idle speed setting (3) and an alternate low-idle speed setting (4) (the axis 1 is engine speed and 2 is engine torque).

NOTE: On QSC8.3 engines during cold start-ups, and with engine temperatures less than 21°C [70°F], pilot injection has priority over alternate low-idle speed until the engine is properly warmed up.

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Depending on original equipment manufacturer (OEM) availability the alternate low-idle speed control feature provides the ability to select an alternate idle speed by an original equipment manufacturer (OEM)-provided switch (1 is in the OFF position, and 2 is in the ON position).

NOTE: The alternate low idle speed can **not** be adjusted by the idle increment/decrement switch.



Idle Shutdown

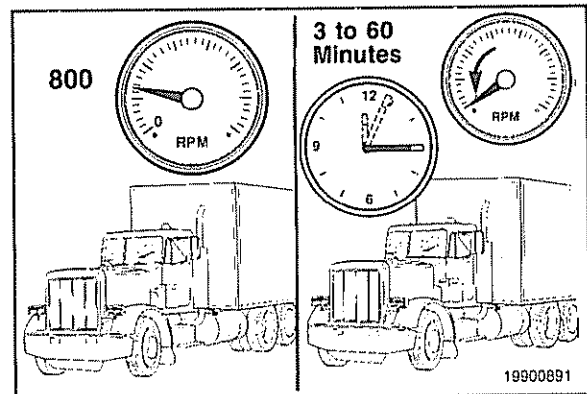
This feature automatically shuts off an engine after a period of engine idling when there is no activity from the driver such as engine speed changing or having the engine under load.

The idle shutdown system will **not** be active at coolant temperatures below 37.8°C [100°F].

After an engine has been automatically shut off, the key **must** be turned off for 15 to 20 seconds before attempting a restart.

The idle shutdown feature can be enabled or disabled using the INSITE™ service tool.

NOTE: This feature will shut off the engine **only**. It will **not** remove power from other accessories powered by the keyswitch. These can drain the battery.

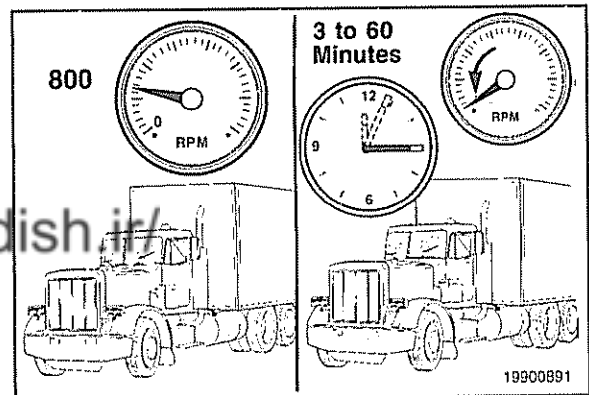


Idle Shutdown Time

This is a period of engine idling time when there is no activity from the driver before the engine automatically shuts off.

The idle shutdown time, if allowed, can be changed using the INSITE™ service tool.

NOTE: This parameter will **not** appear if the idle shutdown feature is turned off.

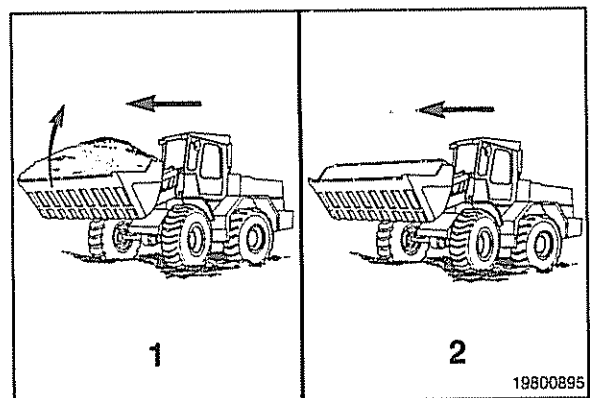


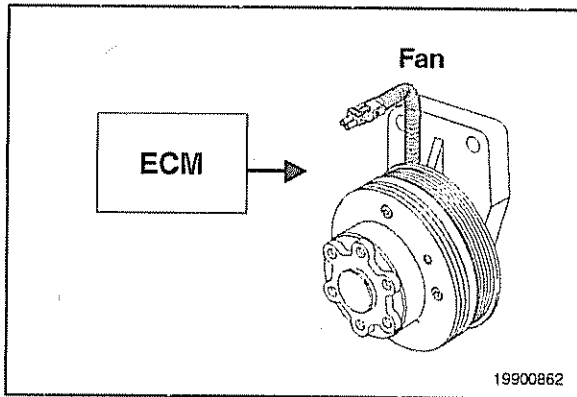
Idle Shutdown Override

This feature allows the driver to override the idle shutdown by changing the engine speed or putting the engine under load (1).

The idle shutdown warning period lasts for a calibrated period of time prior to engine shutdown. The yellow WARNING lamp on the dash will flash during the idle shutdown warning period.

After the idle shutdown feature has been overridden, this feature will **not** shut off the engine again until the vehicle has been moved.

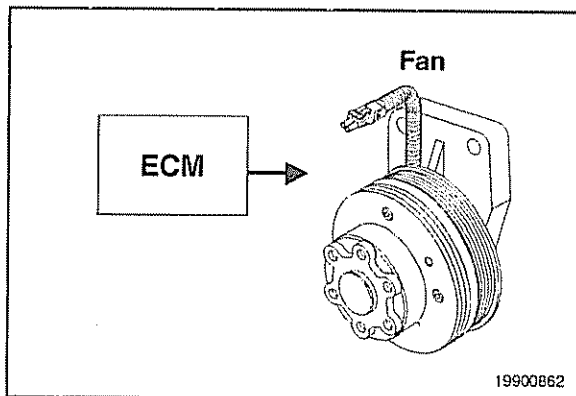




Fan Type

Enable this feature to control a variable speed fan drive to help optimize fuel economy when a variable speed fan is available for use. The electronic control module (ECM) varies fan speed according to coolant temperature to maintain the temperature in the optimum operating range while minimizing the amount of load put on the engine by the fan.

The variable speed fan feature can be enabled or disabled using the INSITE™ service tool.

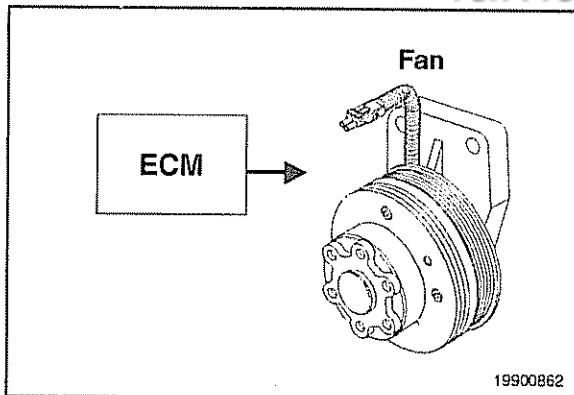


Programmable Fan Logic

Select either 0 VDC equals ON or 12 VDC equals ON to match the fan clutch logic used in the application. It is recommended that a fan relay be used for fans that draw more than six amps.

The programmable fan logic can be adjusted using the INSITE™ service tool.

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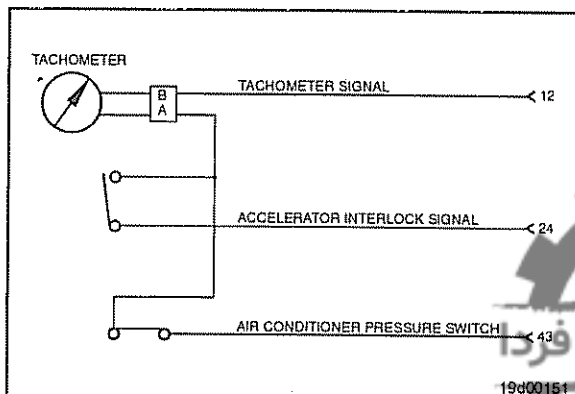


Manual Fan Switch Enable

The ECM can control the cooling fan based on inputs from the coolant temperature sensor and the intake manifold temperature sensor.

Some applications will also provide inputs to the electronic control module (ECM) for auxiliary device cooling, such as air conditioner pressure and power steering temperature. Your application also can include a manual switch for fan control.

The manual fan switch feature can be enabled or disabled using the INSITE™ service tool.



Air Conditioner Pressure Switch Input

Enable this feature if the air conditioner pressure switch input into the ECM is being used to control the fan.

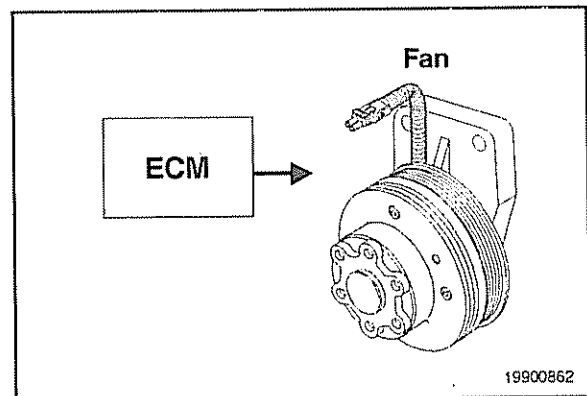
The air conditioner pressure switch input can be enabled by using the INSITE™ service tool.

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Minimum Fan-on Time with Air Conditioner Pressure Switch

This feature controls the minimum amount of time that the fan will stay on when it is activated by the air conditioner pressure switch to reduce excessive fan cycling.

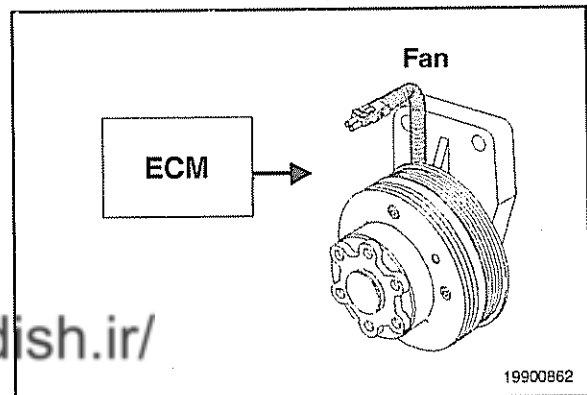
The minimum fan-on time with air conditioner pressure switch can be adjusted by using the INSITE™ service tool.



Fan-on with Exhaust Brake

This feature will enable an electric fan when the exhaust brake is engaged. This increases the total braking power by increasing the parasitic load on the engine.

The fan-on with exhaust brake feature can be enabled or disabled using the INSITE™ service tool.

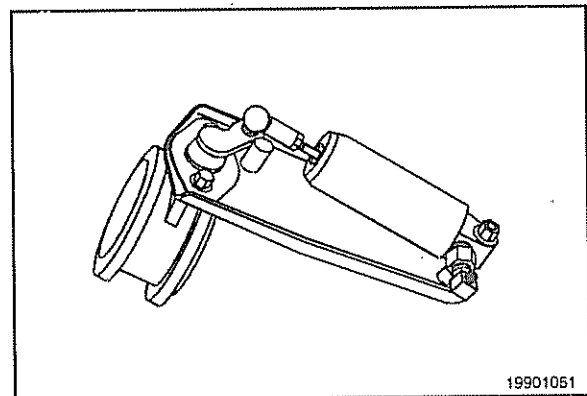


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Exhaust Brake

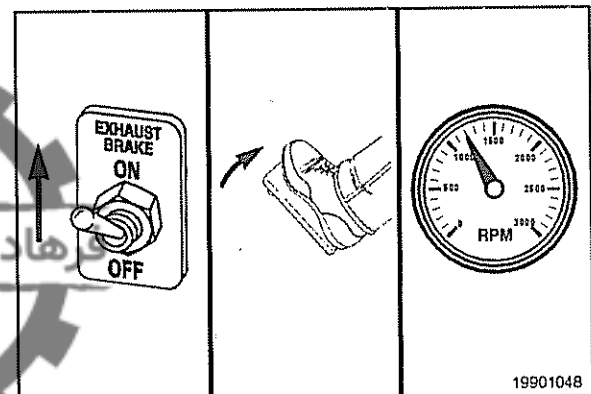
Some vehicles are equipped with an ECM-controlled exhaust brake. This exhaust brake can be used to slow the vehicle. The brake accomplishes this by restricting the exhaust gas flow out of the engine. Using the exhaust brake in hilly terrain or during heavily loaded decelerations can help reduce wear on the service brakes.

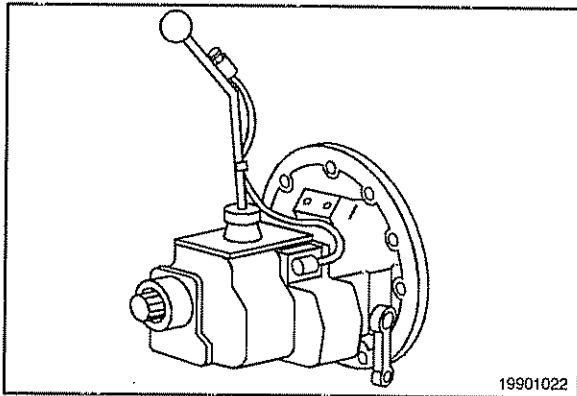
The ECM will activate the exhaust brake when conditions require its operation.



Several operating conditions **must** be true to activate the exhaust brake:

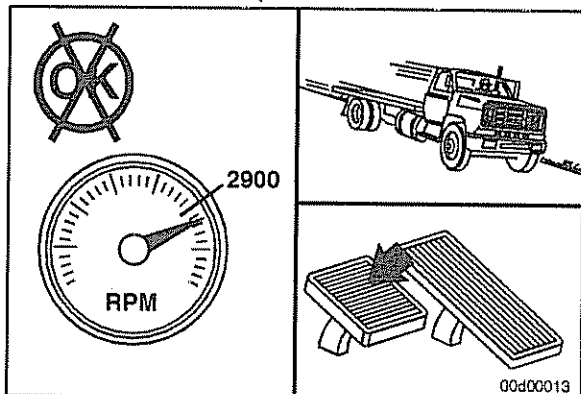
1. The exhaust brake switch **must** be in the ON position.
2. The operator's foot **must** be off the accelerator pedal (pedal at low-idle speed position).
3. The engine speed **must** be above 1000 rpm.





If the above conditions are true, in addition to several ECM internal fueling command checks, then the exhaust brake will engage and begin applying a braking effect to the engine. The exhaust brake will remain on until one of the above conditions is no longer true.

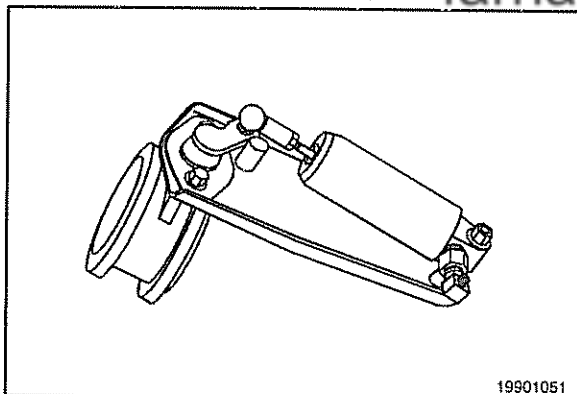
NOTE: Some electronically controlled automatic transmissions will begin downshifting during exhaust brake operation. This keeps the engine speed up near rated speed where the braking effect is greatest.



⚠ CAUTION ⚠

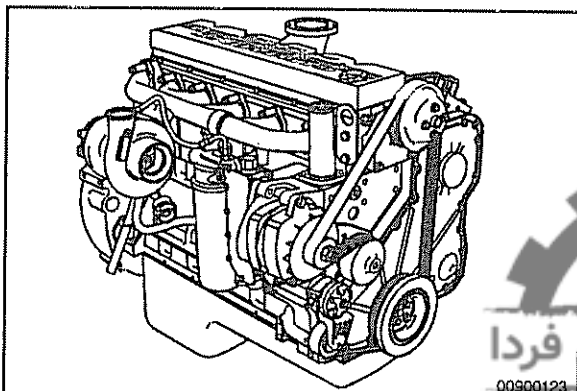
The engine speed must not exceed 2900 rpm under any circumstances. When descending a steep grade, use a combination of transmission gears and engine or service brakes to control the vehicle and engine speed.

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Exhaust Brake or Drivetrain Retarder Control

This feature tells the ECM whether an exhaust brake or a drivetrain retarder is being used on the vehicle. It allows the drivetrain retarder to operate below 1000 rpm down to idle speed, but will disengage at 1000 rpm when the exhaust brake feature is chosen.



Engine Warm-up Protection

This feature inhibits the throttle to keep the engine at low idle. This allows oil to reach all critical engine components before engine speed is increased above low idle.

To limit the engine's speed at start-up, the following inputs are limited:

1. Throttle input
2. Intermediate speed control switches
3. Datalink control inputs.

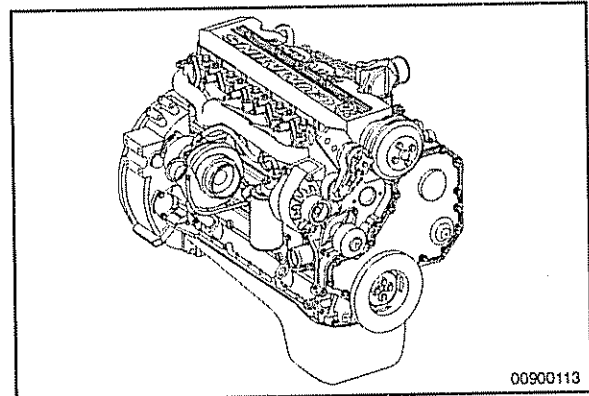
The engine warm-up protection feature can be enabled or disabled using the INSITE™ service tool.

NOTE: The MAINTENANCE lamp is turned on while this feature is operating. Once adequate oil pressure is supplied to the engine, the lamp is turned off.

Hot Shutdown Monitor/Hot Shutdown Load Percent

If the hot shutdown monitor feature is enabled, the electronic control module (ECM) will log an inactive fault code when the engine is turned off while still "hot" by the operator or by the engine protection feature.

An engine is considered "hot" when the hot shutdown load percent of the engine is above the threshold set by the INSITE™ service tool. The hot shutdown load percent is based on the duty cycle load factor that is determined from the engine's fueling levels.



Maintenance Monitor

⚠CAUTION⚠

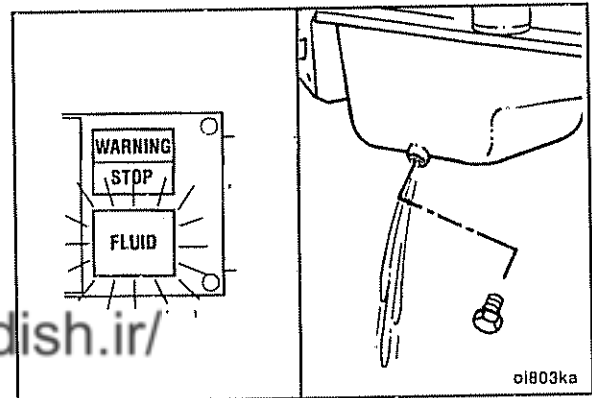
The maintenance monitor is designed to alert the operator of the need for a routine maintenance stop. Maintenance records must still be maintained for historical purposes.

⚠CAUTION⚠

The maintenance monitor uses data received from the electronic control module (ECM) to determine the amount of fuel burned. Whenever a battery voltage fault has occurred, the maintenance monitor data can be inaccurate.

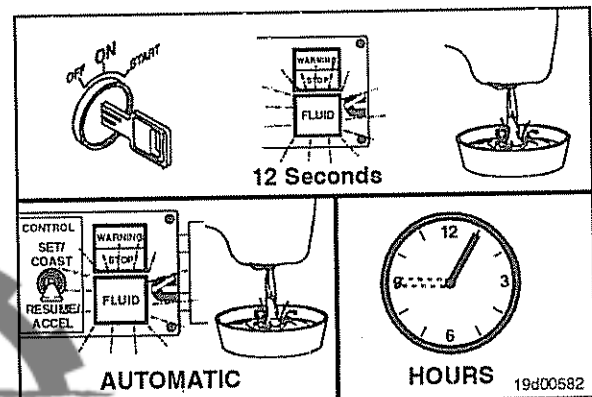
The maintenance monitor is an optional feature that will alert the operator when it is time to change oil and perform any other simultaneous maintenance tasks. The maintenance monitor continuously monitors the time the engine has been operating and the amount of fuel burned, to determine when it is time to change oil.

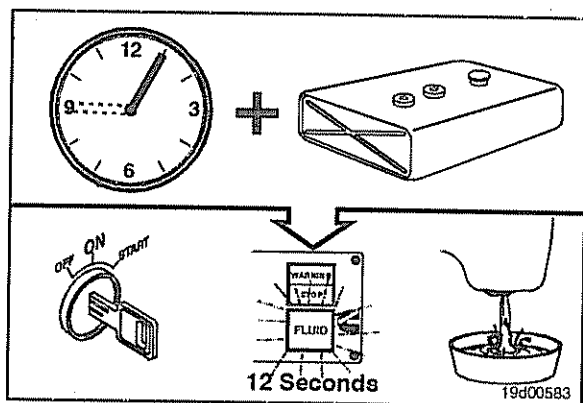
NOTE: The operator **must** still be alert for any indications that the engine needs other service.



The maintenance monitor has three modes of operation:

- Automatic mode
- Manual mode
- Time mode.





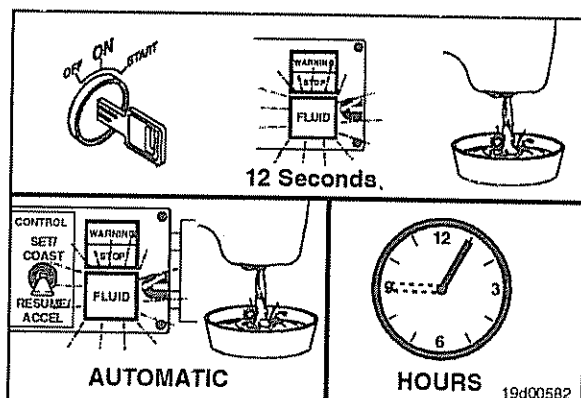
Maintenance Monitor Automatic Mode

⚠CAUTION⚠

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

The automatic mode alerts the operator when it is time to change oil based on Cummins recommended interval. It determines the maintenance interval based on coolant temperature and load factor.

When the automatic mode is selected, the severe oil drain interval duty cycle is the default.

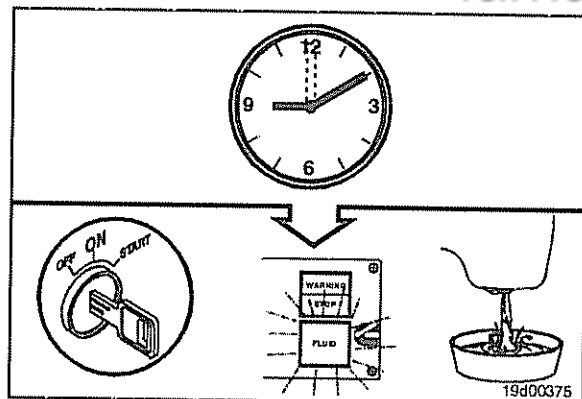


Maintenance Monitor Interval Factor

The interval factor is used **only** in the maintenance monitor automatic mode. It is used to adjust the maintenance interval for severe, normal, or light-duty applications.

The original factory programmed value is SEVERE.

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Maintenance Monitor Manual Mode

⚠CAUTION⚠

When selecting the correct oil-change interval for your application, Cummins Engine Company, Inc. does not recommend exceeding published intervals and is not responsible for damage sustained from overextended drain intervals.

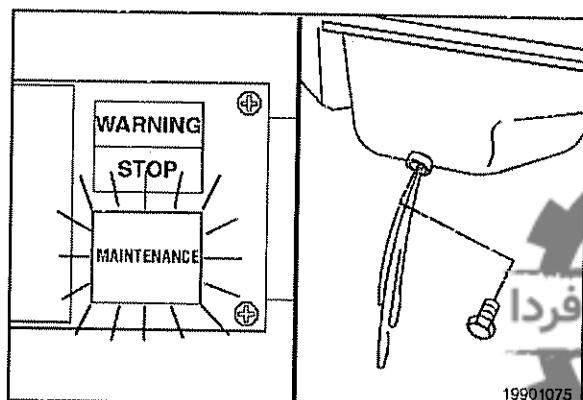
Refer to the Lubricating Oil Drain Intervals in Procedure 102-002.

The time mode allows the customer to enter a desired time interval. The maintenance monitor will then monitor the time the engine has run and alert the operator when the interval has ended.

Maintenance Monitor Interval Alert Percentage

This feature allows the user to enter the percentage of the current interval at which the light comes on, indicating the need for an oil change. The parameter allows the user to obtain an early warning of the need for a maintenance stop.

For example, if the time mode is set to 100 hours, and the interval alert percentage is set to 90 percent, the MAINTENANCE lamp will illuminate at 90 hours (90 percent of 100 hours).



Engine Time Offset

This parameter is part of the trip information system. The value entered here will be added to total ECM time to get total engine time. This parameter allows the time on the engine to be entered when an ECM is replaced.

Engine time offset can be adjusted using the INSITE™ service tool.

Engine Time Offset

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Real-Time Clock

The real-time clock provides time and date for stamping of operational events. The real time clock will maintain time value in units of year, month, day, hour (24-hour base), minute, and second. Loss of clock accuracy will be indicated with a diagnostic fault code. This feature can be set manually or automatically (to the PC time and date) through the INSITE™ service tool.

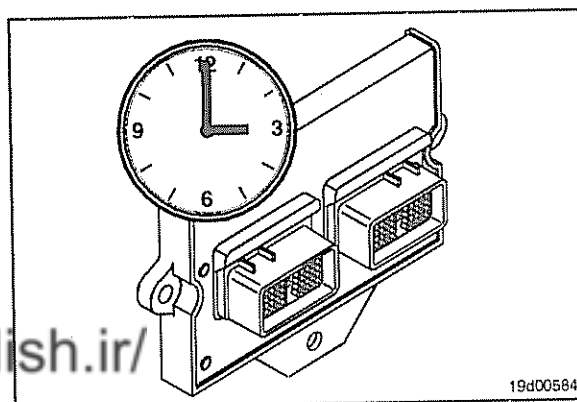
Adjust Time		
	Standard Setting	Customer Selection
Auto Set (set to PC time and date)	No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Manual Date	___	___
Date	__/__/__	Adjust Date
Time	__/__/__	

Reduced accuracy will be indicated with the diagnostic Fault Code 319. Upon loss of clock accuracy, the real-time clock will be "initialized" with the last known real time.

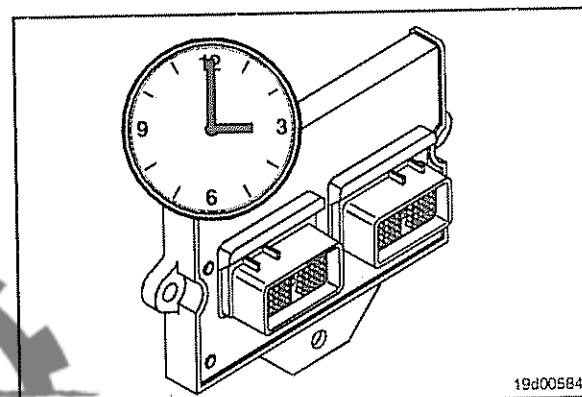
The loss of the real-time clock can occur due to a hardware failure (real-time clock chip fails) or a loss of power. There is no battery backup for the clock. Therefore, if the battery is removed from the system for five seconds, the real-time clock will be lost.

To reinitialize the real-time clock, use the INSITE™ service tool, the menu item "Adjustments - Feature and Parameters." At this point a screen will pop up in which you can manually enter a new time and date, or you can select "Real-Time Clock AutoSet" and the time and date will be set to the PC's time and date. After reinitializing the real time clock, INSITE™ electronic service tool will set the Fault Code 319 inactive.

NOTE: Once the real-time clock has been enabled, you can **not** disable the feature.



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Parameters:

- User-activated datalogger enable
- Trigger No. 1
- Trigger No. 2
- Trigger type
- Fault code trigger
- Fault code trigger when
- Parameter trigger
- Parameter trigger when
- Parameter limit value
- Activation mode
- Sampling rate
- Parameters to log

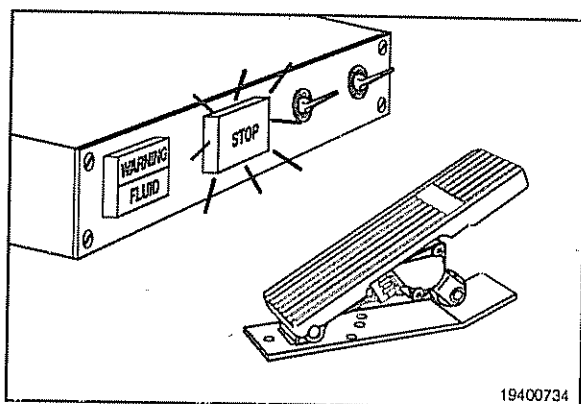
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User-Activated Datalogger

The purpose of this feature is to enable the electronic control module (ECM) to log selectable data parameters on request. This snapshot request can be initiated either by an operator-controlled diagnostic switch or automatically based on a set of selectable trigger points. The electronic control module (ECM) will store, to nonvolatile memory, a maximum of two snapshot events. Half of the data for each snapshot event will consist of pretrigger data, and the other half will be posttrigger data. The INSITE™ electronic service tool will provide a list of loggable data parameters and trigger points for the user to select. In addition, the INSITE™ electronic service tool will allow the user to select the time interval for data parameter sampling and choose manual or automatic triggers. This feature has the potential to decrease equipment downtime due to improved troubleshooting capabilities as well as providing assistance in troubleshooting intermittent problems. Also, in the diagnostic switch mode, an operator can capture data while a problem is occurring, so service personnel can analyze the data at a later time.

Parameters:

- User-activated datalogger enable
- Trigger No. 1
- Trigger No. 2
- Trigger type
- Fault code trigger
- Fault code trigger when
- Parameter trigger
- Parameter trigger when
- Parameter limit value
- Activation mode
- Sampling rate
- Parameters to log.



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Throttle-Activated Diagnostic Switch

Throttle-activated diagnostic switch is intended to eliminate the need for a dash-mounted diagnostic switch, which is used to activate the diagnostic mode to display active fault codes in a sequence of flashing lamps. The throttle-activated diagnostic switch feature eliminates the need for a dash-mounted diagnostic switch by providing a simple sequence of throttle movements that activate the diagnostic mode.

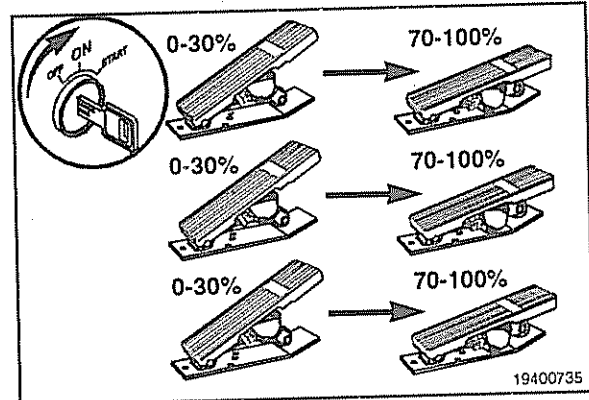
NOTE: The feature will work with all throttle types.

NOTE: In order to reset the maintenance monitor data, a diagnostic switch **must** be installed.

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QSC8.3 and QSL9 Engines Section 1 - Operating Instructions

When the engine is **not** running, a sequence of three throttle cycles after the keyswitch is turned on will activate the diagnostic mode. The increment/decrement switch can be used to navigate to the next or previous fault code. In the case that these switches are **not** available, a single throttle cycle will also increment to the next fault code.

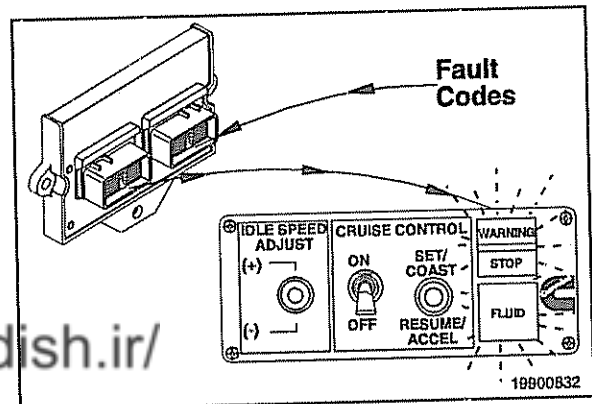


Diagnostic Fault Codes

The QSC8.3 control system can show and record operation anomalies that present themselves as fault codes. These codes will make troubleshooting easier. The fault codes are recorded in the electronic control module (ECM). They can be read using the fault lamps in the dash or with the INSITE™ service tool.

NOTE: Not all engines or QSC8.3 control system anomalies are shown as fault codes.

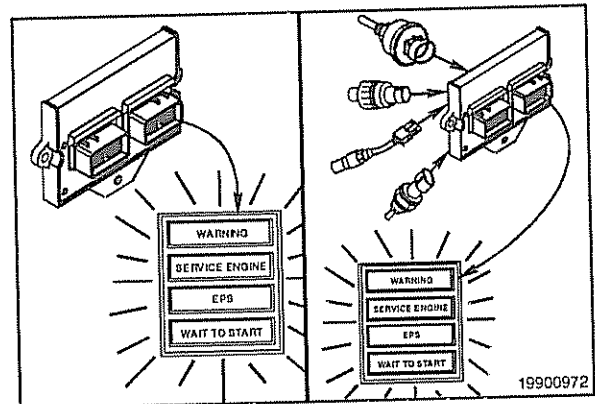
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There are three types of system codes:

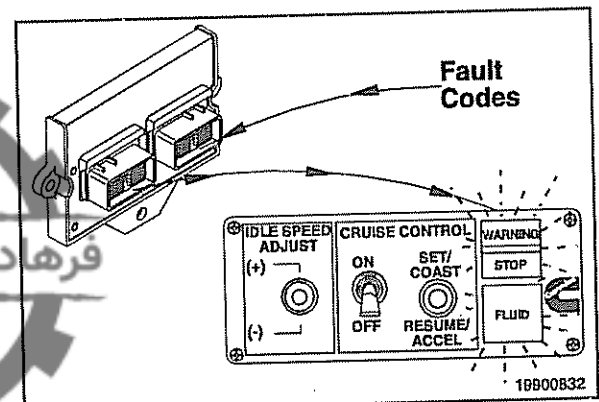
- Engine electronic control system fault codes
- Engine protection system fault codes
- Engine maintenance indicator codes.

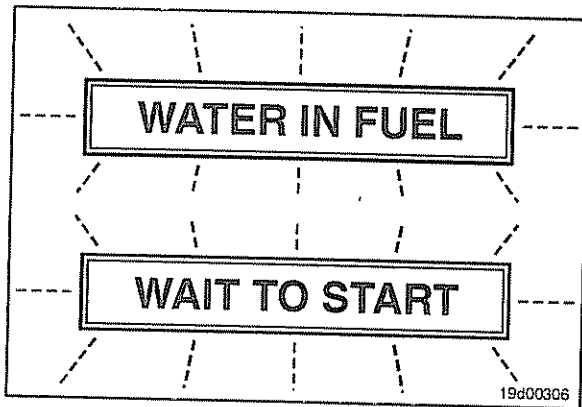
All fault codes recorded will be either active (fault code is currently active on the engine) or inactive (fault code was active at some time, but at the moment is **not** active).



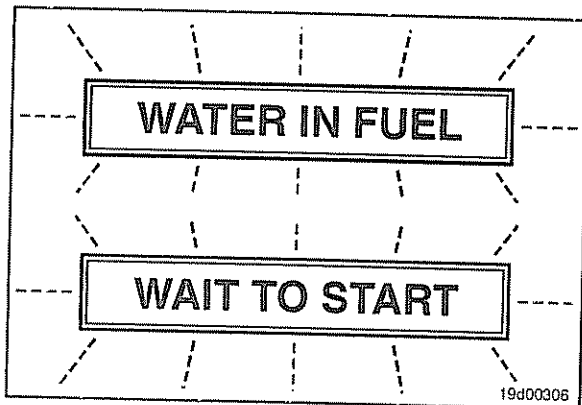
Most, but **not** all, of the electronic fault codes will light a lamp when they are active. There are three possible lamps that can be illuminated when a fault code is active:

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



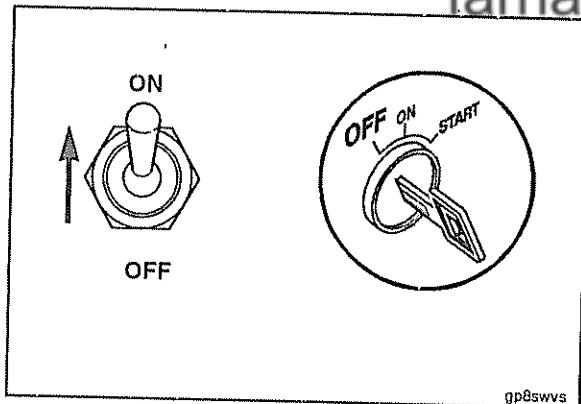


Some vehicles will also have a WAIT TO START lamp and a WATER IN FUEL lamp. The WAIT TO START lamp is illuminated during the preheat time that takes place at key-on during cold-weather starting. To minimize cranking time during cold-weather starting, the engine can **not** be cranked until the WAIT TO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

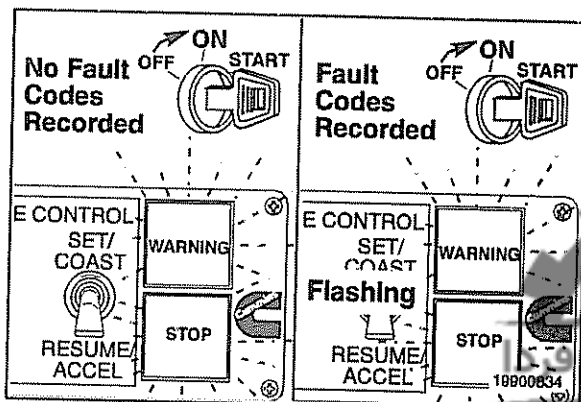


The WATER IN FUEL lamp indicates that the engine's fuel-water separator needs to be drained. This task should be performed, as soon as possible, whenever this lamp is illuminated. Some vehicle OEMs will combine the functions of the MAINTENANCE and WATER IN FUEL lamps. In these cases, the MAINTENANCE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

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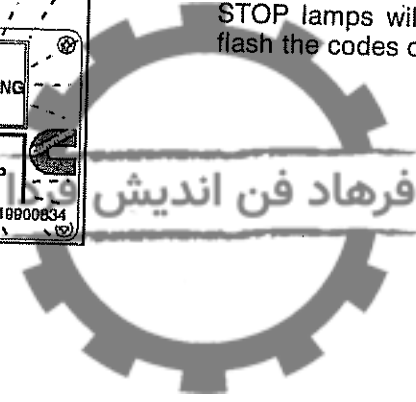
To check for active engine electronic system fault codes and maintenance indicator codes, turn the keyswitch to the OFF position, and move the diagnostic switch to the ON position, or connect the shorting plug into the diagnostic connector.



Turn the vehicle keyswitch to the ON position.

If no active fault codes are recorded, both WARNING and STOP lamps will illuminate and stay on.

If active fault codes are recorded, both WARNING and STOP lamps will illuminate momentarily, then begin to flash the codes of the recorded faults.



1. A yellow WARNING lamp will flash.
2. There is a short 1- or 2-second pause.
3. The fault code will flash on the red STOP lamp.
4. There is a short 1- or 2-second pause between each number.

Example Fault Code Sequences

P=Pause

1 Blink **Fault Code 244:** **1 Blink**

2 Blinks 4 Blinks 4 Blinks

1 Blink **Fault Code 115:** **1 Blink**

1 Blink 1 Blink 5 Blinks

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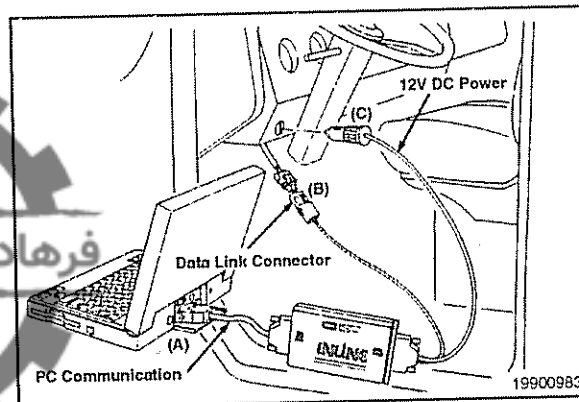
Step Forward to Next Fault Code

The sequence of button presses to step forward to the next fault code is as follows:

- IDLE SPEED ADJUST (+)
- EXHAUST BRAKE ON
- CRUISE CONTROL ON
- SET/COAST
- WAITING/STOP

The diagram shows the physical buttons on the control panel and the corresponding sequence of fault codes displayed on the screen.

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



Electromagnetic Interference (EMI)

General Information

Some engine applications utilize accessories (CB radios, mobile transmitters, etc.) that generate and use radio frequency energy that, if **not** installed and used properly, can cause electromagnetic interference (EMI) conditions to exist between the accessory and Cummins electronic controlled fuel system. Cummins is **not** liable for any performance problems with either the fuel system or the accessory due to EMI. EMI is **not** considered by Cummins to be an engine failure and therefore is **not** warrantable.

System EMI Susceptibility

Your Cummins product has been designed and tested for minimum sensitivity to incoming electromagnetic energy. Testing has shown that there is no engine performance degradation at relatively high energy levels; however, if very high energy levels are encountered, then some noncritical diagnostic fault code logging can occur. The fuel system EMI susceptibility level will protect your engine from most, if **not** all, electromagnetic energy-emitting devices that meet the Federal Communications Commission legal requirements.

System EMI Radiation Levels

Your Cummins product has been designed to emit minimum electromagnetic energy. Electronic components are required to pass various Cummins and industry EMI specifications. Testing has shown that when the engine is properly installed, it will not interfere with onboard communication equipment or with the vehicle's, equipment's, or vessel's ability to meet any applicable EMI standards and regulated specifications.

If an interference condition is observed, follow the suggestions below to reduce the amount of interference:

1. Locate the receiving antenna as far away from the engine and as high as possible.
2. Locate the receiving antenna as far away as possible from all metal obstructions (e.g., exhaust stacks)
3. Consult a representative of the accessory supplier in your area to:
 - Calibrate accurately the device for proper frequency, power output, and sensitivity (both base and remote site devices **must** be properly calibrated)
 - Obtain antenna reflective energy data measurements to determine the optimum antenna location
 - Obtain optimum antenna type and mounting arrangement for your application
 - Make sure your accessory equipment model is built for maximum filtering to reject incoming electromagnetic noise.



Section 2 - Maintenance Guidelines

Section Contents

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

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Maintenance Guidelines - Overview

General Information

Cummins Inc. recommends that the engine be maintained according to the Maintenance Schedule in this section. If the engine is operating in ambient temperatures below -18°C [0°F] or above 38°C [100°F], perform maintenance at shorter intervals. Shorter maintenance intervals are also required if the engine is operated in a dusty environment or if frequent stops are made. Contact your local Cummins Authorized Repair Location for recommended maintenance intervals.

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

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

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

Tool Requirements

General Information

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
ST-1273	Pressure gauge
3375045	Torque wrench (0 to 175 ft-lb)
3375049	Oil filter wrench
3376807	Engine coolant and fuel filter wrench
3822524	Belt tension gauge, click type (v-belts and v-ribbed with 4 or 5 ribs)
3822525	Belt tension gauge, click type (v-ribbed with 6 to 12 ribs)
3824556	Charge air cooler (CAC) pressure kit
3824591	Engine barring gear
3824783	Torque wrench (0 to 300 in-lb)
CC-2800	Refractometer
CC-2802	Coolant test kit
3824842	M10 Compuchek® fitting

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

A computer is required to run the OEM software. Contact your Cummins Authorized Repair Location for information on hardware requirements.

Maintenance Schedule

General Information

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

Daily or Refueling - Maintenance Check

Section 3

- Air Intake Piping - check
- Cooling Fan - check
- Crankcase Breather Tube - check
- Air Tanks and Reservoirs - check
- Engine Coolant Level - check

- Engine Lubricating Oil Level - check
- Every 250 Hours or 3 Months**

Section 4

- Air Cleaner Restriction - check
- Charge Air Piping - check
- Charge Air Cooler - check
- Fuel Injection Pump Mounting - check
- Air Compressor Mounting - check

Every 500 Hours or 6 Months

Section 5

- Fuel Filters (Cummins and OEM supplied) - replace
- Cooling System - check
- Coolant Filter - replace
- Lubricating Oil Filter and Oil - replace
- Batteries - check
- Battery Cables and Connections - check

Every 1000 Hours or 1 Year

Section 6

- Drive Belts - check
- Fan Hub Belt Driven - check
- Cooling Fan Belt Tensioner - check

Every 2000 Hours or 2 Years

Section 7

- Cooling System - drain/flush/fill
- Vibration Damper, rubber - check
- Vibration Damper, Viscous - check
- Engine Steam Cleaning - clean
- Air Compressor Discharge Lines - clean
- Engine Mounts - check

Every 5000 Hours or 4 Years

Section 8

- Overhead Set - adjust

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?

- Truck crane/yard spotter
- Paver/crane/backhoe
- Dozer/scrapper/skidder

If Yes -

Select the correct oil drain interval from Table 1.

If No -

Is the vehicle one of those listed below?

- Tractor/combine/irrigation equipment
- Genset/air compressor/fire pump

If Yes -

Select the correct oil drain interval from Table 2.

If No -

Select the correct oil drain interval from Table 3.

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Vehicle/Equipment	Kilometers	Miles	Hours	Months
Truck Crane/Yard Spotter	14,500	9000	500	6
Paver/Crane/Skidder	N/A	N/A	500	6
Dozer/Scraper/Skidder	N/A	N/A	500	6

Vehicle/Equipment	Kilometers	Miles	Hours	Months
Tractor/Combine/Irrigation Equipment	N/A	N/A	500	6
Genset/Air Compressor/Fire Pump	N/A	N/A	500	6

Vehicle/Equipment	Kilometers	Miles	Hours	Months
All Others	14,500	9000	500	6

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

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Section 3 - Maintenance Procedures at Daily Interval

Section Contents

	Page
Air Intake Piping	3-2
Maintenance Check	3-2
Air Tanks and Reservoirs	3-3
Drain	3-3
Coolant Level	3-3
Maintenance Check	3-3
Crankcase Breather Tube	3-3
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Fan, Cooling	3-2
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Canister Type	3-5
Spin-on Type	3-5
Lubricating Oil Level	3-5
Maintenance Check	3-5

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Daily Maintenance Procedures - Overview

General Information

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

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

Engine Operation Report

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

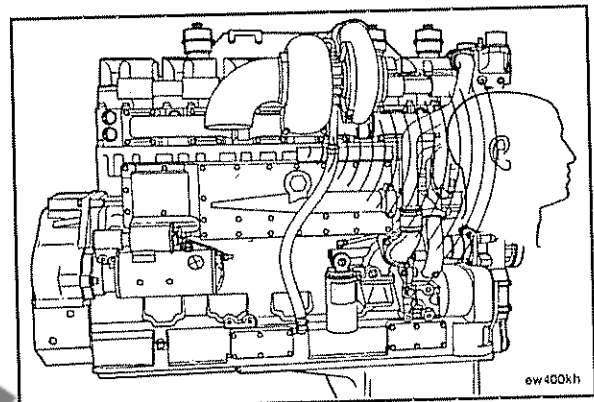
Comparison and intelligent interpretation of the daily report, along with a practical follow-up action, will eliminate most failures and emergency repairs.

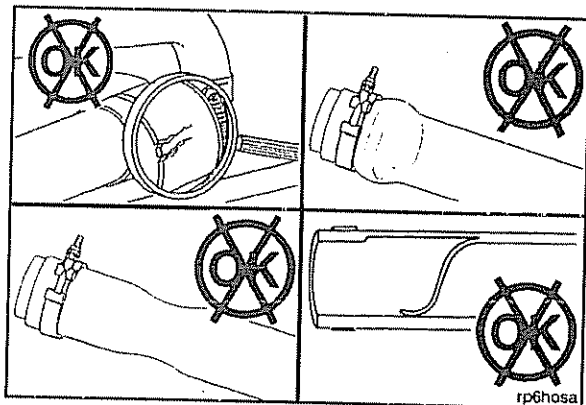
Report to the maintenance department any of the following conditions:

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

Unusual Engine Noise

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





Air Intake Piping Maintenance Check

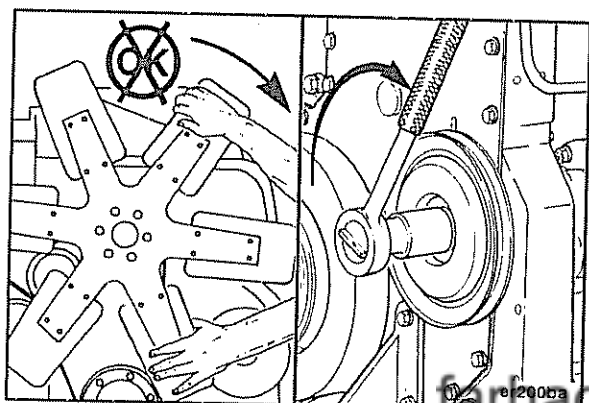


Visually inspect the intake piping daily for wear points and damage to piping, loose clamps, or punctures that can damage the engine.

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

Torque Value: 8 N•m [72 in-lb]

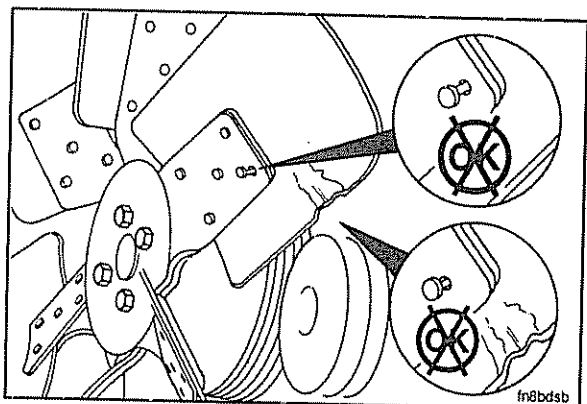
Check for corrosion under the clamps and hoses of the intake system piping. Corrosion can allow corrosive products and dirt to enter the intake system. Disassemble and clean, as required.



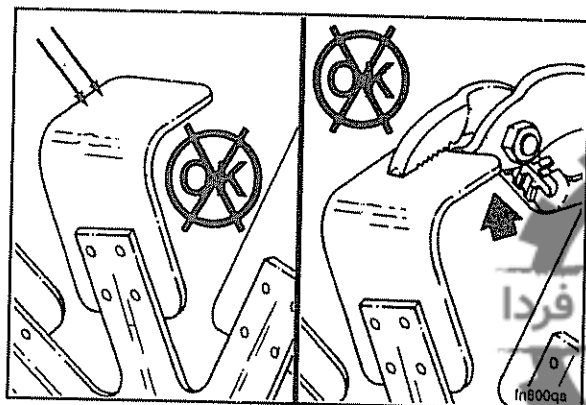
Fan, Cooling Inspect for Reuse

▲ WARNING ▲

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



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



▲ WARNING ▲

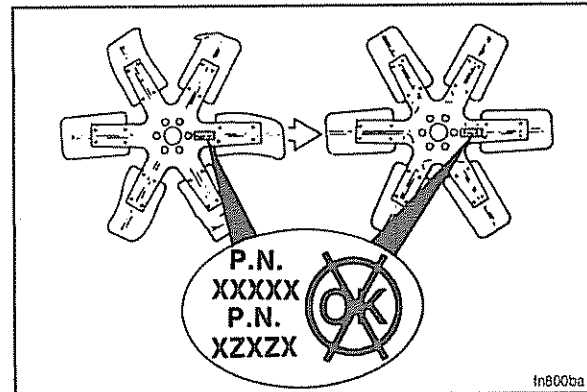
Do not straighten a bent fan blade or continue to use a damaged fan. A bent or damaged fan blade can fail during operation and cause personal injury or property damage.

QSC8.3 and QSL9 Engines
Section 3 - Maintenance Procedures at Daily Interval

Coolant Level
Page 3-3

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.

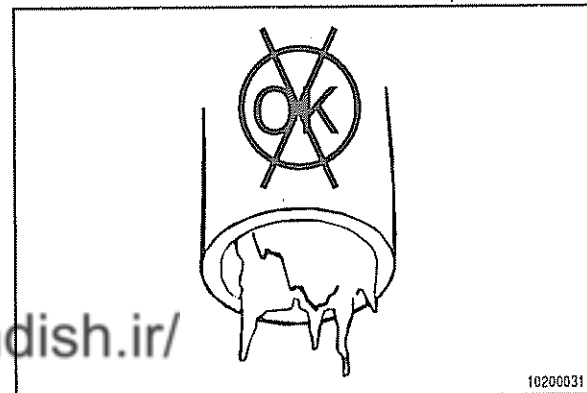
Refer to the vehicle or equipment manufacturer's specifications for capscrew torque.



Crankcase Breather Tube Maintenance Check

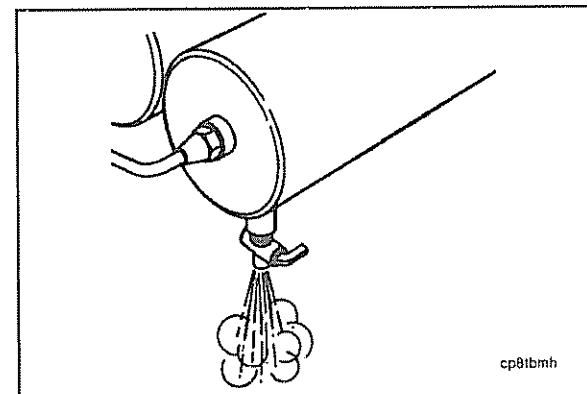
Inspect the breather tube for sludge, debris, or ice in the tube.

Inspect the tube more frequently in icy conditions.



Air Tanks and Reservoirs Drain

If automatic purging or spitter valves are used, confirm the valves are operating correctly. If a manual drain valve is used on the wet tank, open the draincock on the wet tank to drain any moisture accumulated in the air system. If oil is present, the air compressor system **must** be checked. Contact your Cummins Authorized Repair Location.



Coolant Level Maintenance Check



WARNING

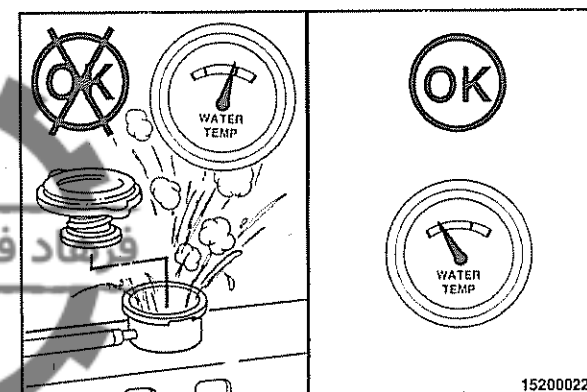
Do not remove a pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [120°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

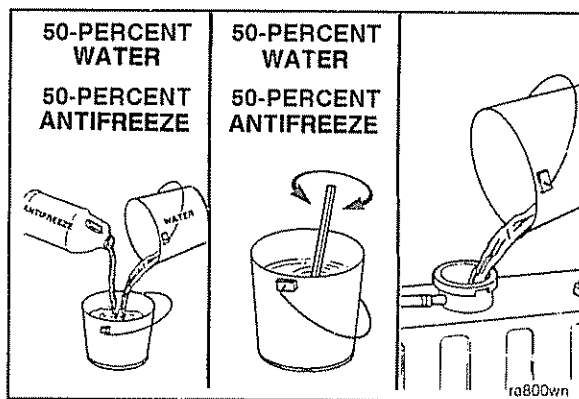


CAUTION

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

The coolant level **must** be checked daily.



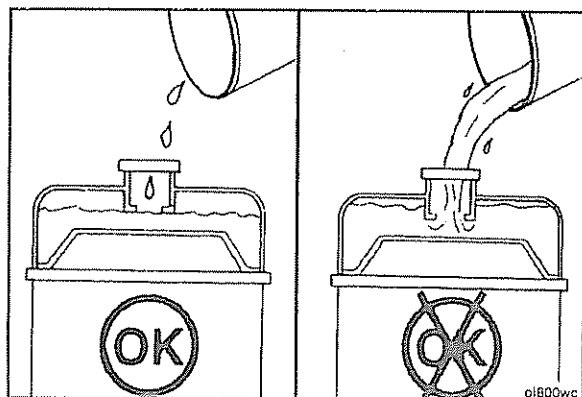


⚠ CAUTION ⚠

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

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

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



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

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

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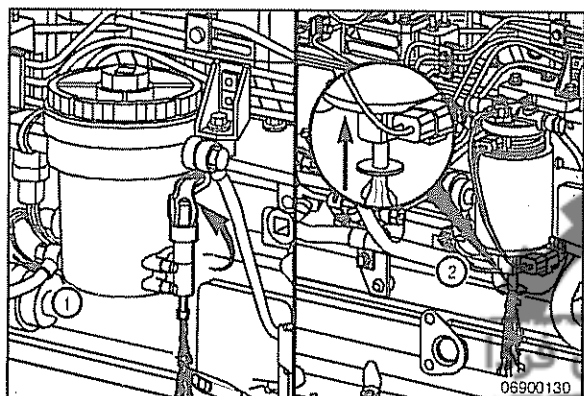
Fuel-Water Separator Drain

⚠ 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.

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Spin-on Type

Shut off the engine.

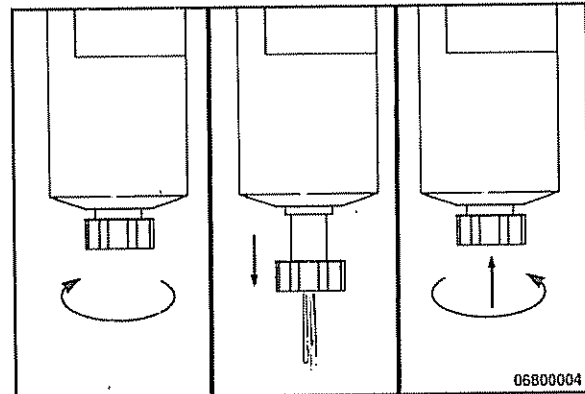
Use your hand to open the drain valve. Turn the valve **counterclockwise** approximately $3\frac{1}{2}$ turns until the valve drops down 25.4mm [1 in] and draining occurs.

Drain the filter sump until clear fuel is visible.



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

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



Lubricating Oil Level Maintenance Check



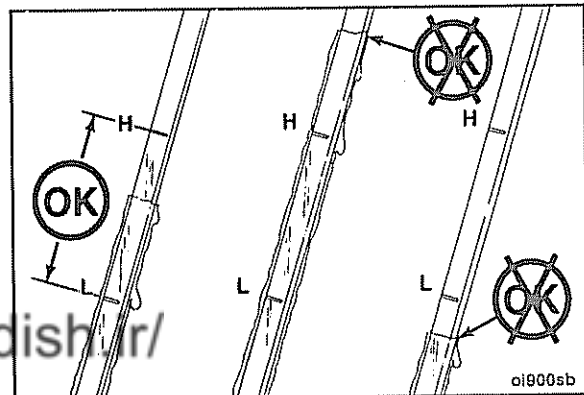
Never operate the engine with oil level below the L (low) mark or above the H (high) mark. Poor engine performance or engine damage can occur.

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.

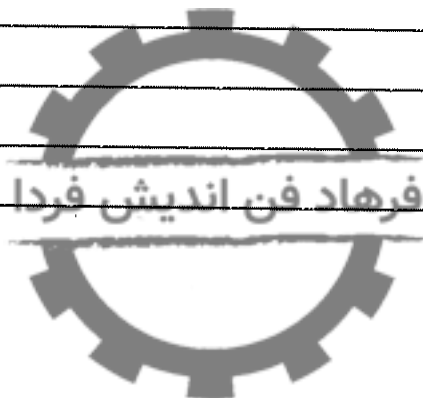
Wait at least 15 minutes after shutting off the engine to check the oil level. This allows time for the oil to drain into the oil pan.

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



Notes

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Section 4 - Maintenance Procedures at 250 Hours or 3 Months

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Maintenance Check.....	4-1
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Maintenance Check.....	4-2
Charge-Air Cooler	4-2
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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.

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).

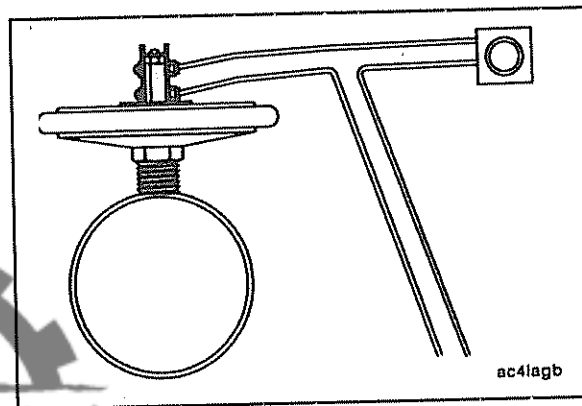
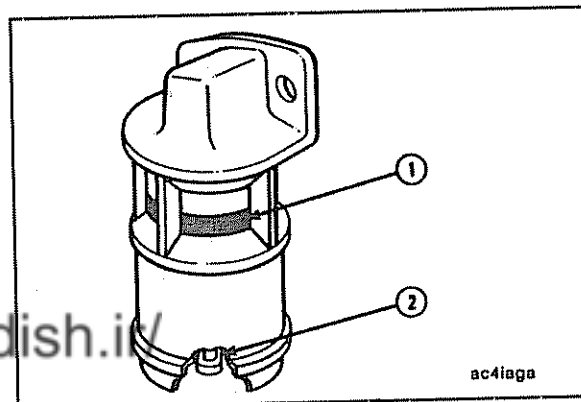
Restriction or vacuum indicators need to be installed as close as possible to the turbocharger air inlet in order to obtain a true indication of restrictions.

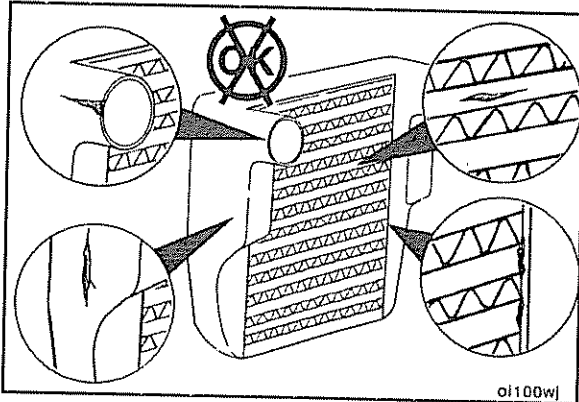
⚠ CAUTION ⚠

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.

Vacuum Indicator

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

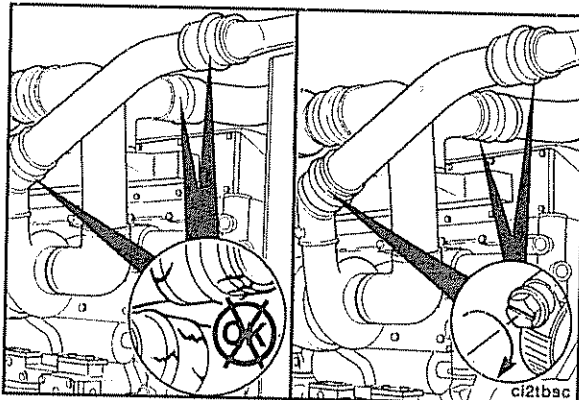




Charge-Air Cooler Maintenance Check



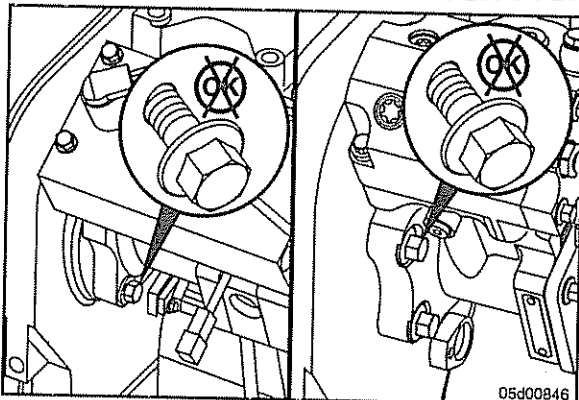
Inspect the charge-air cooler (CAC) for dirt and debris blocking the fins. Check for cracks, holes, or other damage. If damage is found, refer to the vehicle, vessel, or equipment manufacturer.



Charge-Air Piping Maintenance Check

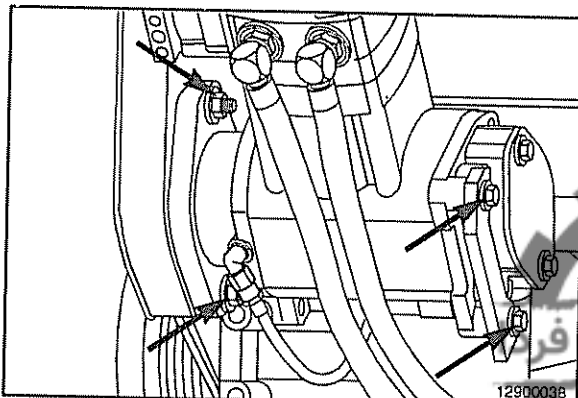


Inspect the charge-air piping and hoses for leaks, holes, cracks, or loose connections. Tighten the hose clamps if necessary. Refer to the vehicle or equipment manufacturer's specifications for the correct torque value.



Fuel Pump Maintenance Check

Inspect the fuel injection pump mounting nuts, including the support bracket, for loose or damaged hardware.



Air Compressor Maintenance Check

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

Section 5 - Maintenance Procedures at 500 Hours or 6 Months

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Supplemental Coolant Additive (SCA)	5-6
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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.

Fuel Filter (Spin-On Type)

General Information

CAPS Fuel System

The CAPS fuel system requires the use of a single fuel filter. The filter **must** have the following characteristics:

- water-separating
- 10-micron rating
- water-in-fuel sensor
- water-drain valve
- engine mounted or chassis mounted

Fleetguard® FS1022 meets these requirements.

Cummins Common Rail Fuel System

The Cummins Common Rail fuel system requires the use of two fuel filters. The suction side filter **must** have the following characteristics:

- water-separating
- 10-micron rating
- water-in-fuel sensor with shunt resistor
- water-drain valve
- **always** chassis mounted

Fleetguard® FS1003 meets these requirements.

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

- 2-micron rating
- engine mounted or chassis mounted

Fleetguard® FF5488 meets these requirements.

Refer to Section E for Engine Identification. The CM554 engine uses the CAPS fuel system. The CM850 engine uses the Cummins Common Rail fuel system.

Remove

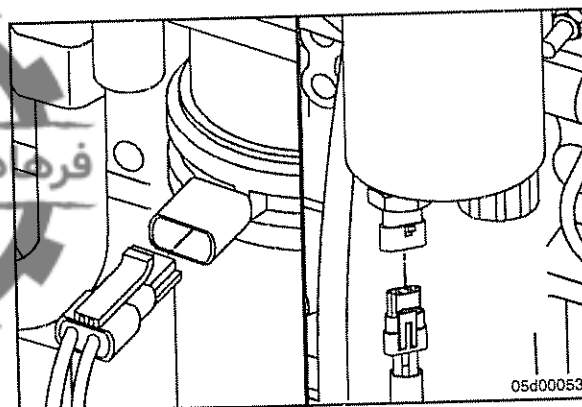
Disconnect the wiring harness from the water-in-fuel sensor, if equipped.

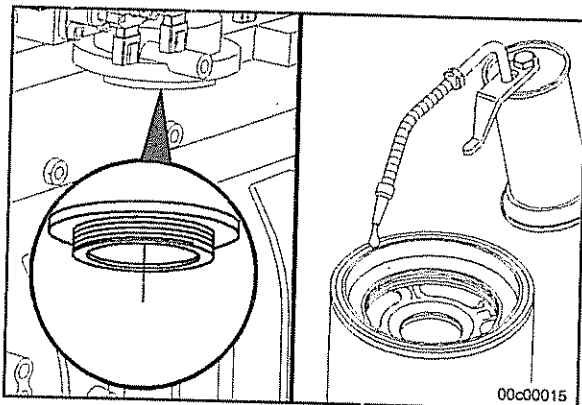
Disconnect the wiring harness from the fuel heater, if equipped.

Loosen and remove the fuel filter.

Make sure the seal ring does **not** stick to the filter head.

Remove the ring with an o-ring pick, if necessary.





Install CAPS Fuel System

⚠CAUTION⚠

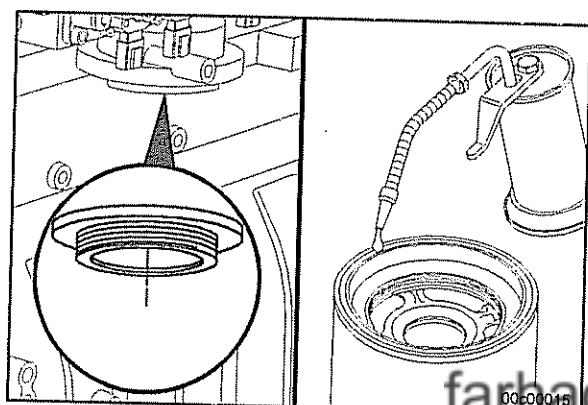
Mechanical overtightening can distort the threads as well as damage the filter element seal or filter canister.

Do **not** fill the fuel filter with fuel before installation; instead, prime the fuel system using the fuel lift pump.

Be sure the center seal ring is installed onto the filter spud.

Install the filter as specified by the filter manufacturer.

Connect the water-in-fuel sensor and the fuel heater, if equipped.



Cummins Common Rail Fuel System

⚠CAUTION⚠

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

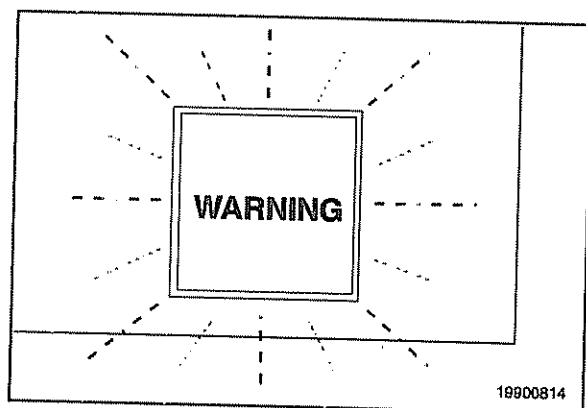
It will be necessary to fill the 10-micron water stripping (suction side) fuel filter with fuel.

Do **not** fill the 2-micron (pressure side) fuel filter with fuel before installation; instead, prime the fuel system using the fuel lift pump.

Be sure the center seal ring is installed onto the filter spud.

Install the filter as specified by the filter manufacturer.

Connect the water-in-fuel sensor and the fuel heater, if equipped.



The Cummins Common Rail Fuel System is capable of detecting the presence of the correct water-in-fuel sensor.

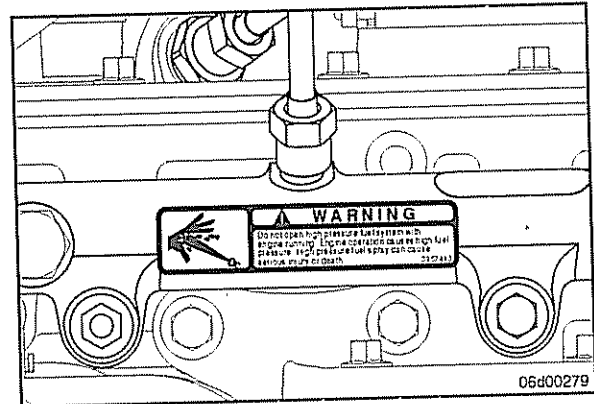
If the water-in-fuel sensor is incompatible or disconnected, the engine WARNING lamp will illuminate.



Prime

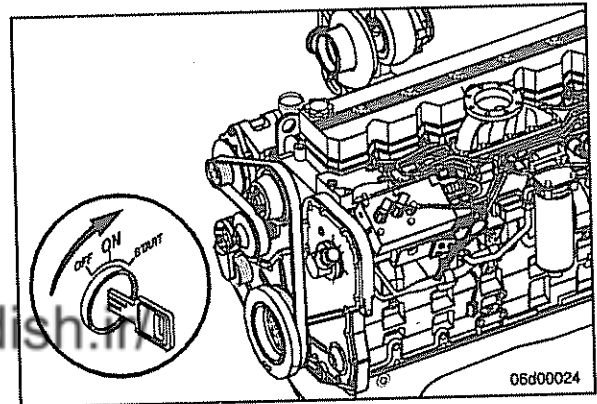
⚠ WARNING ⚠

Do not open the high-pressure fuel system with the engine running. Engine operation causes high fuel pressure. High-pressure fuel spray can cause serious injury or death.



Cycle the keyswitch and allow the lift pump to run. The lift pump will run for 30 seconds. Afterwards, turn the keyswitch off and back on again allowing the lift pump to run again.

Allow the lift pump to run for three or four 30-second cycles before attempting to start the engine.

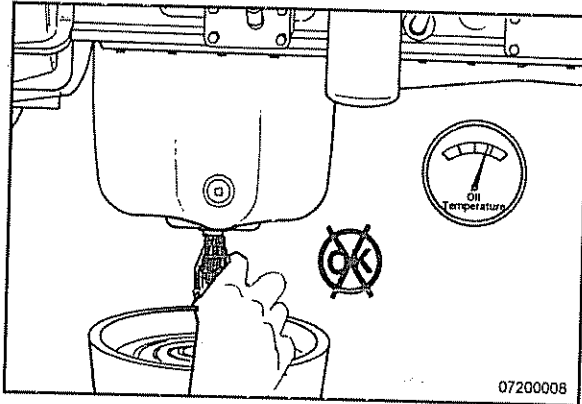


Finishing Steps

Operate the fuel lift pump to help prime the fuel system. Turn the keyswitch to RUN, but do **not** attempt to start the engine. This will cause the ECM to operate the fuel lift pump through a priming cycle which lasts at least 30 seconds. Cycle the lift pump several times by keying off, waiting 10 seconds and keying back on again.

Once the engine is started, slowly increase the engine speed while air is purged from the fuel plumbing.





Lubricating Oil and Filters Drain

▲ WARNING ▲

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

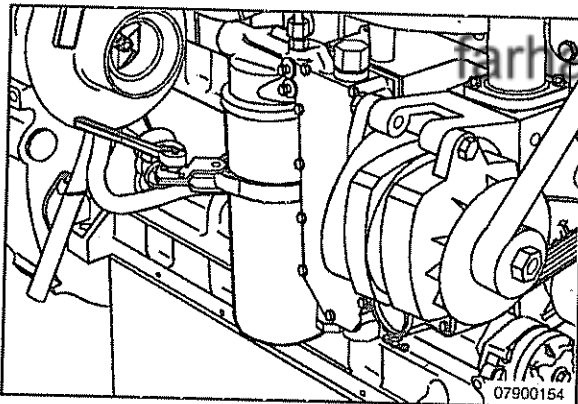
▲ WARNING ▲

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

NOTE: Use a container that can hold at least 23.6 liters [25 qt] of lubricating oil.

NOTE: For composite oil pans, hold the external locking nut in position with a separate wrench while removing the drain plug. This will prevent the bulkhead from loosening during drain plug removal.

Operate the engine until the coolant temperature reaches 60°C [140°F]. Shut off the engine. Remove the oil drain plug. Drain the oil immediately to make sure all the oil and suspended contaminants are removed from the engine.



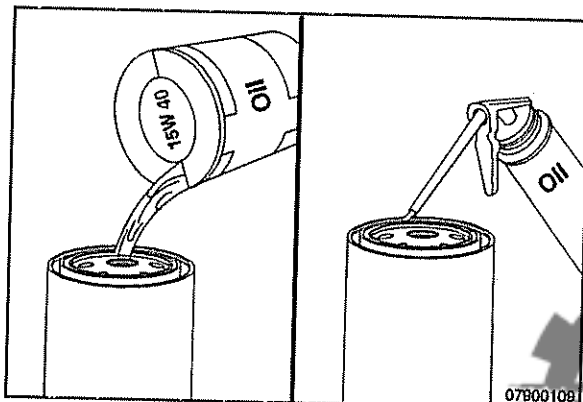
Remove

Clean the area around the lubricating oil filter head.



Using an oil filter wrench, remove the filter.

Clean the gasket surface of the filter head with a clean lint-free cloth.



Install

▲ CAUTION ▲

The lubricating oil filter should be full of oil at start-up to prevent engine damage.

Use clean 15W-40 oil to coat the gasket surface of the filter.

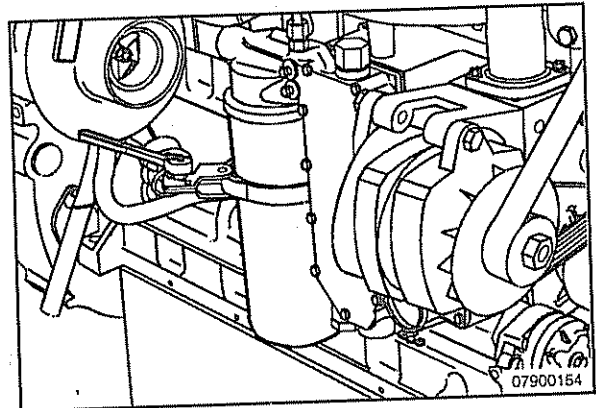
Fill the filter with clean 15W-40 oil.

CAUTION

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

Install the filter on the oil filter head. Tighten the filter until the gasket contacts the filter head surface.

Tighten the filter according to the instructions supplied with the filter.

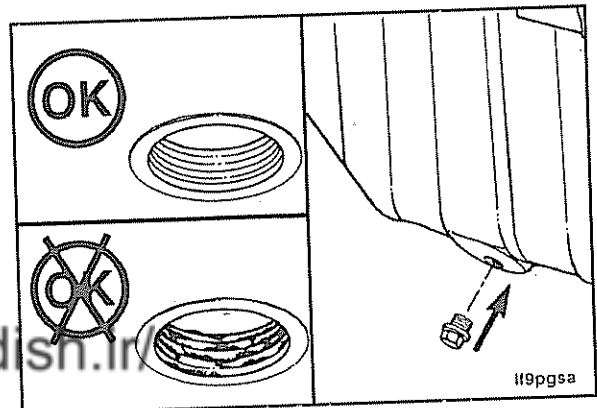


CAUTION

For composite oil pans, always use a new sealing washer on the oil drain plug. Hold the external locking nut in place while tightening the oil drain plug.

Clean and check the lubricating oil drain plug threads and sealing surface.

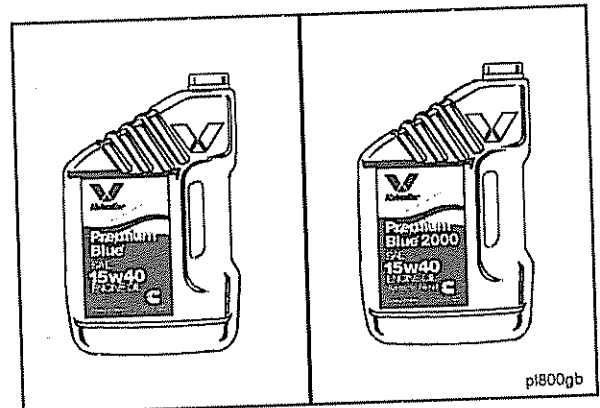
Install the lubricating oil pan drain plug.



Torque Value		
	N·m	ft·lb
Steel Oil Pan	80	59
Cast Aluminum Oil Pan	60	45
Composite Oil Pan	60	45

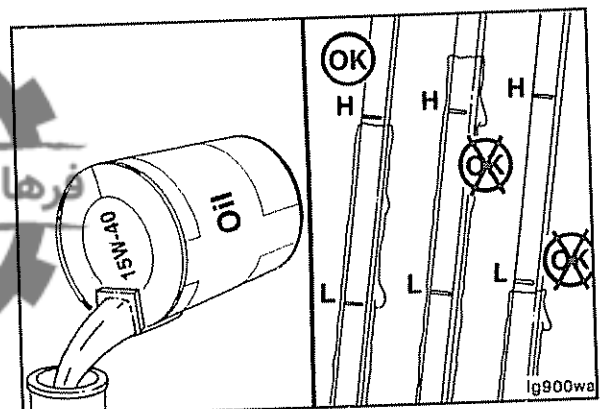
Fill

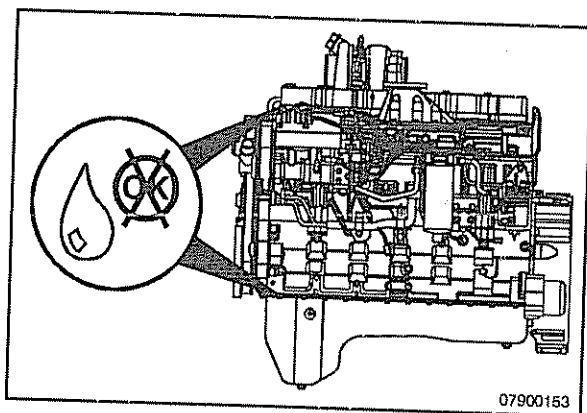
NOTE: Use a high quality 15W-40 multiviscosity oil, such as Cummins Premium Blue®, or equivalent, in Cummins engines. Choose the correct oil for your operating climate as outlined in the Operation and Maintenance Manual.



Fill the engine with clean lubricating oil to the proper level.

NOTE: When filling the oil pan, use the fill tube on the side of the engine rather than on top of the rocker lever cover.

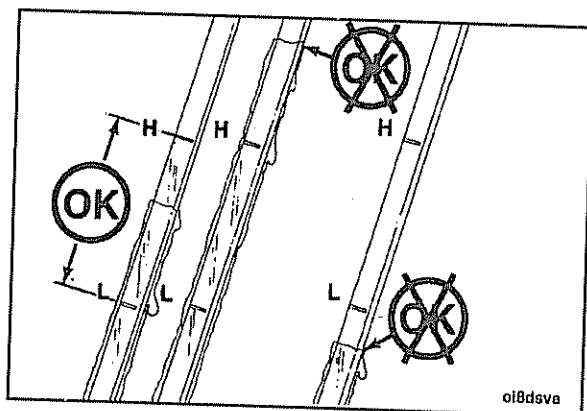




WARNING

If no oil pressure is noted within 15 seconds after the engine is started, shut down the engine to reduce the possibility of internal damage.

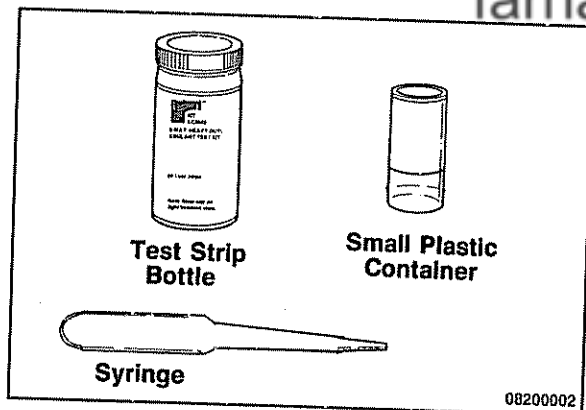
Idle the engine to inspect for leaks at the drain plug.



Shut off the engine. Wait approximately 10 minutes to let the oil drain from the upper parts of the engine. Check the level again.



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



Supplemental Coolant Additive (SCA) and Antifreeze Concentration



Maintenance Check

Supplemental Coolant Additive (SCA)

Check the SCA concentration level:

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

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



Antifreeze



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

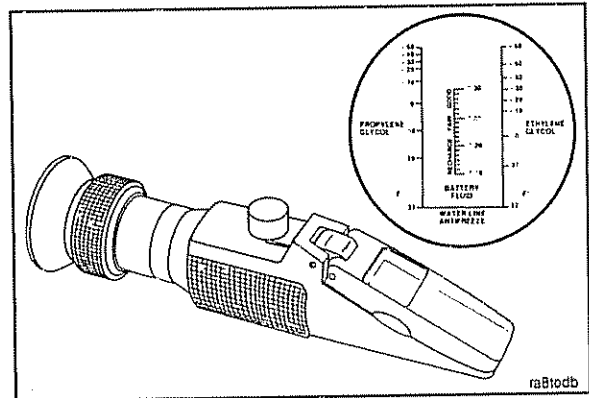
Check the antifreeze concentration. Use a mixture of 50-percent water and 50-percent ethylene glycol or propylene glycol-based antifreeze to protect the engine to -32°C [-26°F] year-around.

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

Antifreeze is essential in every climate.

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

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



Coolant Filter

Remove

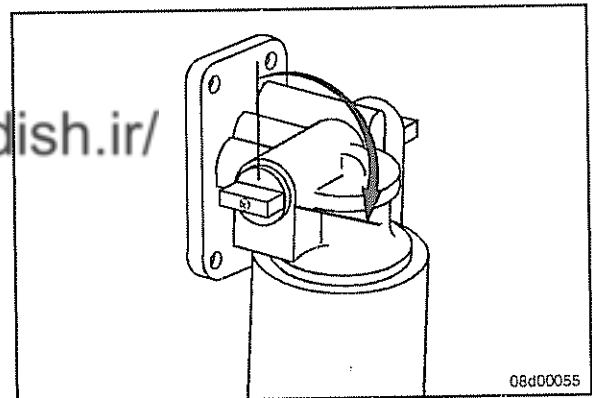


Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [120°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

NOTE: Some engine models do not require coolant filters.

Remove the coolant system pressure cap.

Turn the shutoff valve to the OFF position by rotating the knob from vertical to horizontal in the direction shown.

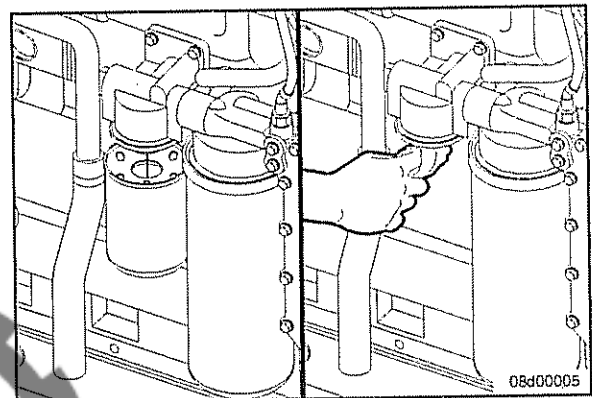


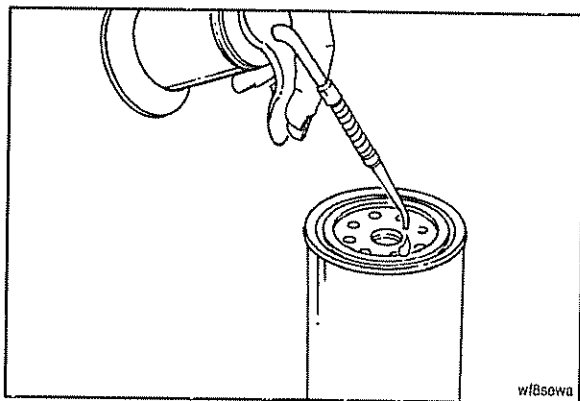
A small amount of coolant can leak when servicing the coolant filter with the shutoff valve in the OFF position. To reduce the possibility of personal injury, avoid contact with hot coolant.



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

Remove and discard the coolant filter.





Install



CAUTION
Do not allow oil to get into the filter. Oil will damage the DCA.

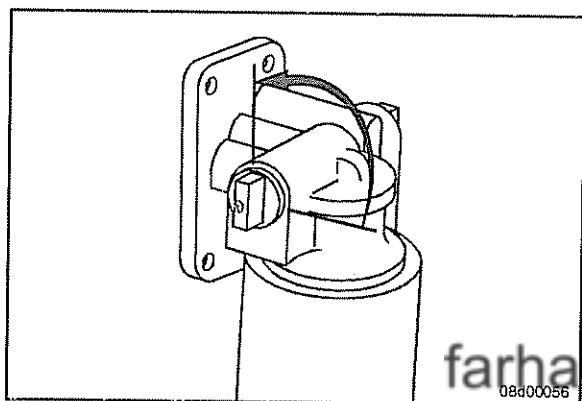


CAUTION
Mechanical overtightening can distort the threads or damage the filter head.

Apply a thin film of lubricating oil to the gasket sealing surface before installing the new coolant filter.

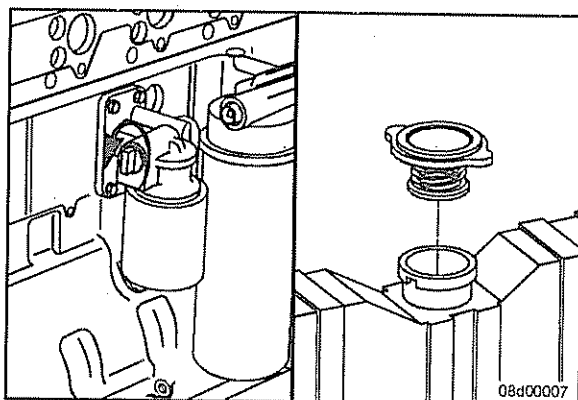
Install the coolant filter on the filter head. Tighten the filter until the gasket contacts the filter head surface.

Tighten the coolant filter an additional 1/2 to 3/4 of a turn, or as specified by the filter manufacturer.

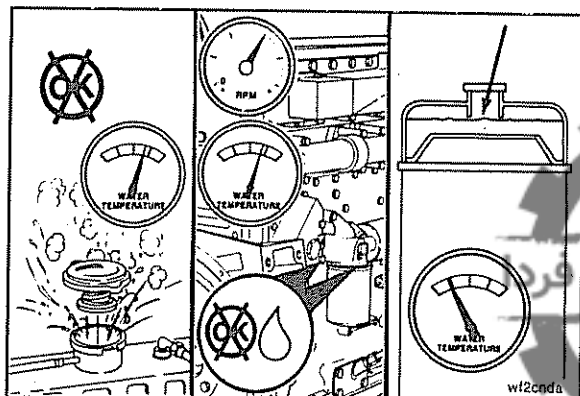


CAUTION
The valve must be in the ON position to prevent engine damage.

Turn the shutoff to the ON position by rotating the knob from horizontal to vertical in the direction shown.



Install the coolant system pressure cap.



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.

Operate the engine and check for coolant leaks.

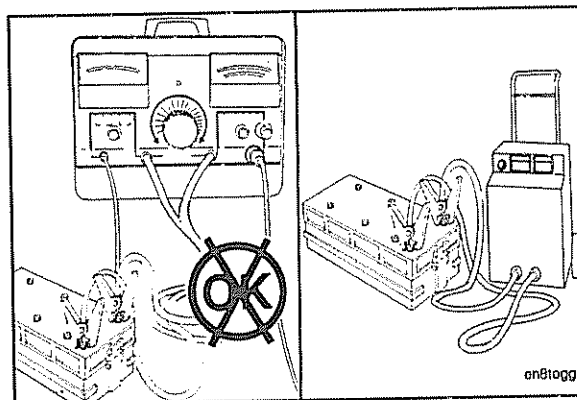
After the air has been purged from the system, check the coolant level again.

Batteries

Inspect

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

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



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

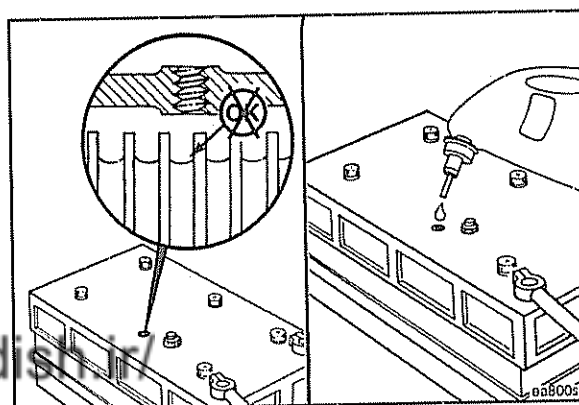


⚠ WARNING ⚠

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

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

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



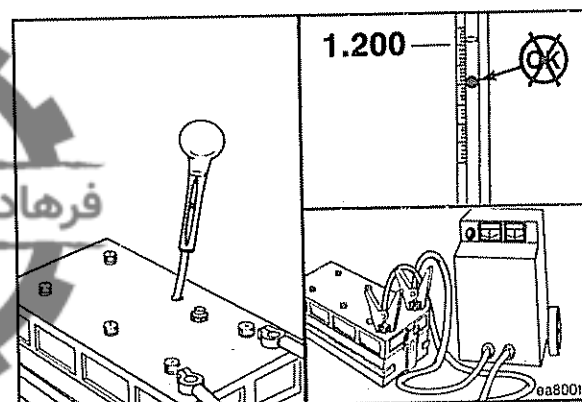
Refer to the accompanying table to determine the battery state of charge based on the specific-gravity readings.

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

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

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

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

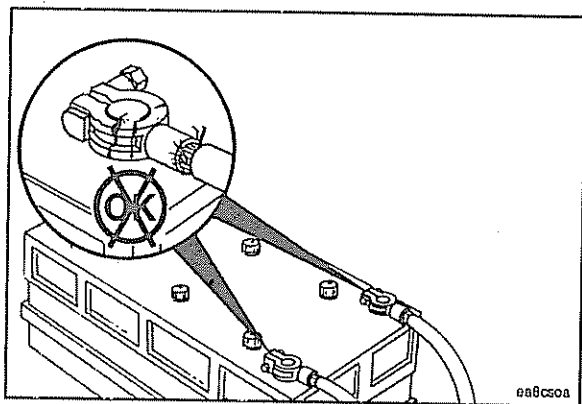
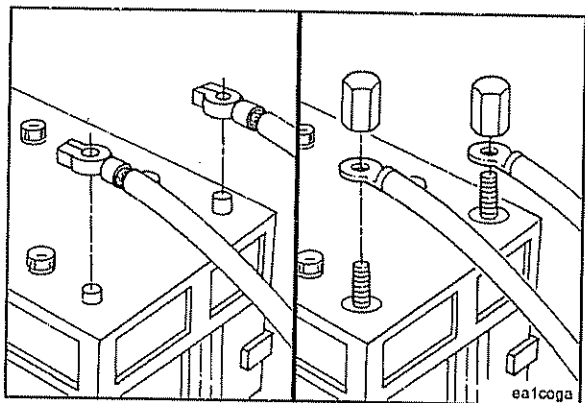


Battery Cables and Connections

Initial Check

There are two possible heavy-duty battery connections:

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



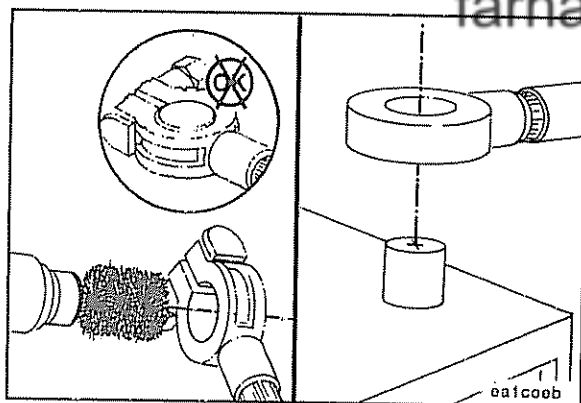
⚠ WARNING ⚠

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



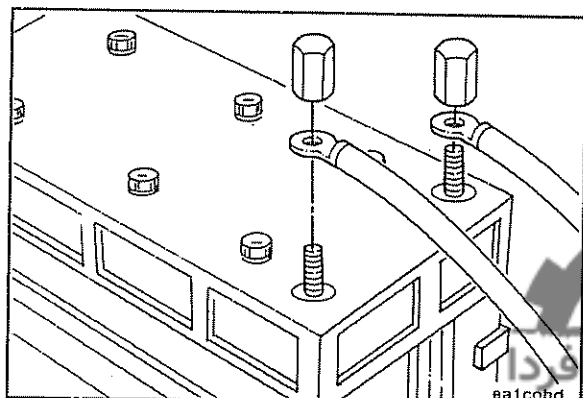
Remove and inspect the battery cables and connections for cracks or corrosion.

Replace broken terminals, connectors, or cables.



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

Make sure all debris is removed from the connecting surfaces.



⚠ WARNING ⚠

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



Install the cables and tighten the battery connections.

Coat the terminals with grease to prevent corrosion.

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Section 6 - Maintenance Procedures at 1000 Hours or 1 Year

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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.

Drive Belts

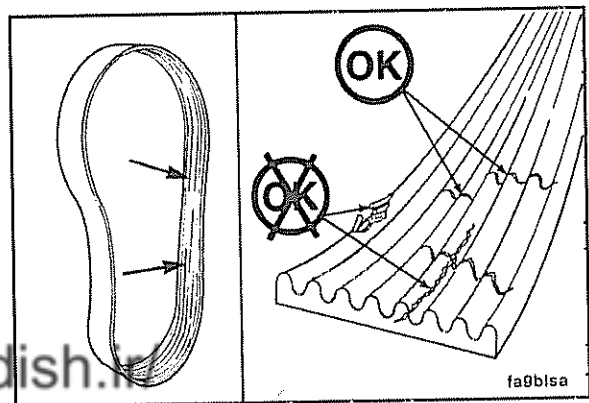
Maintenance Check

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.



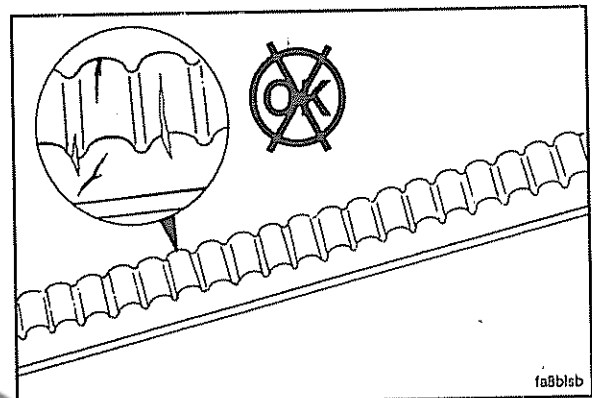
Cogged Belt

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

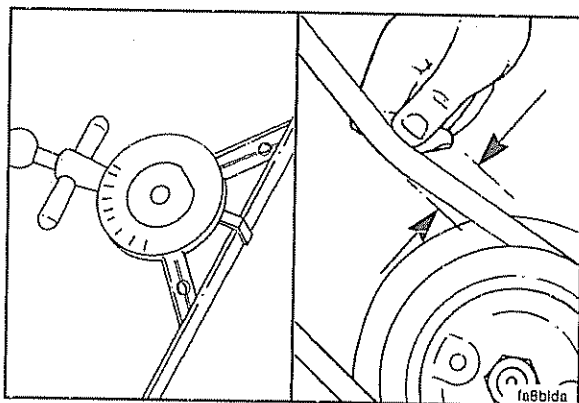
Adjust the belts that have a glazed or shiny surface, which indicates belt slippage. Correctly installed and tensioned belts will show even pulley and belt wear. Refer to Section A for belt adjustment and replacement procedures.

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



Section 6 - Maintenance Procedures at 1000 Hours or 1 Year

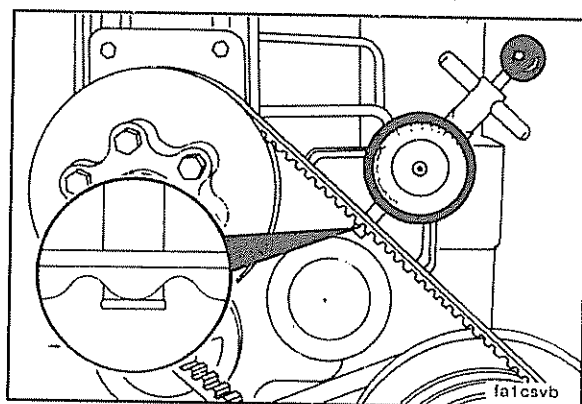


Measure the belt tension in the center span of the pulleys. Refer to the Belt Tension Chart in Section V for the correct gauge and tension value for the belt width used.

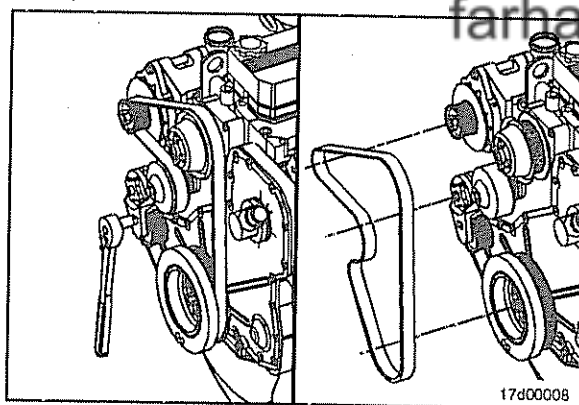


An alternate method (deflection method) can be used to check belt tension by applying 110 N [25 lbf] force between the pulleys on v-belts. If the deflection is more than one belt thickness per foot of pulley center distance, the belt tension **must** be adjusted.

Refer to Section A for adjustment procedures.

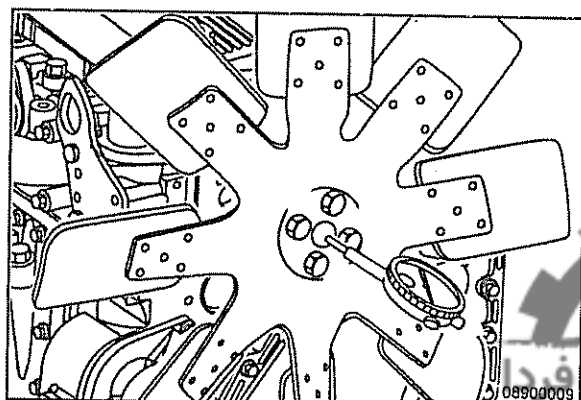


For cogged belts, **make sure** that the belt tension gauge is positioned so that the center tensioning leg is placed directly over the high point (hump) of a cog. Other positioning will result in incorrect measurement.



Fan Hub, Belt Driven Maintenance Check

Remove the drive belt.



NOTE: The fan hub **must** rotate without any wobble or excessive end play.



Check the fan hub bearing.

Fan Hub End Play

mm		in
0.15	MAX	0.006

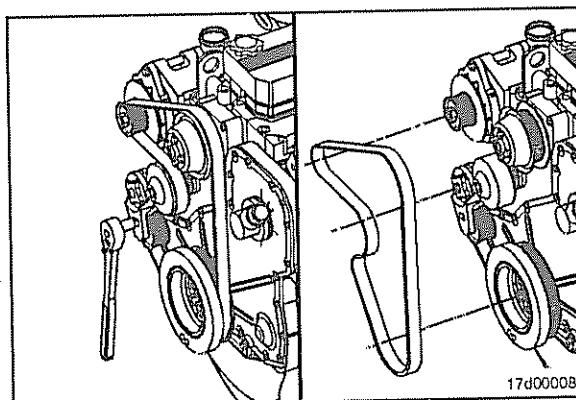


Drive Belt, Cooling Fan

Remove

Lift the tensioner to remove the drive belt.

NOTE: 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.

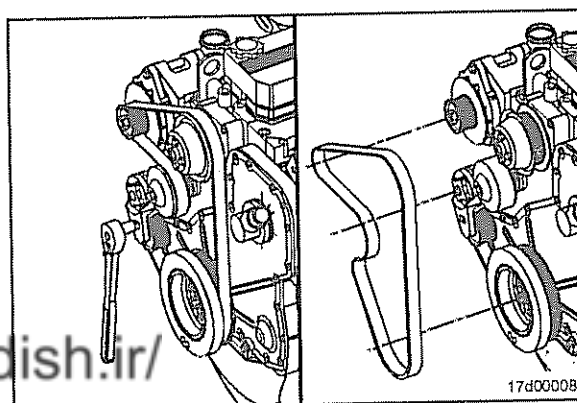


Install

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

NOTE: 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.

Service Tip: If difficulty is experienced installing the drive belt (i.e., 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.



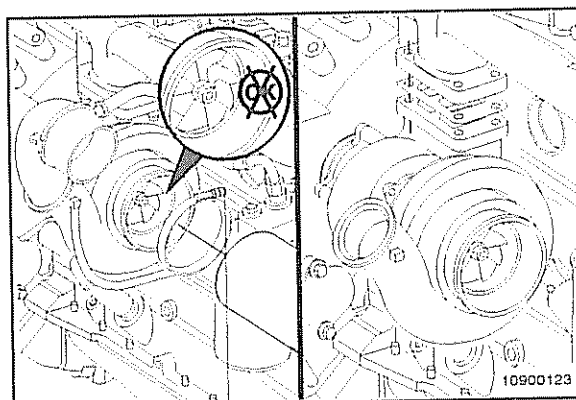
Turbocharger

Inspect for Reuse

Remove the intake pipe from the turbocharger.

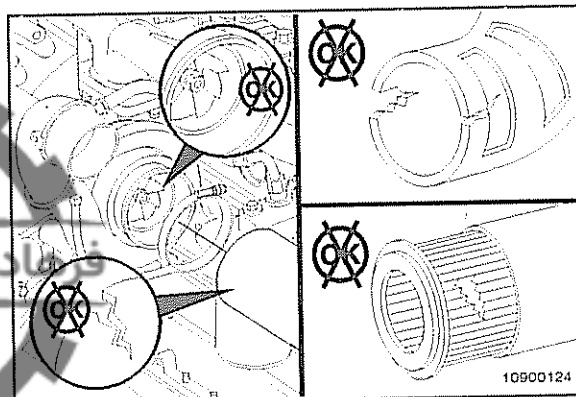
Inspect the turbocharger compressor impeller blades for damage.

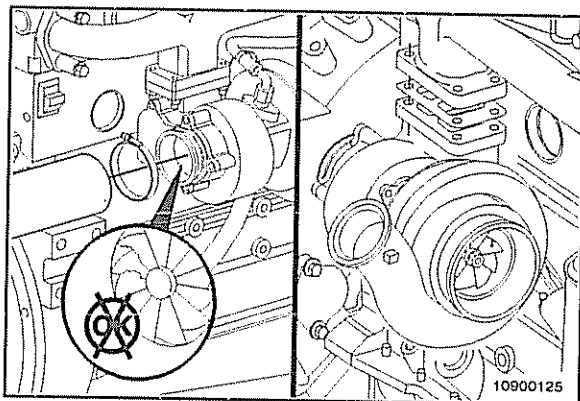
Replace the turbocharger if damage is found. Contact a Cummins Authorized Repair Location for replacement.



If the compressor impeller is damaged, inspect the intake piping and filter element for damage.

Repair any damage before operating the engine.

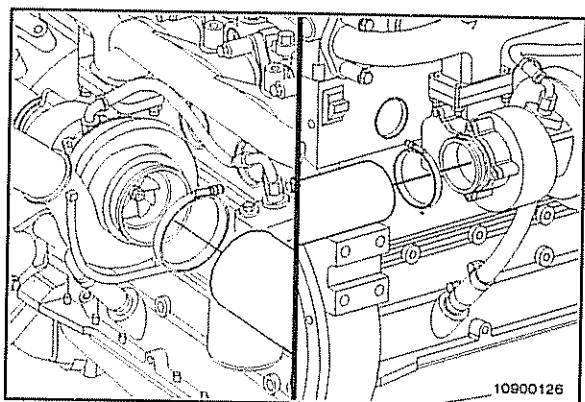




Remove the exhaust pipe from the turbocharger.
Inspect the turbine wheel for damage.



Replace the turbocharger if damage is found. Contact a Cummins Authorized Repair Location for replacement.



Install the intake pipe and tighten the clamp.
Install the exhaust pipe and tighten the clamp.



Torque Value: 8 N•m [71 in-lb]

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Section 7 - Maintenance Procedures at 2000 Hours or 2 Years

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QSC8.3 and QSL9 Engines
Section 7 - Maintenance Procedures at 2000 Hours or 2 Years
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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.

Cooling System

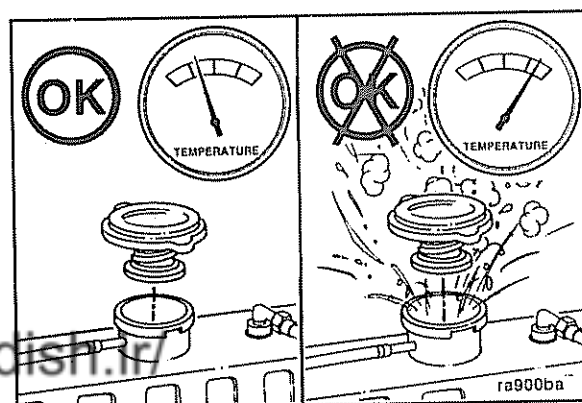
Drain



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.

Remove the pressure cap.

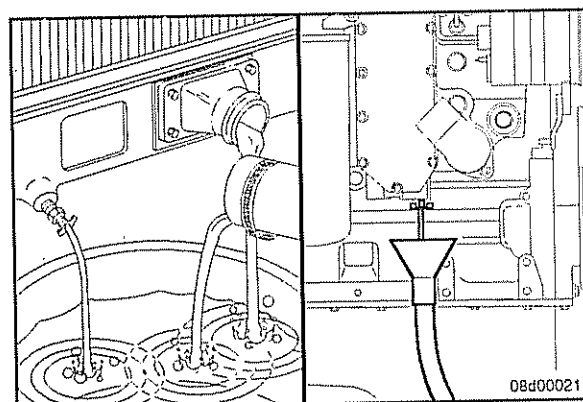


WARNING

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

A drain pan with a capacity of 19 liters [5 gal] will be adequate for most applications.

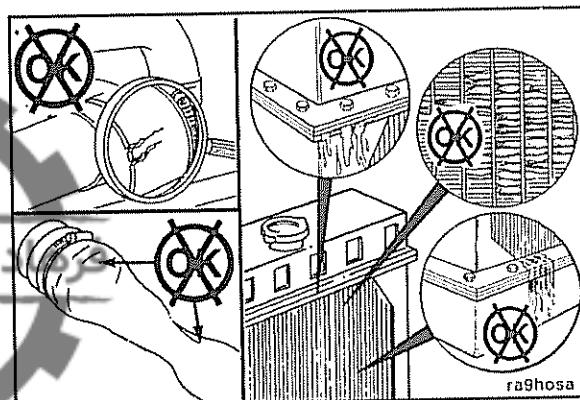
Drain the cooling system by opening the drain valve on the radiator and removing the plug in the bottom of the water inlet hose.



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

Check the radiator for leaks, damage, and buildup or dirt.

Clean and replace as required.

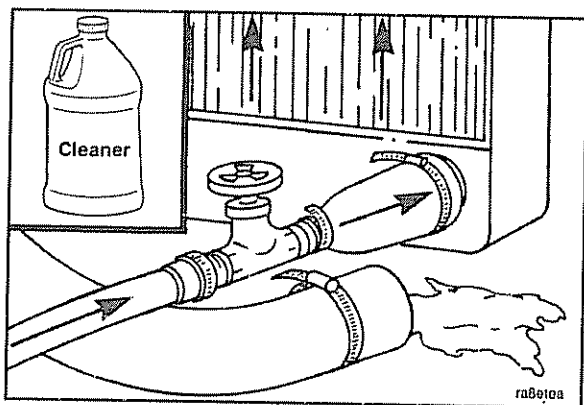


Flush

⚠ WARNING ⚠

Do not use caustic cleaners in the cooling system. Aluminum components will be damaged.

The cooling system must be clean to work correctly and to eliminate buildup of harmful chemicals.



Restore™ is a heavy-duty cooling system cleaner that removes corrosion, silica gel, and other deposits. The performance of Restore™ is dependent 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 of 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.

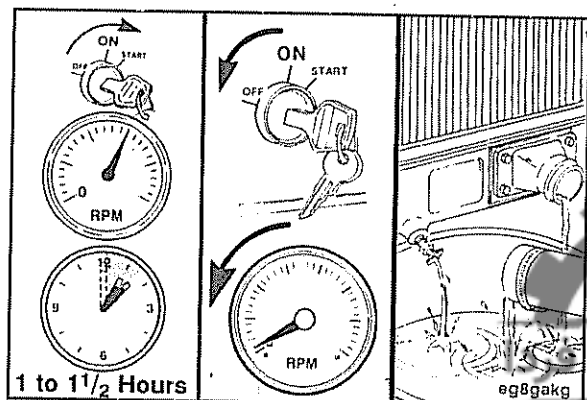
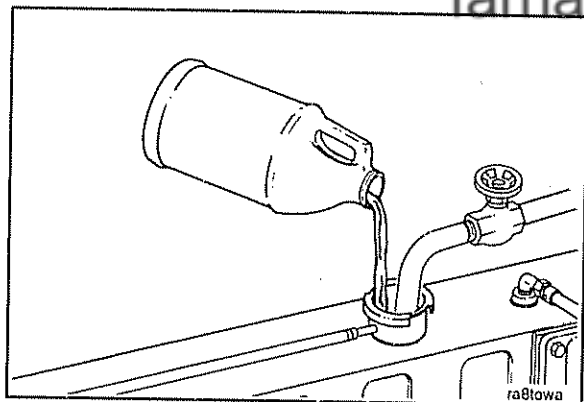
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⚠ CAUTION ⚠

Fleetguard® Restore™ contains no antifreeze. Do not allow the cooling system to freeze during the cleaning operation.

After draining the coolant, immediately add 3.8 liters [1 gal] of Fleetguard® Restore™, Restore Plus™, or equivalent, for each 38 to 57 liters [10 to 15 gal] of cooling system capacity, and fill the system with plain water.

Turn the cab heater temperature switch to high to allow maximum coolant flow through the heater core. The blower does **not** have to be on.



⚠ 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.

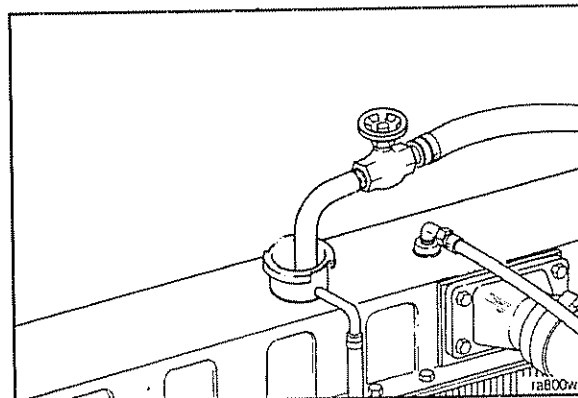
⚠ WARNING ⚠

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

Operate the engine at normal operating temperatures, at least 85°C [185°F] for 1 to 1-1/2 hours.

Shut off the engine and drain the cooling system.

Fill the cooling system with clean water.



⚠ 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.

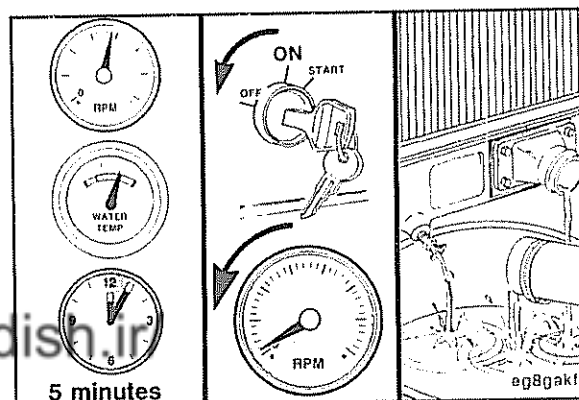
⚠ WARNING ⚠

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

Operate the engine at high idle for five minutes with the coolant temperature above 85°C [185°F].

Shut off the engine and drain the cooling system.

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



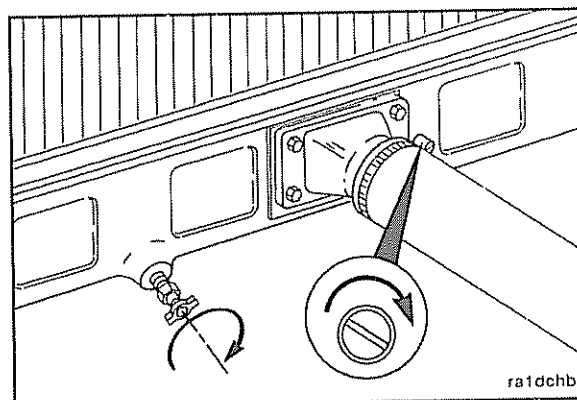
Fill

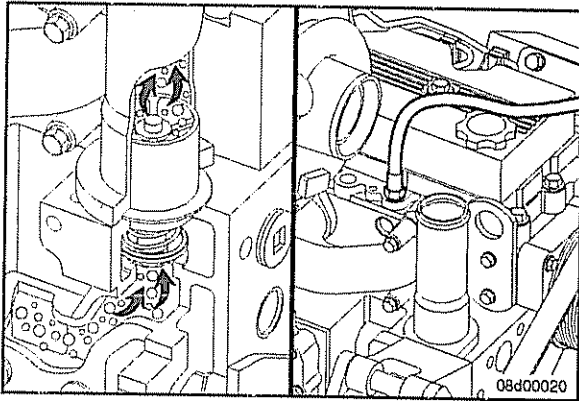
Close the radiator draincocks.

Install the lower radiator hose(s).

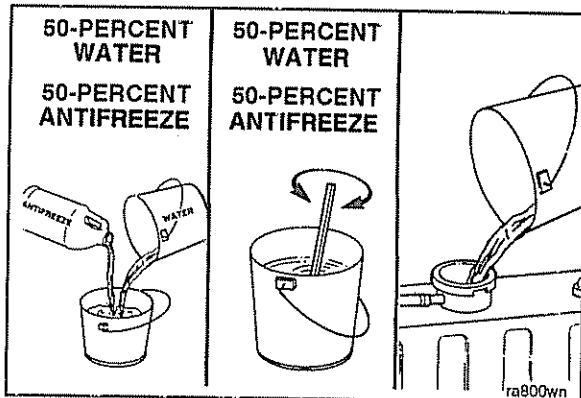
Tighten the hose clamps.

Torque Value: 5 N•m [44 in-lb]





The system is designed to use a specific quantity of coolant. If the coolant level is low, the engine will run hot. If the addition of coolant is necessary, the engine or system has a leak. Find and repair the leak. The system has a designed fill rate of 19 liters [5 gal] per minute.

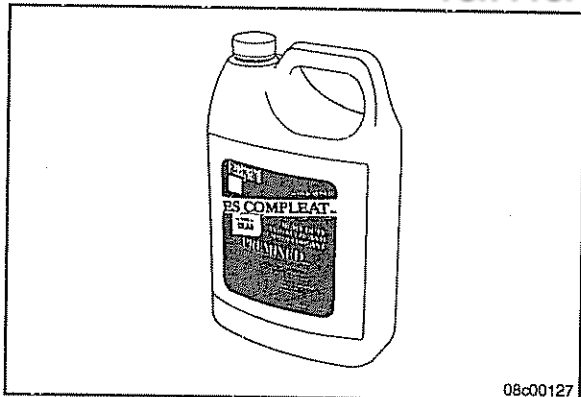


⚠ CAUTION ⚠

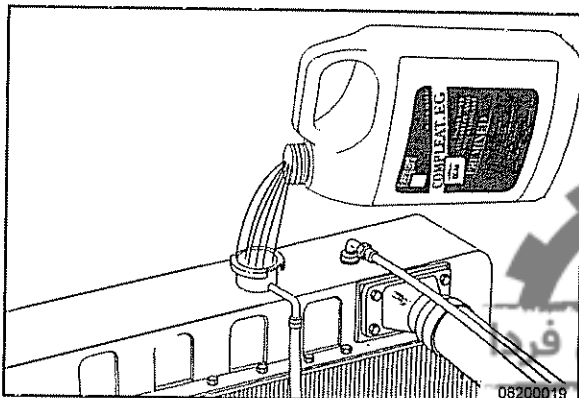
Never use water alone for coolant. This can result in damage from corrosion.

Use a 50-percent water and 50-percent ethylene glycol or propylene-glycol-based antifreeze to fill the cooling system.

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Cummins Inc. recommends using Fleetguard® COMPLETE ES. It is available in glycol forms (ethylene and propylene) and complies with ASTM D6210 (EG) and ASTM D6211 (PG) specifications.



Fill the cooling system with heavy-duty coolant and install the correct service filter (if equipped).

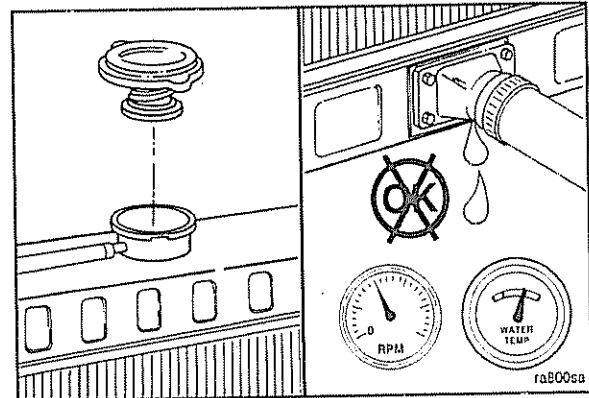


QSC8.3 and QSL9 Engines
Section 7 - Maintenance Procedures at 2000 Hours or 2 Years

Vibration Damper, Rubber
Page 7-5

Install the pressure cap. Operate the engine until the coolant reaches a temperature of 80°C [176°F] and check for coolant leaks.

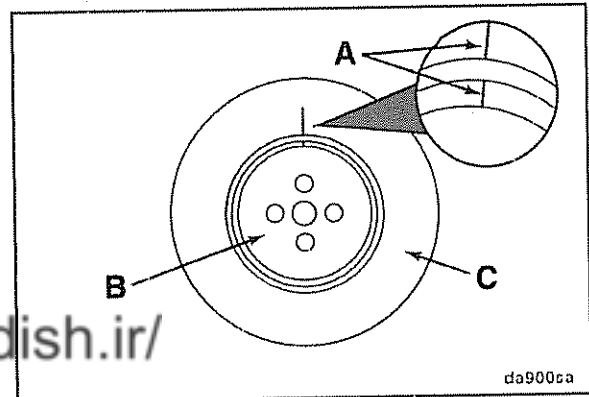
Check the coolant level again to make sure that the system is full of coolant or that the coolant level has risen to the hot level in the recovery bottle on the system, if so equipped.



Vibration Damper, Rubber
Inspect for Reuse

Check the index lines (A) on the 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 damper.

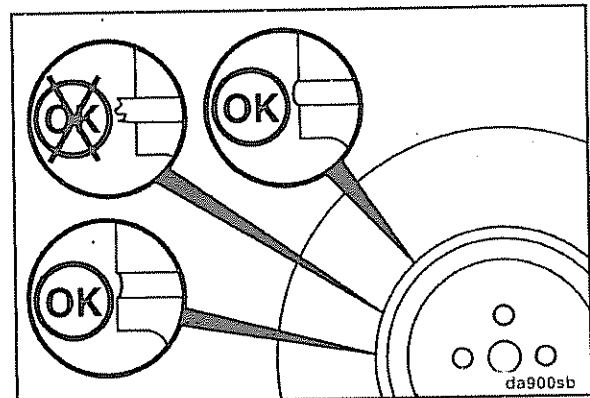
Inspect the vibration damper hub (B) for cracks. Replace the damper if the hub is cracked.

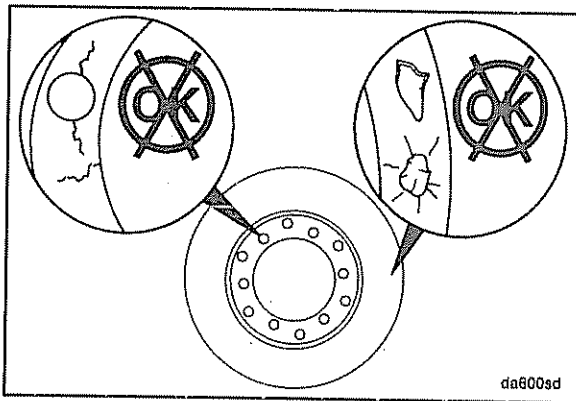


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Inspect the rubber member for deterioration. If pieces of rubber are missing or if the elastic member is more than 3.18 mm [1/8 in] below the metal surface, replace the damper.

NOTE: Also look for forward movement of the damper ring on the hub. Replace the damper if any movement is detected.





Vibration Damper, Viscous Inspect



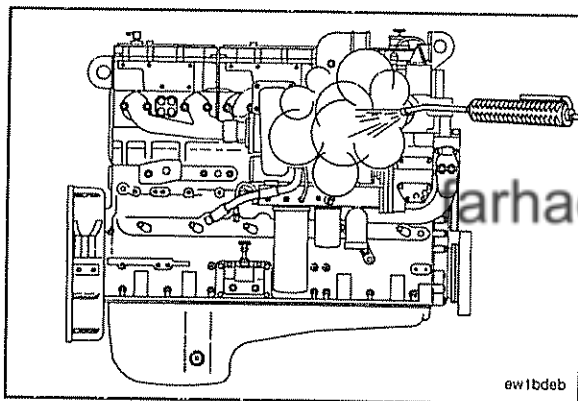
The silicone fluid in the vibration damper will become solid after extended service and will make the damper inoperative. An inoperative vibration damper can cause major engine or drivetrain failures.

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.

Viscous dampers have a limited life. The maximum damper life specifications are located in Maintenance Specifications (Section V).

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



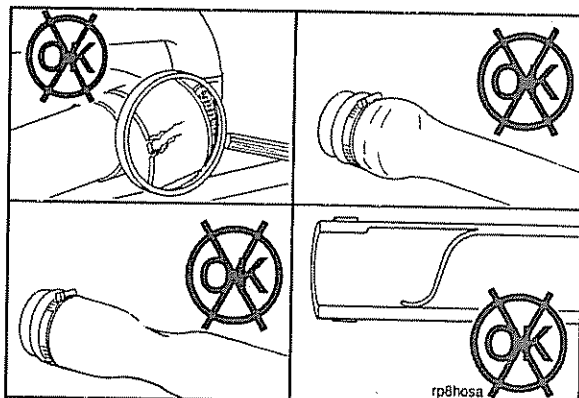
Engine Steam Cleaning Clean



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

Steam is the best method of cleaning a dirty engine or a piece of equipment. If steam is **not** available, use a solvent to wash the engine.

Protect all electrical components, openings, and wiring from the full force of the cleaner spray nozzle.



Radiator Hoses Maintenance Check

Check all hoses for cracks, cuts, or collapsing.

NOTE: The silicone engine coolant hose will exhibit swelling due to the elasticity of the hose.



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

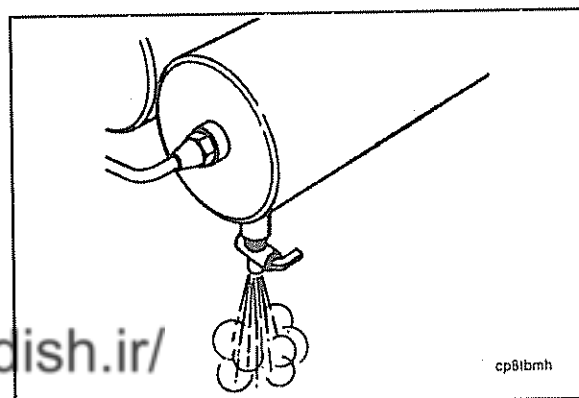


WARNING

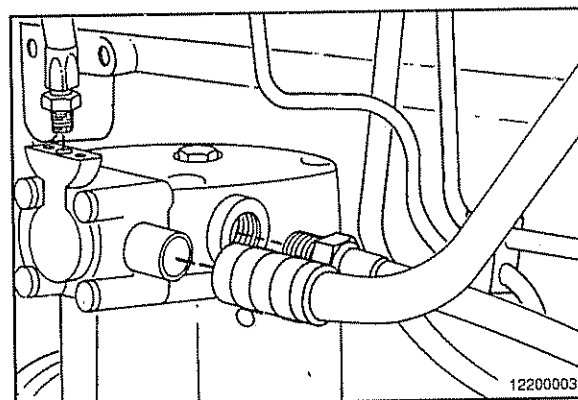
Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

Shut off the engine.

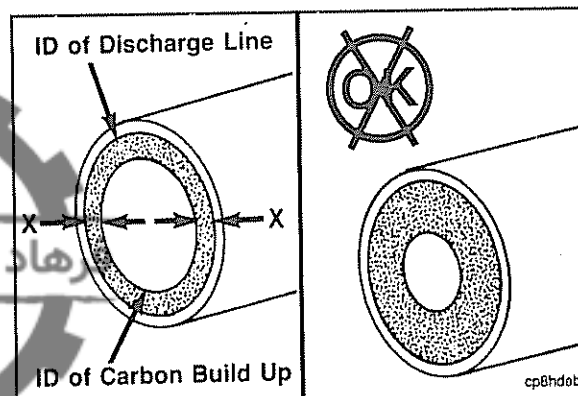
Open the drain valve on the wet tank to release the system air pressure.

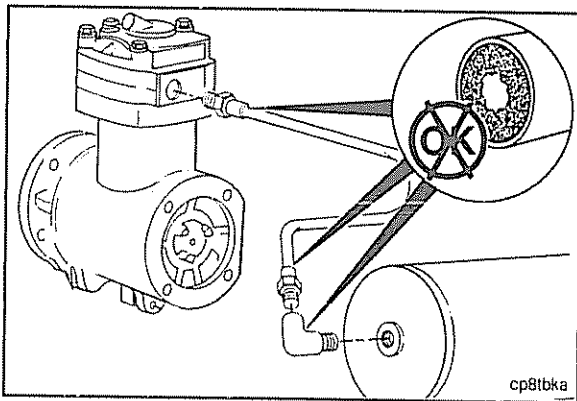


Remove the air compressor discharge line from the air compressor. Location of the air compressor discharge line can be found in Flow Diagram, Compressed Air System in System Diagrams (Section D).

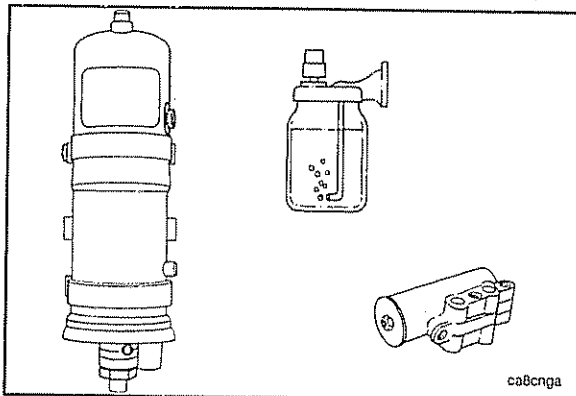


Measure the total carbon deposit thickness inside the air discharge line as shown. If the total carbon deposit ($X + X$) exceeds 2 mm [1/16 in], clean and inspect the cylinder head, the valve assembly, and the discharge line. Replace if necessary. Contact the Cummins Authorized Repair Location for procedures.





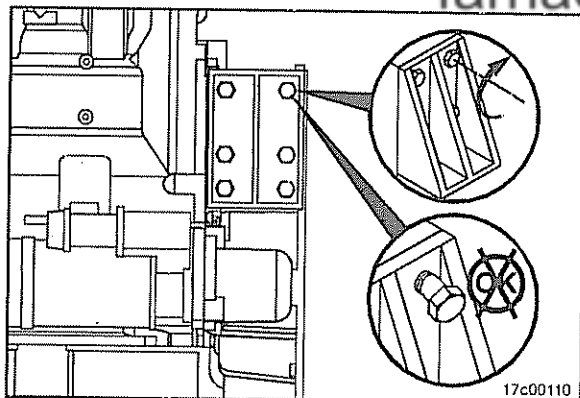
If the total carbon deposit exceeds specifications, continue checking the air discharge line connections up to the first tank until total carbon deposit is less than 2 mm [1/16 in]. Clean or replace any lines or connections that exceed this specification.



Inspect any air driers, 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.



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Engine Mounting Bolts Maintenance Check



⚠ CAUTION ⚠

Damaged engine mounts and brackets can cause engine misalignment. Driveline component damage can result in vibration complaints.



Inspect all rubber-cushioned mounts for cracks or damage.

Inspect all mounting brackets for cracks or damaged bolt holes.

Check the torque on the engine-mounting nuts and bolts. Tighten any that are loose. Refer to the equipment manufacturer for torque specifications.



Section 8 - Maintenance Procedures at 5000 Hours or 4 Years

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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.

Overhead Set Preparatory Steps

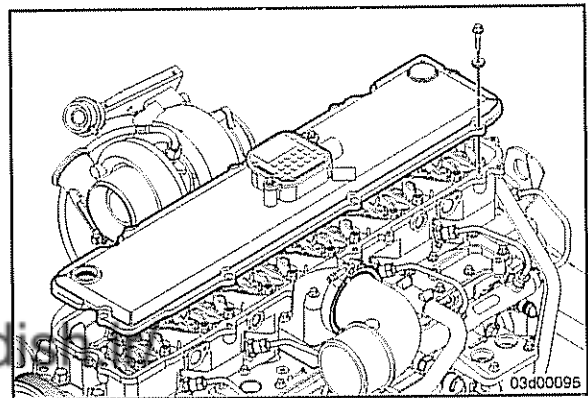
Remove the crankcase breather tube, rocker lever cover mounted breather **only**.

Remove the variable geometry turbocharger actuator air supply line, if equipped.

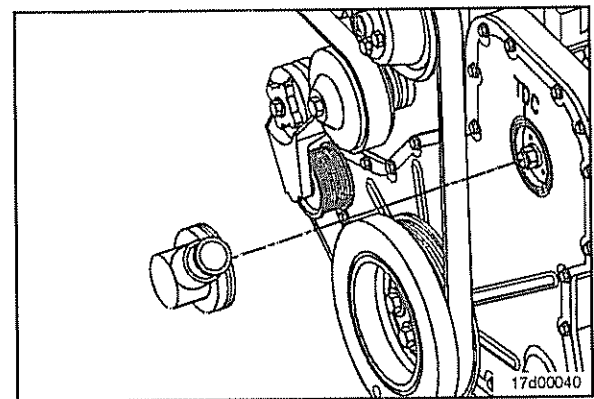
Remove the capscrews.

Remove the rocker lever cover and gasket.

NOTE: Rocker lever cover configurations will be different based upon if the cover is center bolted or perimeter bolted. The rocker lever cover can also be taller if the engine is equipped with engine brakes.



Remove the plastic fuel pump drive cover located on the front of the engine.

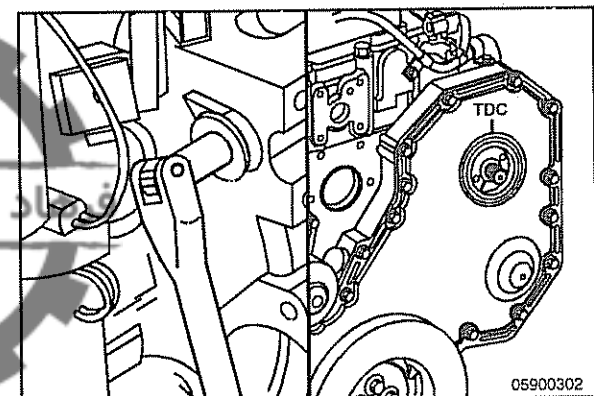


Adjust



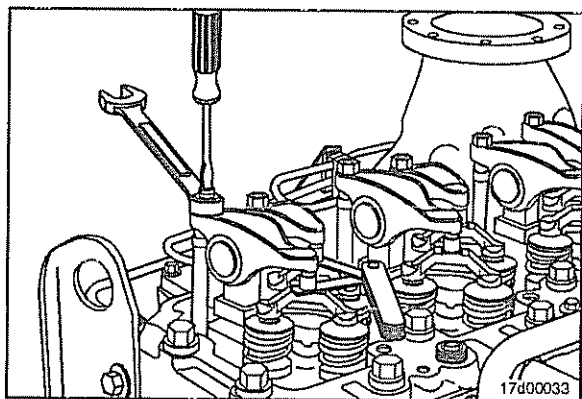
Engine coolant temperature should be less than 60°C [140°F].

Using the barring tool, Part Number 3824591, rotate the crankshaft to align the top dead center marks on the gear cover and the fuel pump gear.



Section 8 - Maintenance Procedures at 5000 Hours or 4 Years

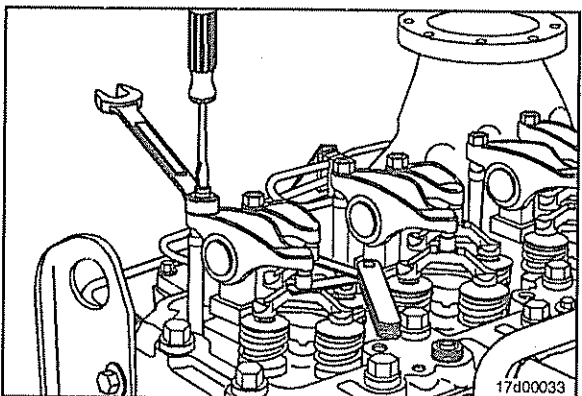
With the engine in this position, lash can be checked on the following rocker arms: 1I, 1E, 2I, 3E, 4I, and 5E.



Lash Check Limits

	mm		in
Intake	0.152	MIN	0.006
	0.559	MAX	0.022
Exhaust	0.381	MIN	0.015
	0.813	MAX	0.032

NOTE: Lash checks are performed as part of a troubleshooting procedure, and resetting is **not** required during checks as long as the lash measurements are within the above limits.



Measure lash by inserting a feeler gauge between the crosshead and the rocker lever ball insert and socket while lifting up on the end of the rocker arm. If the lash measurement is out of specifications, loosen the locknut and adjust the lash to nominal specifications.

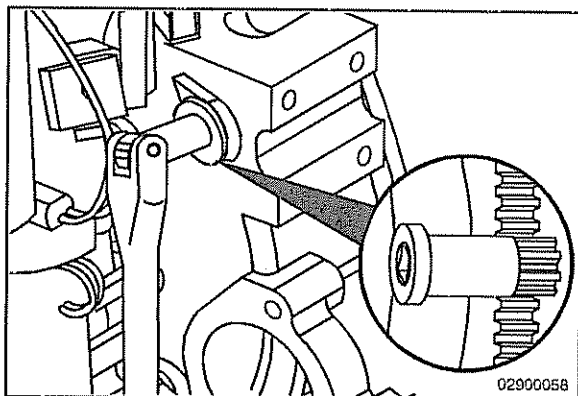
Lash Reset Specifications

	mm		in
Intake	0.305	NOM	0.012
Exhaust	0.559	NOM	0.022

NOTE: Lash resets are **only** required at the interval specified in the Maintenance Schedule when lash is measured and found out of specification, or when engine repairs cause removal of the rocker arms and/or loosening of the adjusting screws.

Tighten the locknut and measure again.

Torque Value: 24 N•m [18 ft-lb]



Using the barring tool, Part Number 3824591, rotate the crankshaft 360 degrees and measure lash for rocker arms 2E, 3I, 4E, 5I, 6I, and 6E. Reset the lash if out of specification.

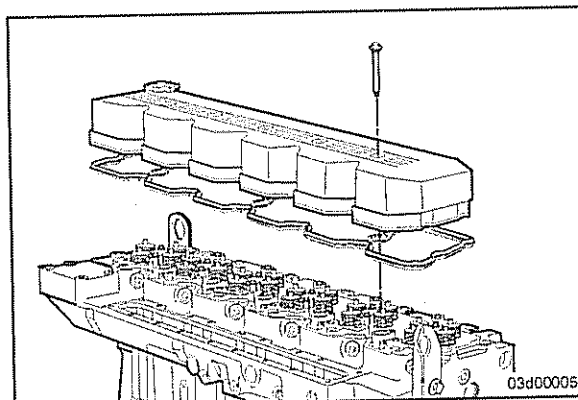


Finishing Steps

Center Bolted Rocker Lever Cover

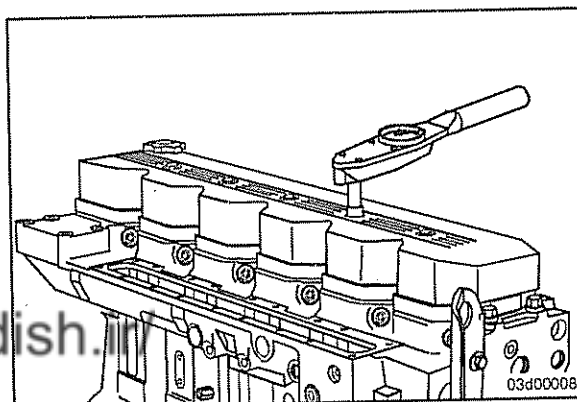
Place the gasket on the cylinder head. Be sure the gasket is properly aligned around the cylinder head capscrews.

Install the rocker lever cover and capscrews.



Tighten the capscrews.

Torque Value: 12 N•m [106 in-lb]



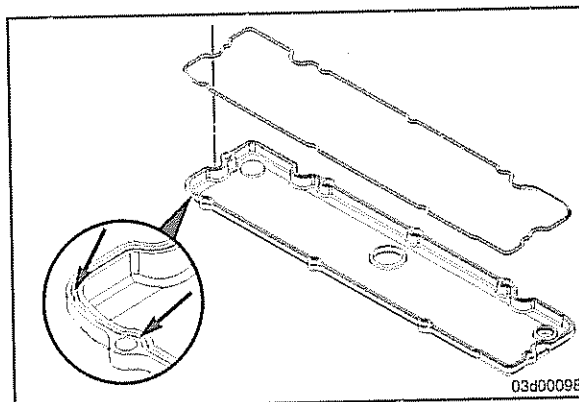
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Perimeter Bolted Rocker Lever Cover

NOTE: If the gasket has been removed from the rocker lever cover, a new gasket **must** be used.

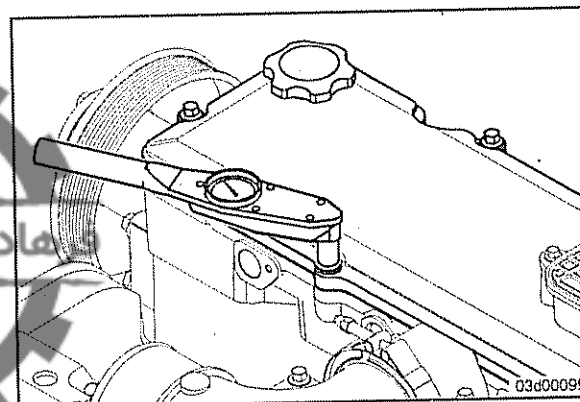
The following installation procedure **must** be used when installing the press-in gasket.

1. Press the molded gasket into the corners of the rocker lever cover.
2. Press the gasket around the capscrew mounting holes.
3. Press the remaining gasket into the rocker lever cover.



Install the rocker lever cover and capscrews.

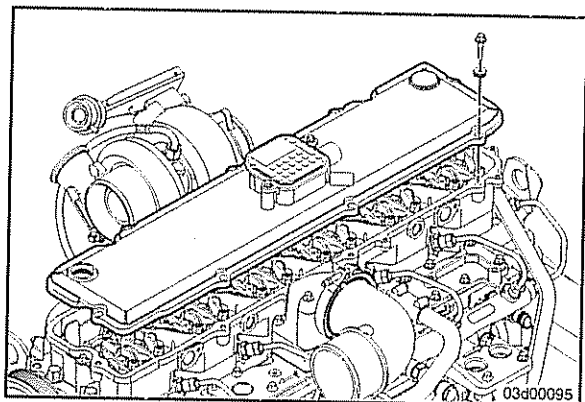
Torque Value: 12 N•m [106 in-lb]



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Install the crankcase breather tube, rocker lever cover mounted breather **only**.

Install the variable geometry turbocharger actuator air supply line, if equipped.



Engine Brake Preparatory Steps

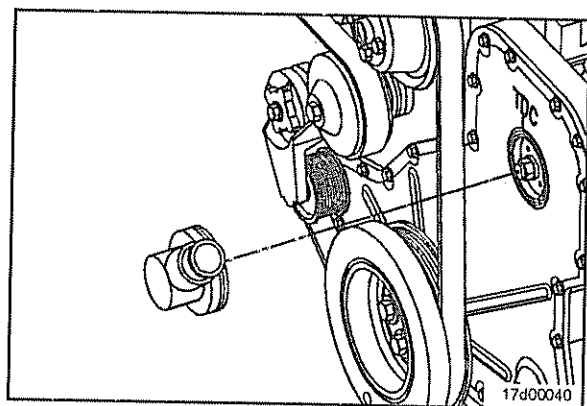
Remove the crankcase breather tube, rocker lever cover mounted breather **only**.

Remove the variable geometry turbocharger actuator air supply line, if equipped.

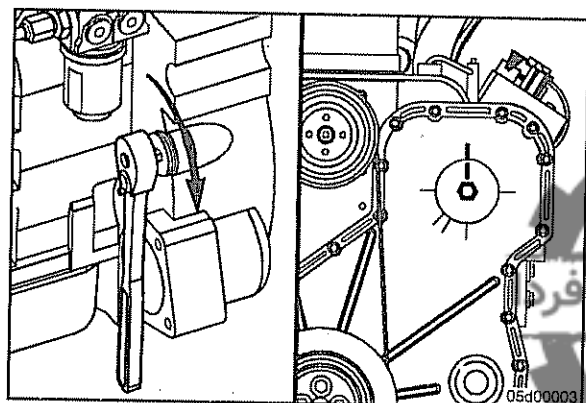
Remove the capscrews.

Remove the rocker lever cover and gasket.

NOTE: Rocker lever cover configurations will be different based upon if the cover is center bolted or perimeter bolted. The rocker lever cover can also be taller if the engine is equipped with engine brakes.



Remove the plastic fuel pump drive cover located on the front of the engine.



Adjust

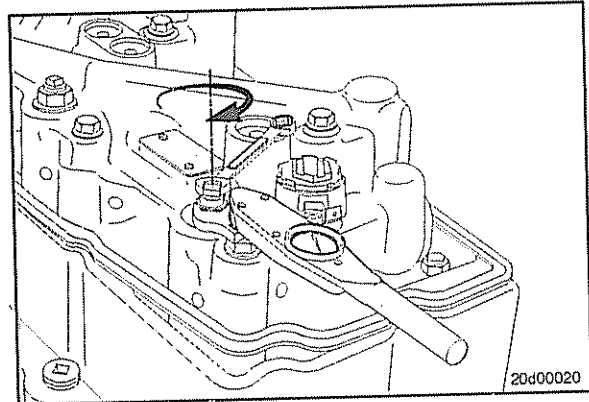
Using the barring tool, Part Number 3824591, rotate the crankshaft to align the mark on the fuel pump gear with the top dead center mark on the gear cover.

QSC8.3 and QSL9 Engines
Section 8 - Maintenance Procedures at 5000 Hours or 4 Years

Engine Brake
Page 8-5

When the engine is in the top dead center position, brake lash can be set on cylinders 1, 3, and 5.

Using two wrenches, hold the adjusting nut and loosen the lock nuts on the brake at cylinders 1, 3, and 5.

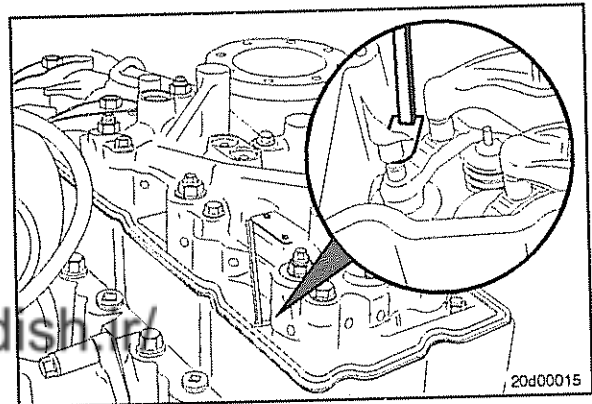


Brake Lash - Feeler Gauge Method

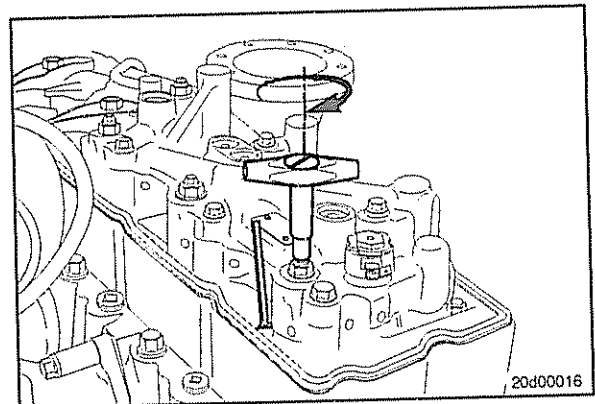
Insert the appropriate brake lash feeler gauge between the brake slave piston and exhaust crosshead pin on cylinder number 1.

Brake Lash - Feeler Gauge	
Tool Part No.	Lash Specification
3163681	2.286 mm [0.090 in]

NOTE: If the correct size feeler gauge is not available, there is an alternate dial indicator method for setting the brake lash following in this procedure.



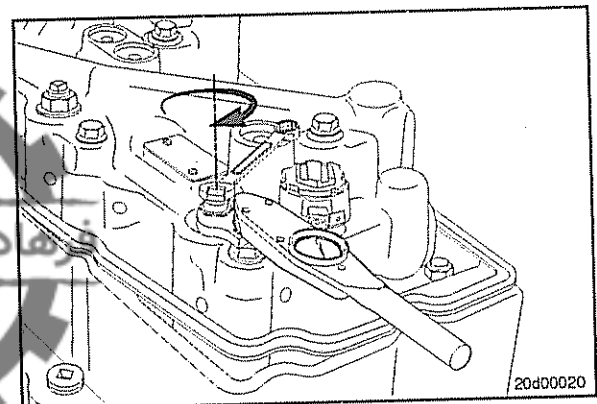
Using the 6 in-lb torque wrench, Part Number 3376592, tighten the adjusting nut until the torque wrench "clicks," or until drag is felt on the feeler gauge.



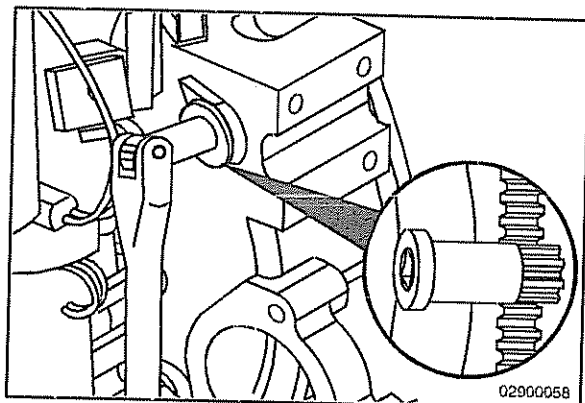
Remove the feeler gauge. Using two wrenches, hold the adjusting nut and tighten the locknut.

Torque Value: 35 N•m [25 ft-lb]

Repeat for cylinders 3 and 5.

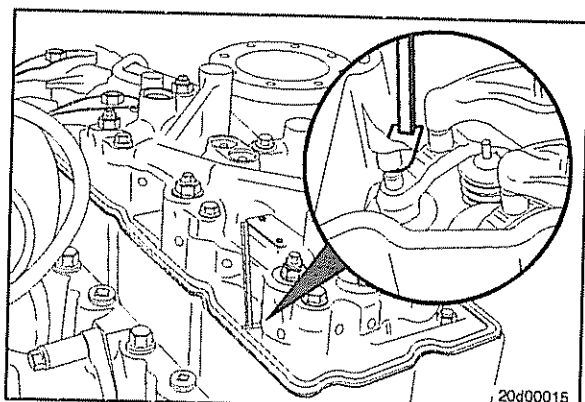


QSC8.3 and QSL9 Engines
Section 8 - Maintenance Procedures at 5000 Hours or 4 Years



Using the engine barring tool, Part Number 3824591, rotate the crankshaft 360 degrees to align the mark on the fuel pump gear with the mark on the gear cover that is 180 degrees away from top dead center.

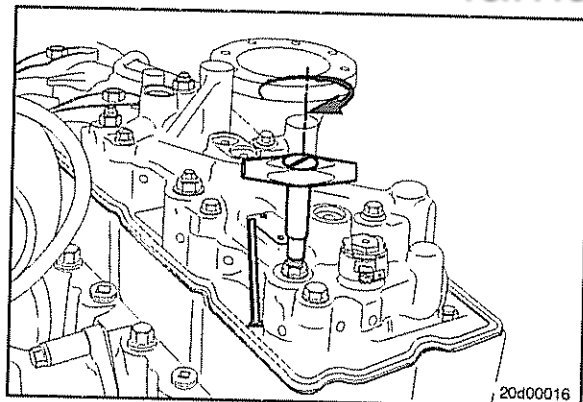
When the engine is in position, brake lash can be set on cylinders 2, 4, and 6.



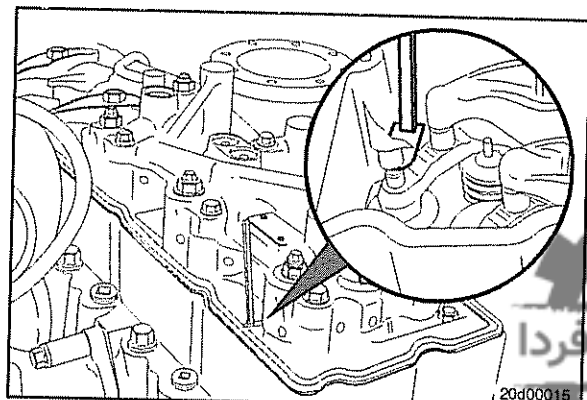
Insert the appropriate brake lash feeler gauge between the brake the brake sleeve piston and the exhaust crosshead pin on cylinder number 2.

Brake Lash - Feeler Gauge	
Tool Part No.	Lash Specification
3163681	2.286 mm [0.090 in]

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Using the 6 in-lb torque wrench, Part Number 3376592, tighten the adjusting nut until the torque wrench "clicks," or until drag is felt on the feeler gauge.



Remove the feeler gauge. Using two wrenches, hold the adjusting nut and tighten the locknut.

Torque Value: 35 N•m [25 ft-lb]

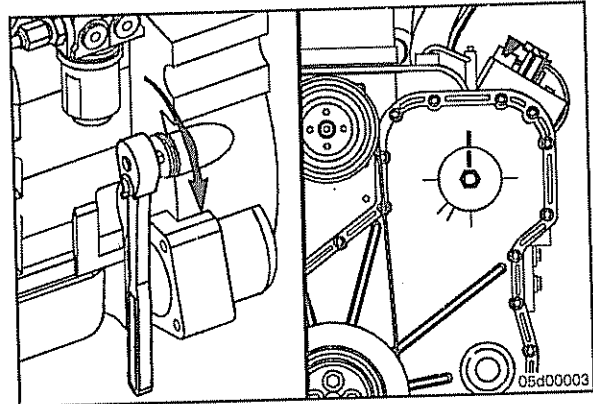
Repeat for cylinders 4 and 6.

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QSC8.3 and QSL9 Engines
Section 8 - Maintenance Procedures at 5000 Hours or 4 Years

The following method can be used instead of the feeler gauge method if a feeler gauge of the proper size is **not** available.

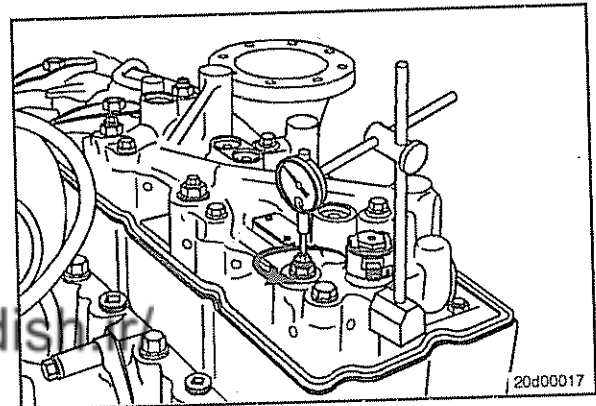
Using the barring tool, Part Number 3824591, rotate the crankshaft to align the mark on the fuel pump gear with the top dead center mark on the gear cover.



Brake Lash - Dial Indicator

Tighten the backlash adjusting nut on cylinder 1 until resistance is felt. Place the dial indicator tip on the adjusting nut and zero the dial indicator. Turn the lash adjusting nut in a **counterclockwise** direction until the appropriate lash is reached.

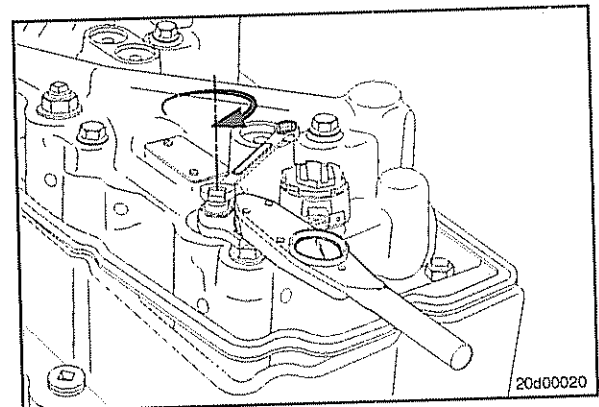
Brake Lash Specification 2.286 mm [0.090 in]



Using two wrenches, hold the adjusting nut and tighten the locknut.

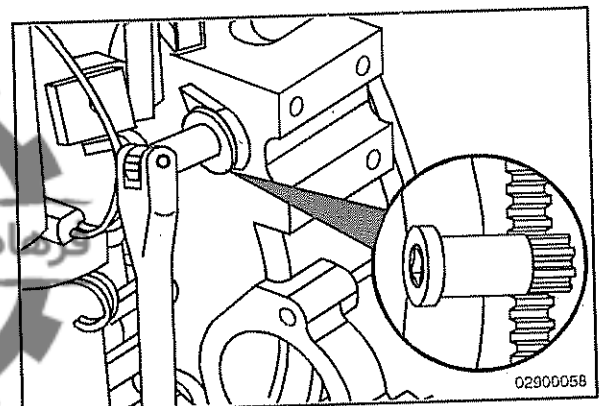
Torque Value: 35 N•m [25 ft-lb]

Repeat for cylinders 3 and 5.

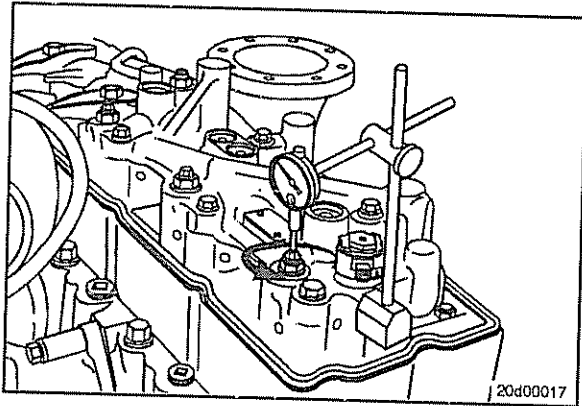


Using the engine barring tool, Part Number 3824591, rotate the crankshaft 360 degrees to align the mark on the fuel pump gear with the mark on the gear cover that is 180 degrees away from top dead center.

When the engine is in position, brake lash can be set on cylinders 2, 4, and 6.

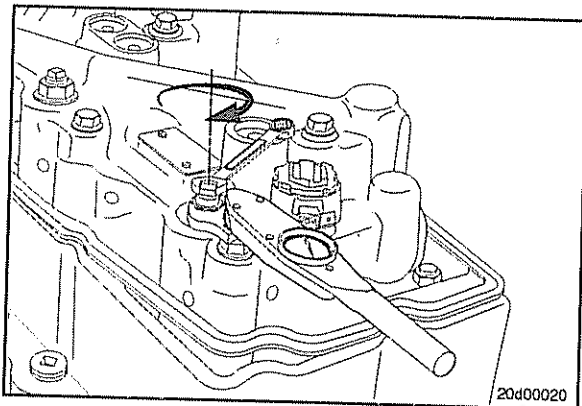


QSC8.3 and QSL9 Engines
Section 8 - Maintenance Procedures at 5000 Hours or 4 Years



Tighten the backslash adjusting nut on cylinder number 2 until resistance is felt. Place the dial indicator tip on the adjusting nut and zero the dial indicator. Turn the lash adjusting nut in a **counterclockwise** direction until the appropriate lash is reached.

Brake Lash Specification 2.286 mm [0.090 in]

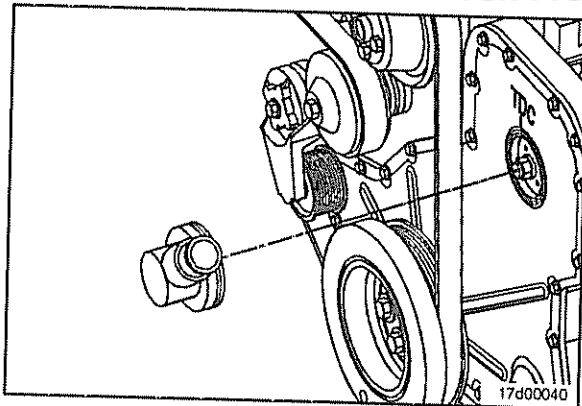


Using two wrenches, hold the adjusting nut and tighten the locknut.

Torque Value: 35 N•m [25 ft-lb]

Repeat for cylinders 4 and 6.

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Finishing Steps

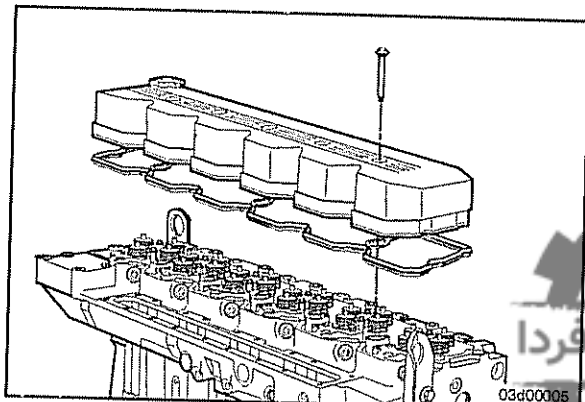
Center Bolted Rocker Lever Cover

Install the plastic fuel pump drive cover located on the front of the engine.



Place the gasket on the cylinder head. Be sure the gasket is properly aligned around the cylinder head capscrews.

Install the rocker lever cover and capscrews.

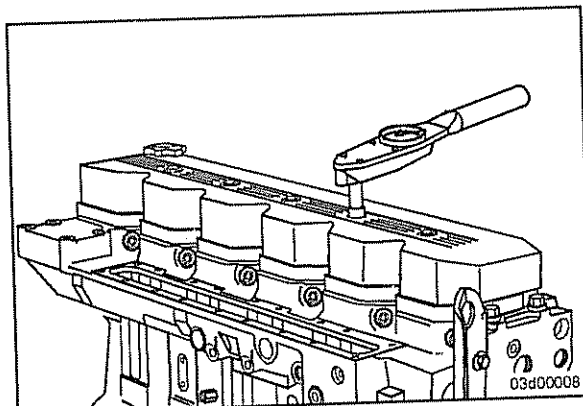


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QSC8.3 and QSL9 Engines
Section 8 - Maintenance Procedures at 5000 Hours or 4 Years

Tighten the capscrews.

Torque Value: 12 N•m [106 in-lb]

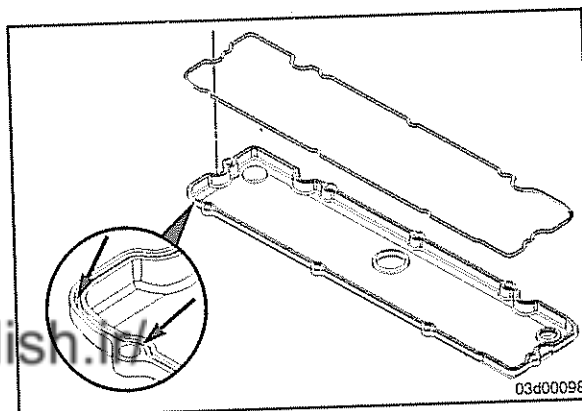


Perimeter Bolted Rocker Lever Cover

NOTE: If the gasket has been removed from the rocker lever cover, a new gasket **must** be used.

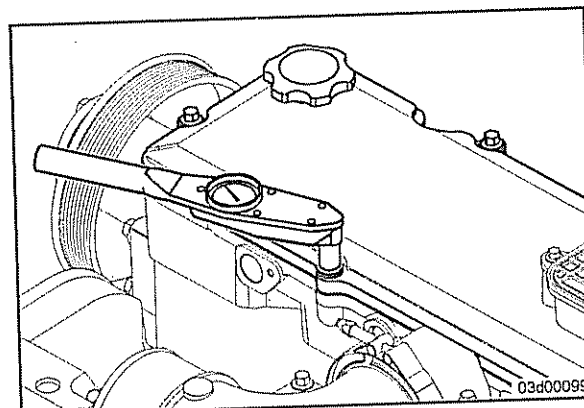
The following installation procedure **must** be used when installing the press-in gasket.

1. Press the molded gasket into the corners of the rocker lever cover.
2. Press the gasket around the capscrew mounting holes.
3. Press the remaining gasket into the rocker lever cover.



Install the rocker lever cover and capscrews.

Torque Value: 12 N•m [106 in-lb]

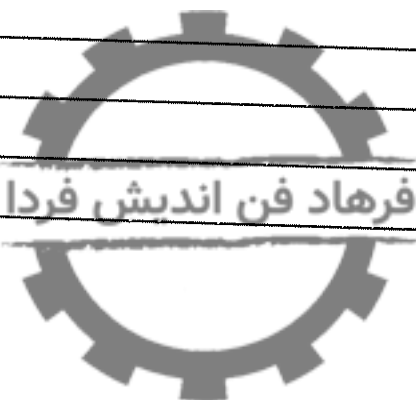


Install the crankcase breather tube, rocker lever cover mounted breather **only**.

Install the variable geometry turbocharger actuator air supply line, if equipped.

Notes

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Section A - Adjustment, Repair, and Replacement

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Engine Storage - Long Term

General Information

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

Lubricating Oil Dipstick Calibrate

⚠ WARNING ⚠

Some state and federal agencies 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. If not reused, dispose of in accordance with local environmental regulations.

⚠ WARNING ⚠

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

Install the dipstick in the dipstick tube housing.

Use clean 15W-40 oil to fill the oil pan to the specified LOW oil level. Refer to Lubricating Oil System Specifications in Procedure 018-017 of this manual for the correct engine oil capacity.

⚠ CAUTION ⚠

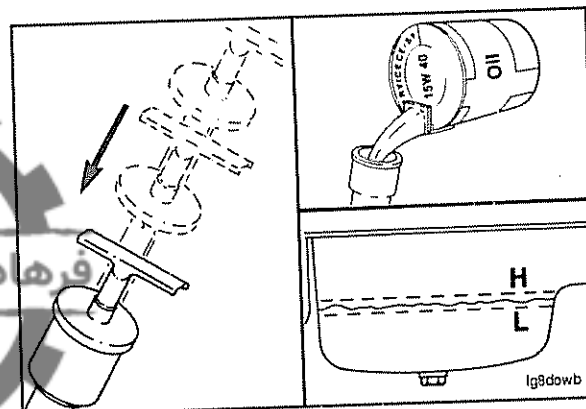
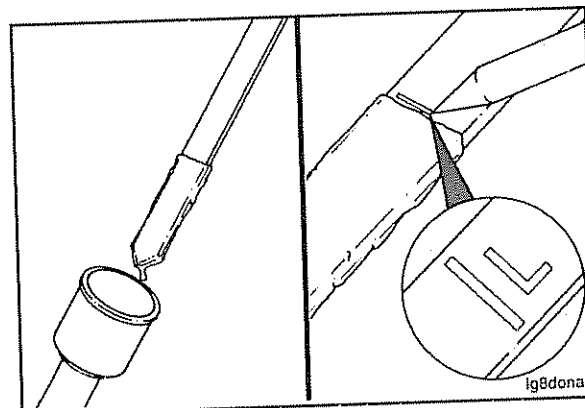
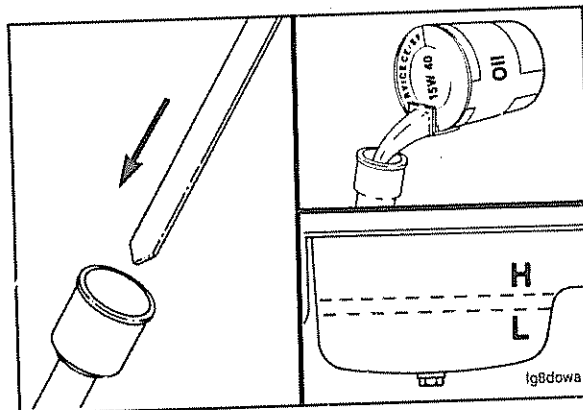
Use care when marking the dipstick. The dipstick will break if the scribe mark is too deep.

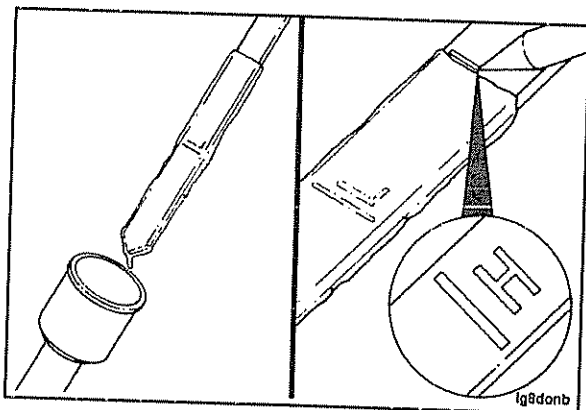
Remove the dipstick and scribe a mark across the stick at the oil level. Label the mark with an L to indicate the "LOW" oil level.

NOTE: If a new blank dipstick is being used, cut the dipstick off approximately 38 mm [1.5 in] below the LOW oil level mark.

Wipe off the dipstick and install it in the dipstick tube housing.

Fill the oil pan to the specified HIGH oil level. Refer to Lubricating Oil System Specifications in Procedure 018-017 of this manual for the correct engine oil capacity.



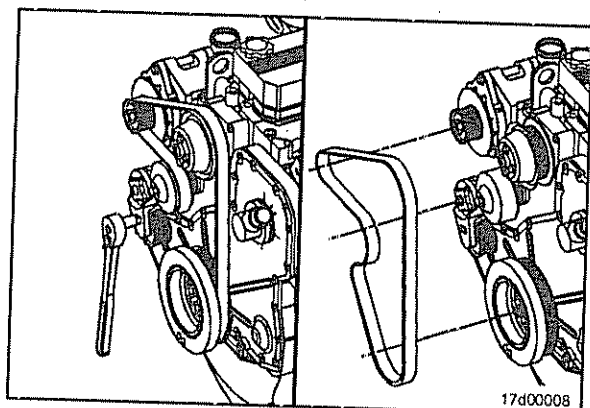


CAUTION

Use care when marking the dipstick. The dipstick will break if the scribe mark is too deep.



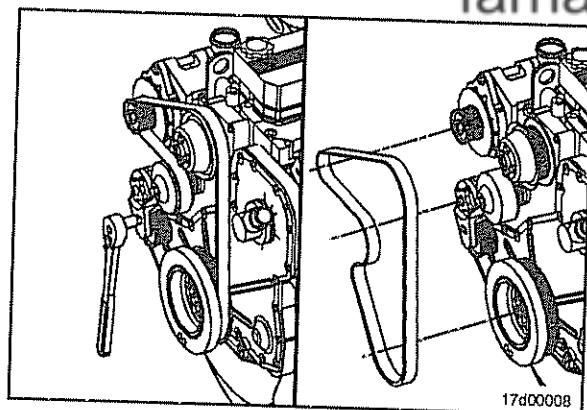
Remove the dipstick and scribe a mark across the stick at the oil level. Label the mark with an H to indicate the HIGH oil level.



Drive Belt, Cooling Fan Remove

Lift the tensioner to remove the drive belt.

NOTE: 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.

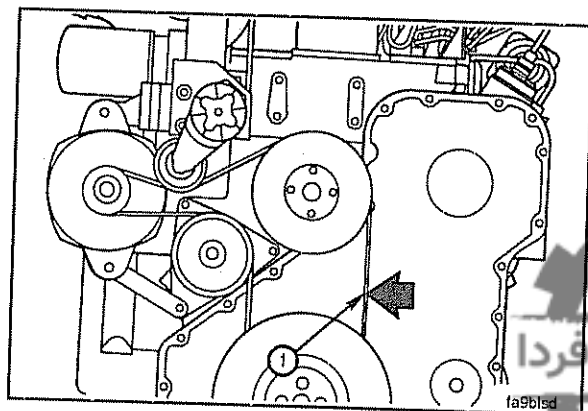


Install

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

NOTE: 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.

Service Tip: If difficulty is experienced installing the drive belt (i.e., 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.



Belt Tensioner, Automatic (Water Pump)

Initial Check

Check the belt deflection at the longest span of the belt. The deflection **must** be checked at the center (1) of the span.

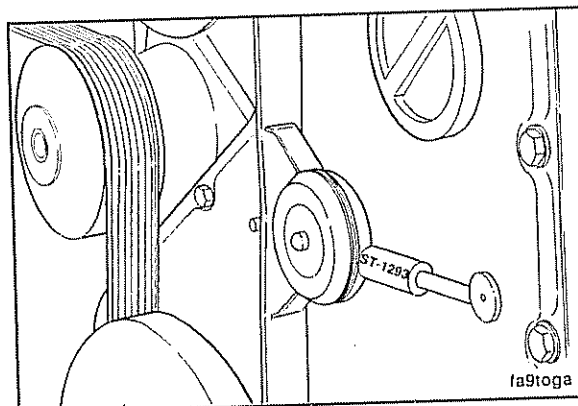
The maximum deflection allowed in the belt is 9.5 to 12.7 mm [3/8 to 1/2-in].

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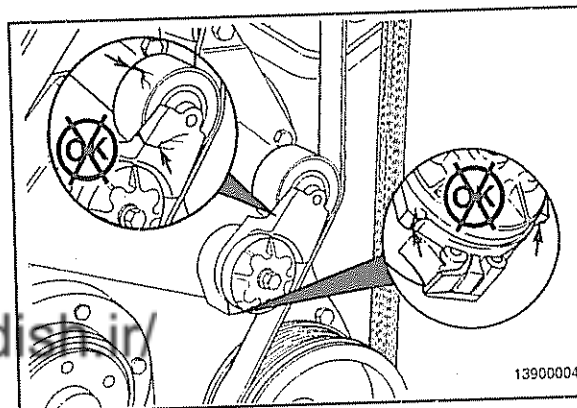
QSC8.3 and QSL9 Engines
Section A - Adjustment, Repair, and Replacement

Drive Belt, Alternator
Page A-3

Use the Cummins belt tensioner gauge, Part Number ST-1293, to measure the tension in the drive belt. This needs to be in the range of 360 to 480 N [80 to 100 ft-lb].

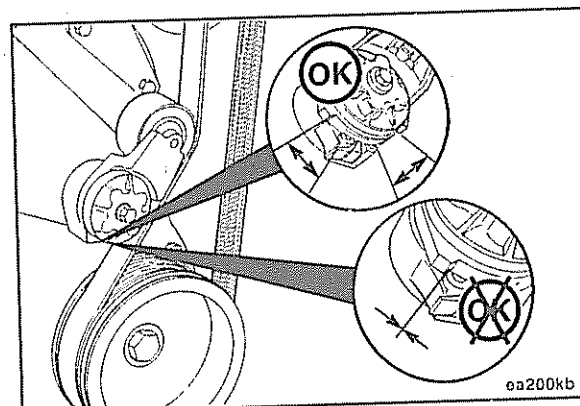


Check the tensioner arm, pulley, and stops for cracks. If any cracks are noticed, the tensioner **must** be replaced.



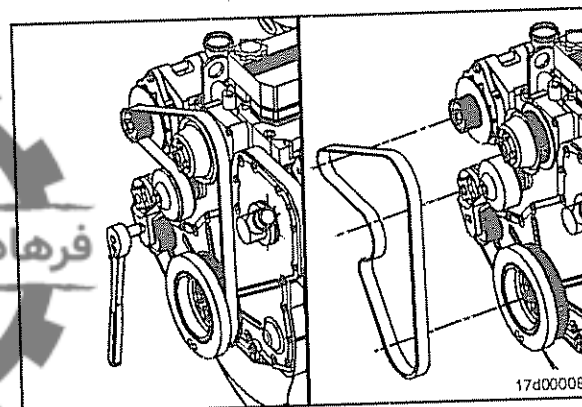
With the belt on, verify that neither tensioner arm stops are in contact with the spring casing stop. If either stop is touching, the drive belt **must** be replaced.

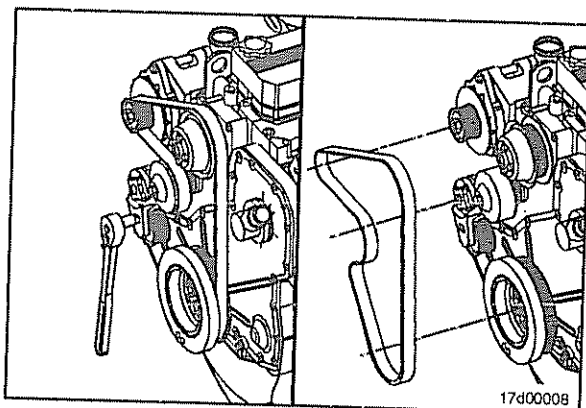
After replacing the belt, if the tensioner arm stops are still in contact with the spring casing stop, replace the tensioner.



Drive Belt, Alternator Remove

Lift the tensioner to relieve tension on the belt and remove the belt.

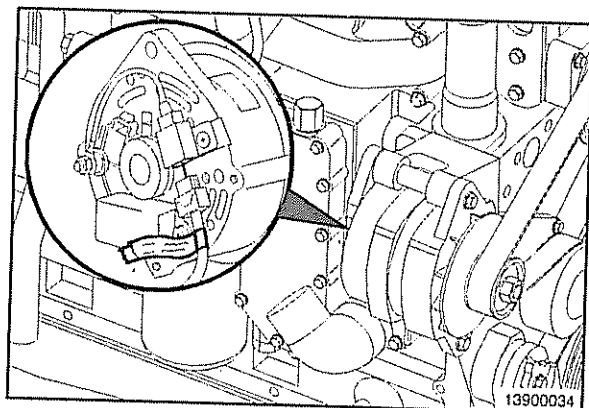




Install

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

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



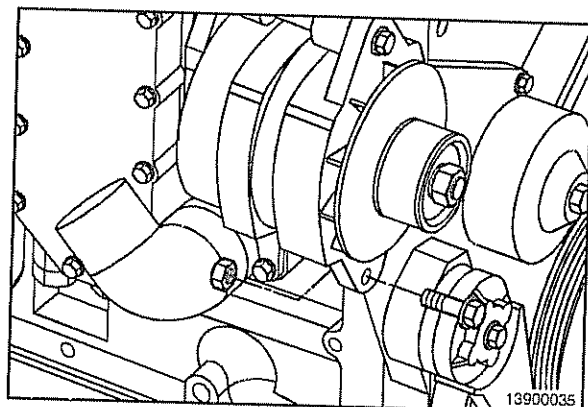
Alternator Remove

⚠ WARNING ⚠

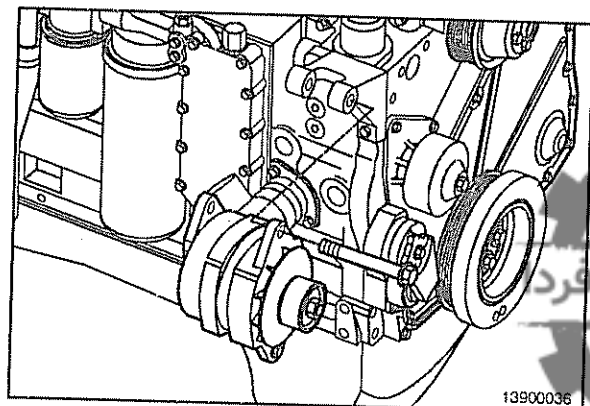
Batteries can emit explosive gases. To reduce the possibility of personal injury, always ventilate the compartment before servicing the batteries. To reduce the possibility of arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

Remove and tag all wires and complete the following steps:

- Disconnect the ground cable from the battery terminal.



Remove the alternator link capscrew.



Remove the alternator mounting capscrew.
Remove the alternator.

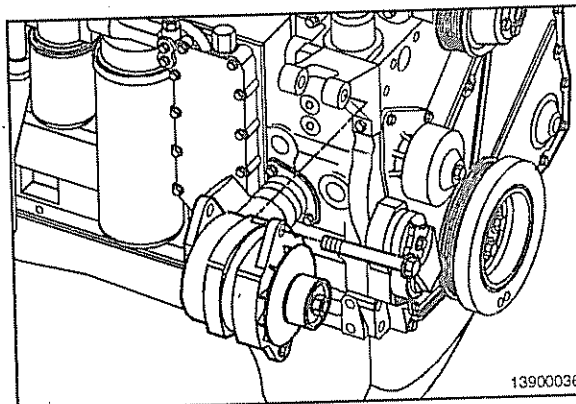
QSC8.3 and QSL9 Engines
Section A - Adjustment, Repair, and Replacement

Charge-Air Cooler
Page A-5

Install

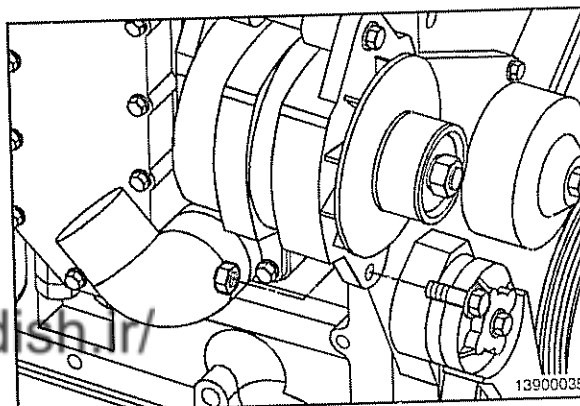
Install the alternator and alternator capscrews in the reverse order of removal.

Torque Value: 43 N•m [32 ft-lb]

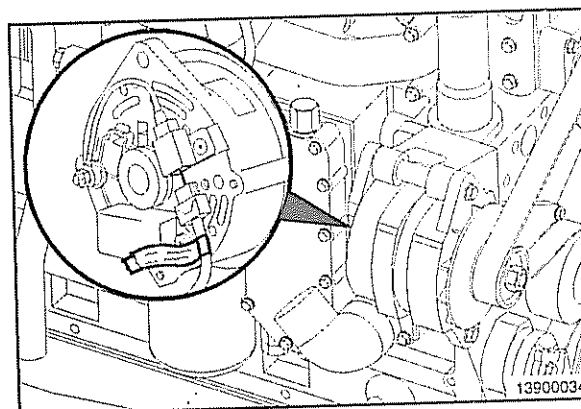


Install the alternator link capscrew.

Torque Value: 24 N•m [18 ft-lb]



Connect all wires to the alternator.
Connect the battery ground cable.

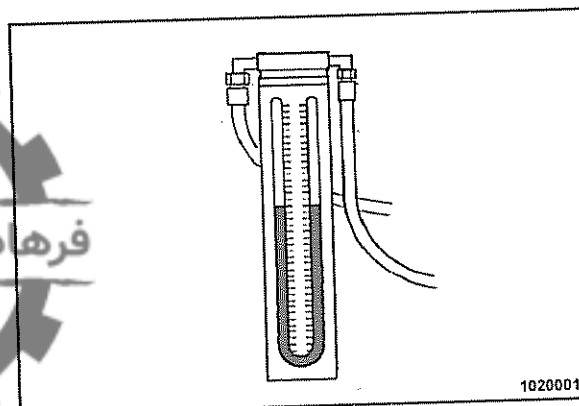


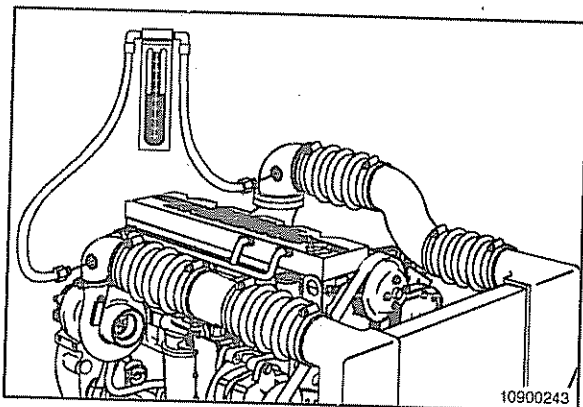
Charge-Air Cooler Pressure Test

Mercury Manometer, Part Number ST-1111-3

Preferred Method

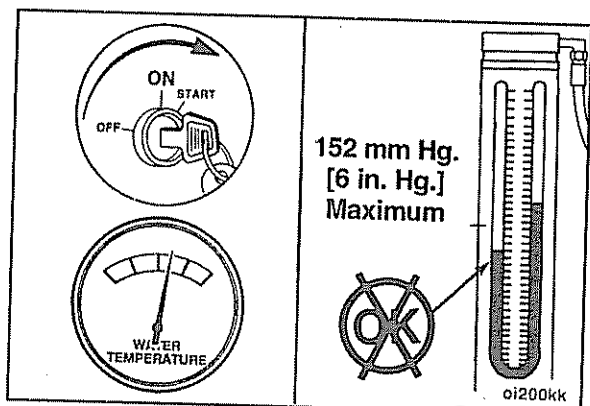
Measure the charge air cooler system pressure drop with a mercury manometer.





Install one end of a mercury manometer, Part Number ST-1111-3, in the 1/8-inch fitting in the turbocharger compressor outlet elbow.

Install the other end of the mercury manometer in the intake manifold.



Operate the engine at rated rpm and load. Record the readings on the manometer.

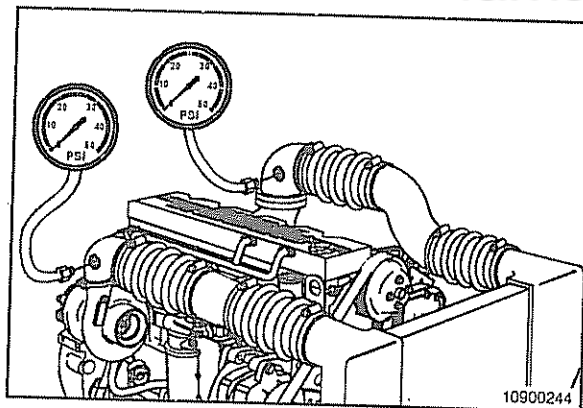


If the differential pressure is greater than 152 mm Hg [6 in. Hg], check the charge air cooler and associated piping for plugging, restrictions, or damage.



Clean or replace, if necessary.

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Pressure Gauge, Part Number ST-1273

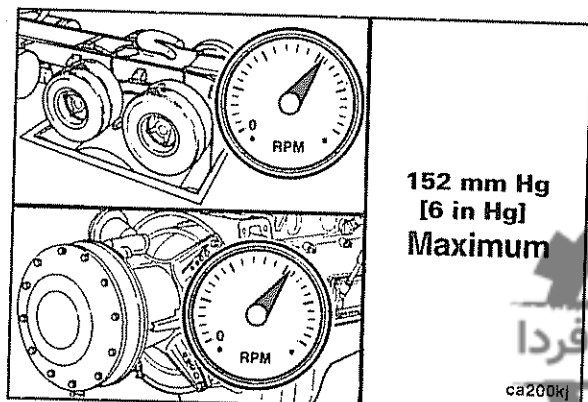
Optional Method



Obtain two pressure gauges, Part Number ST-1273. Check both gauges on the same pressure source at 206 kPa [30 psi] to maintain consistency.

Install one pressure gauge in the 1/8-inch fitting in the turbocharger compressor outlet elbow.

Install the other pressure gauge in the intake manifold.



Operate the engine at rated rpm and load. Record the readings on the two gauges.



If the differential pressure is greater than 152 mm Hg [6 in. Hg], check the charge air cooler and associated piping for plugging, restrictions, or damage.



Clean or replace, if necessary.

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Leak Test



WARNING

To prevent possible injury if either plug blows off during the test, secure safety chains on the test plugs to any convenient capscrew on the radiator assembly. This test must be performed with securely fastened safety chains.

To check the charge air cooler for cracked tubes or header, remove the inlet and outlet hoses from the cooler. The charge air cooler does **not** have to be removed from the chassis.

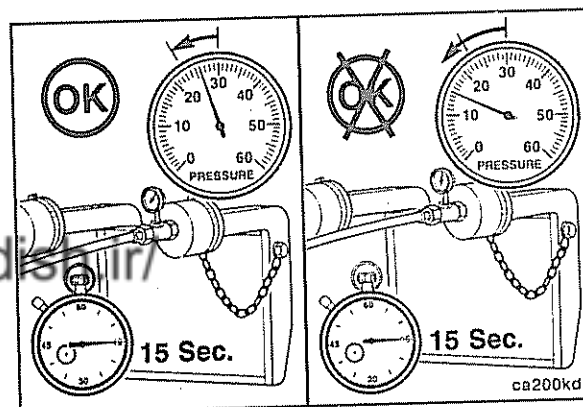
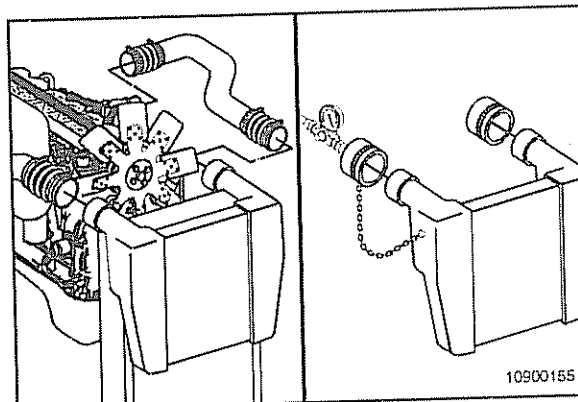
Install a plug or cap over the outlet side of the cooler. Install a pressure gauge and a regulated shop air supply line with a shutoff valve to the inlet side of the cooler.

Apply air pressure to the cooler until the pressure gauge reads a steady 207 kPa [30 psi] of air pressure.

Shutoff the air flow to the cooler, and start a stopwatch at the same time. Record the leakage at 15 seconds.

If the pressure drop is 48 kPa [7 psi] or less in 15 seconds, the cooler is operational.

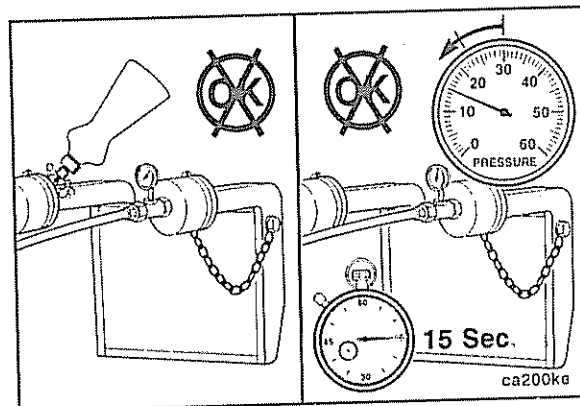
If the pressure drop is greater than 48 kPa [7 psi] in 15 seconds, check all connections again.

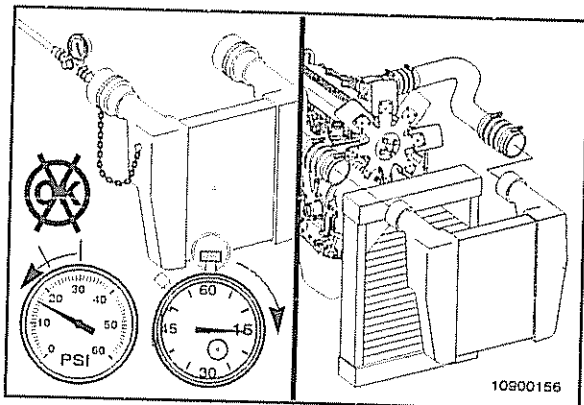


Determine if the pressure drop is caused by a leak in the charge air cooler or by a leaky connection. Use a spray bottle filled with soapy water applied to all hose connections, and watch for bubbles to appear at the location of the leak.

If the pressure drop is caused by a leaky connection, repair the connection, and repeat the test. If the leak is within the charge air cooler, repeat the test to verify the accuracy of the pressure drop measurement. Similar pressure drop readings **must** be obtained at least three consecutive tests before the reading can be considered accurate.

NOTE: If a charge air cooler leaks more than 48 kPa [7 psi] in 15 seconds, it will appear as a major leak in a leak tank.

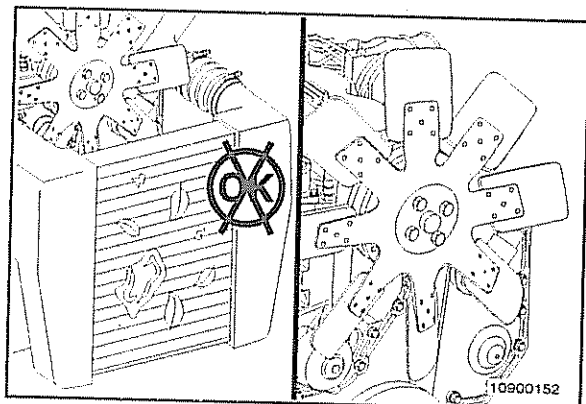




If the pressure drop is greater than 48 kPa [7 psi] in 15 seconds, the charge air cooler **must** be replaced.

Refer to the equipment manufacturer's service manual for replacement instructions.

NOTE: Charge air coolers are **not** designed to be 100-percent leak-free. If the pressure drop is less than 48 kPa [7 psi] in 15 seconds, then the charge air cooler does **not** need to be replaced.

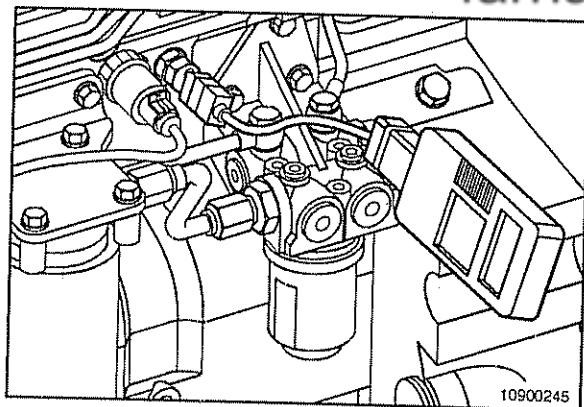


Temperature Differential Test

Inspect the charge air cooler fins for obstructions to air flow. Remove obstructions such as a winterfront or debris. Manually lock shutters in the OPEN position, if equipped.

Lock the fan drive in the ON mode to prevent erratic test results. This can be done by installing a jumper wire across the temperature switch.

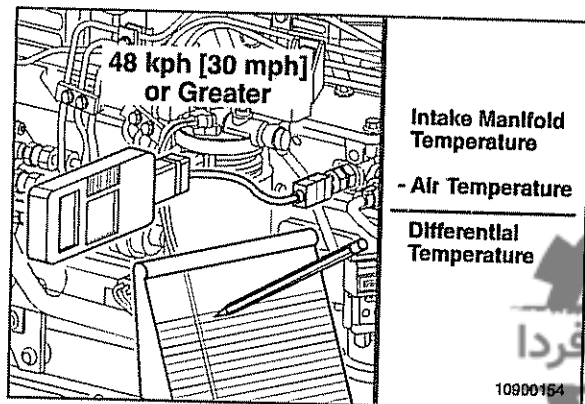
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Install fluke digital thermometer, Part Number 3822666, into the intake manifold at the 1/8-inch NPT tap near the air horn connection with the intake manifold.

Another alternative is to use the monitor mode on the INSITE™ electronic service tool.

Install another thermocouple at the air cleaner inlet to measure ambient air temperature.



Perform a road test with the engine at peak power and a vehicle speed of 48 kph [30 mph] or greater.

Record the intake manifold temperature and the ambient air temperature.

Calculate the differential temperature:

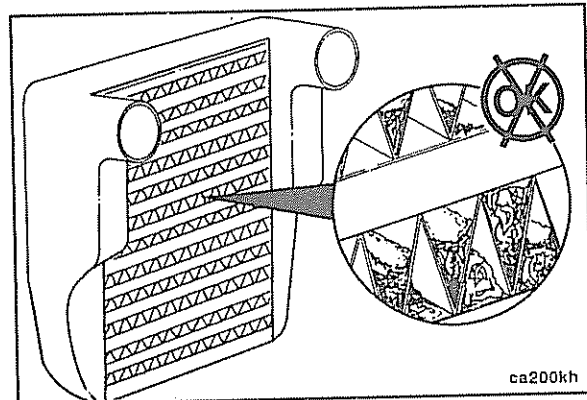
- Intake Manifold Temperature minus Ambient Air Temperature equals Differential Temperature
- Maximum Differential Temperature equals 28°C [50°F]

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QSC8.3 and QSL9 Engines
Section A - Adjustment, Repair, and Replacement

Starting Motor
Page A-9

If the temperature differential is greater than the specifications, check the charge air cooler for dirt and debris on the fins and clean as necessary. If the problem still exists, check the charge air cooler for debris in the fins or between the charge air cooler and radiator. Confirm full fan engagement.



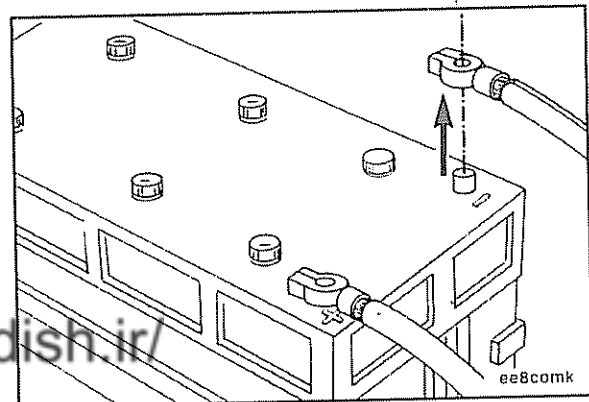
Starting Motor Preparatory Steps



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.

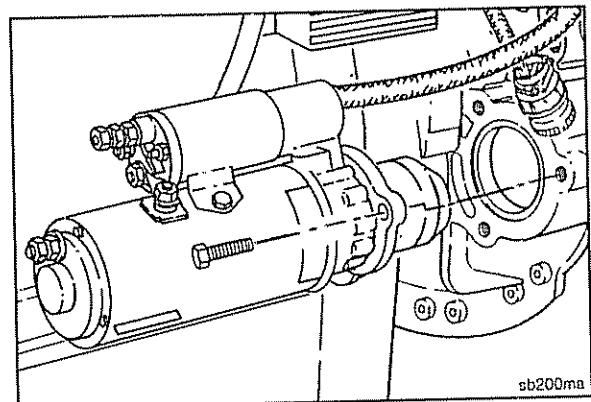
Remove and tag all wires.



Remove

Remove the three capscrews and the starting motor.

If equipped with a starting motor spacer, remove the spacer and clean all surfaces between the starting motor, starting motor spacer, and flywheel housing with a wire brush.

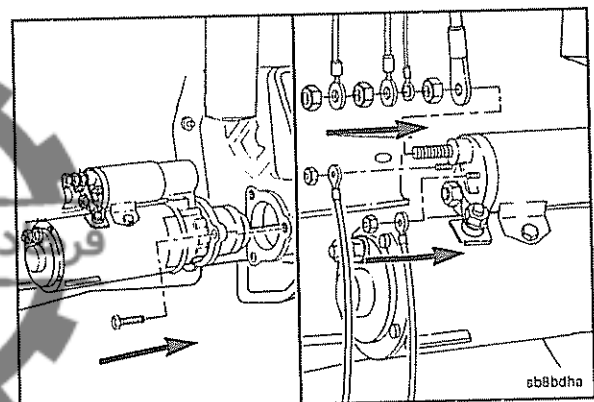


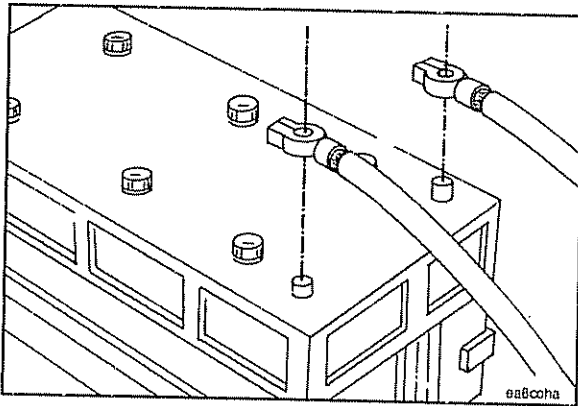
Install

Install the starting motor in the reverse order of removal.

Torque Value: 43 N•m [32 ft-lb]

Connect all electrical connections to the starting motor.





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.

Install and tighten the battery electrical connections. Connect the negative (-) cable last.

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Section D - System Diagrams

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General Information.....	D-1

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System Diagrams - Overview

General Information

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

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

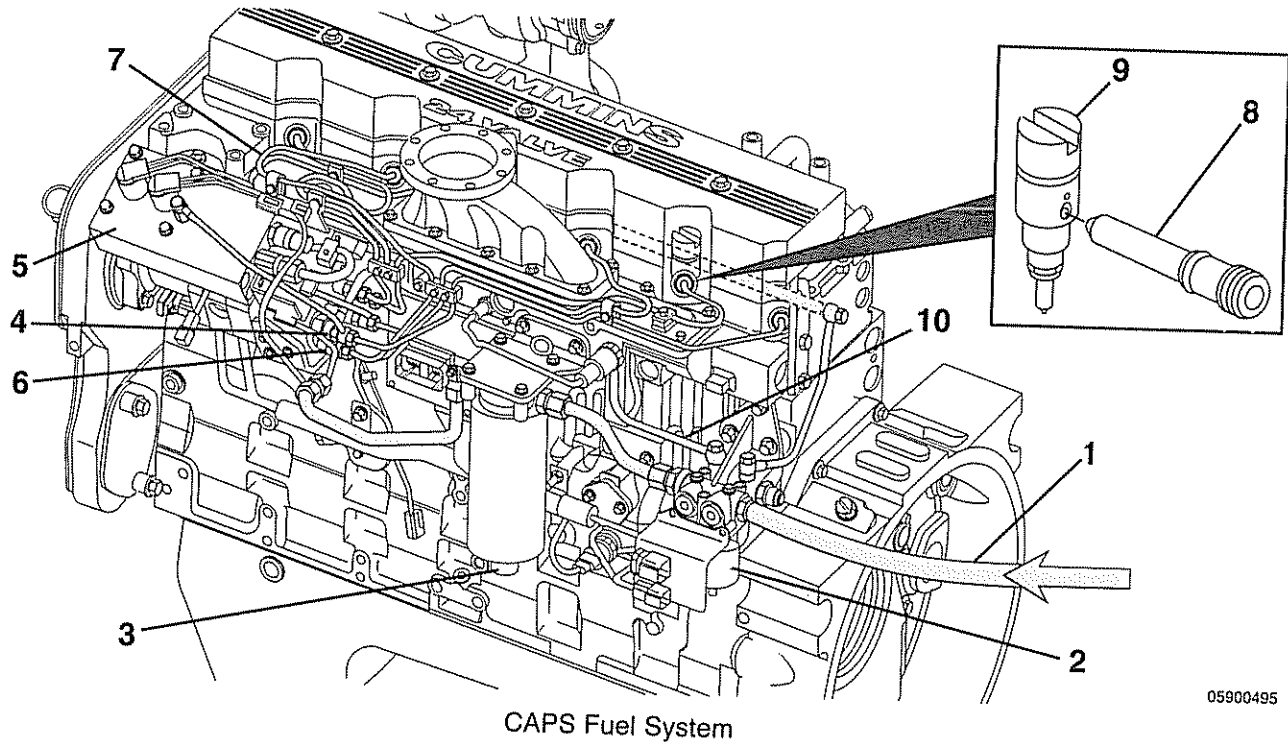
Knowledge of the engine systems can help you in troubleshooting, service, and general maintenance of your engine.

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Flow Diagram, Fuel System

General Information



05900495

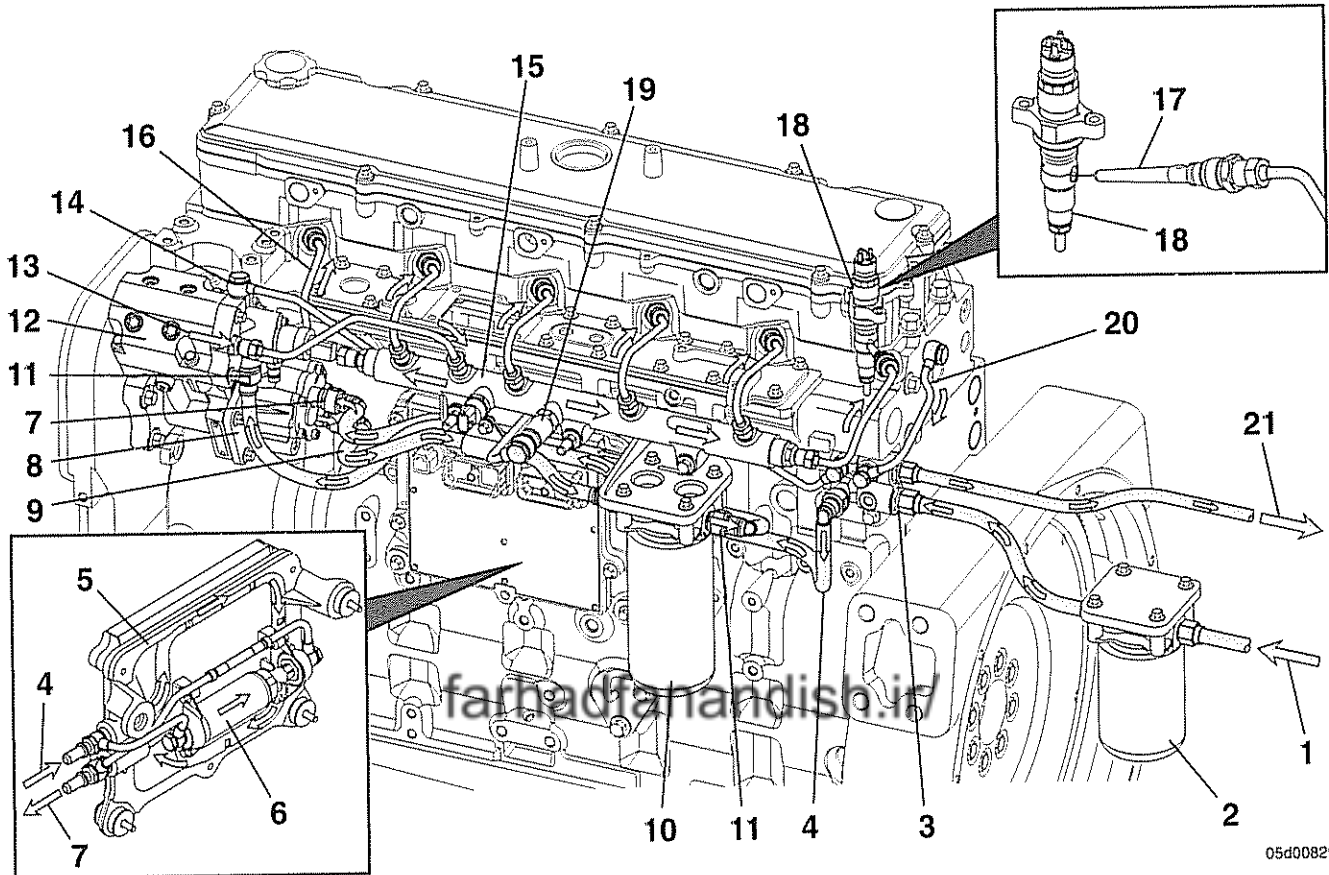
1. Fuel from supply tank
2. Electronic lift pump
3. Fuel filter and water separator
4. Fuel drain line
5. CAPS injection pump
6. Distributor outlet fitting
7. High-pressure supply lines
8. Fuel connector
9. Injectors
10. Fuel return to supply tank

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Flow Diagram, Fuel System

General Information



05d00829

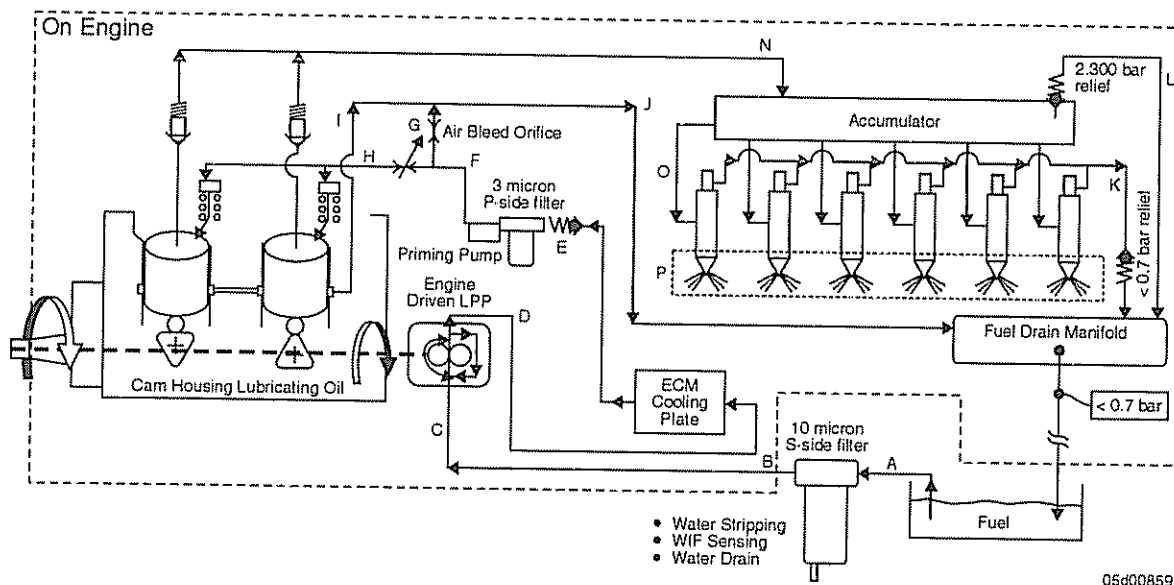
Cummins Common Rail Fuel System

1. Fuel from supply tank
2. Fuel filter and water separator
3. OEM fuel supply connection
4. Fuel supply to ECM mounted fuel lift pump
5. ECM cooling plate
6. ECM mounted fuel lift pump
7. Fuel outlet from ECM mounted fuel lift pump
8. Fuel gear pump
9. Fuel from gear pump to fuel filter
10. Primary fuel filter
11. Fuel inlet to fuel pump actuator
12. High-pressure fuel pump
13. Fuel outlet from high-pressure pump
14. High-pressure pump drain flow connection
15. Fuel rail
16. High-pressure injector supply lines
17. High-pressure fuel connector
18. Fuel injector
19. Fuel pressure relief valve
20. Fuel injector drain flow line
21. Fuel return to supply tanks



Flow Diagram, Fuel System

General Information



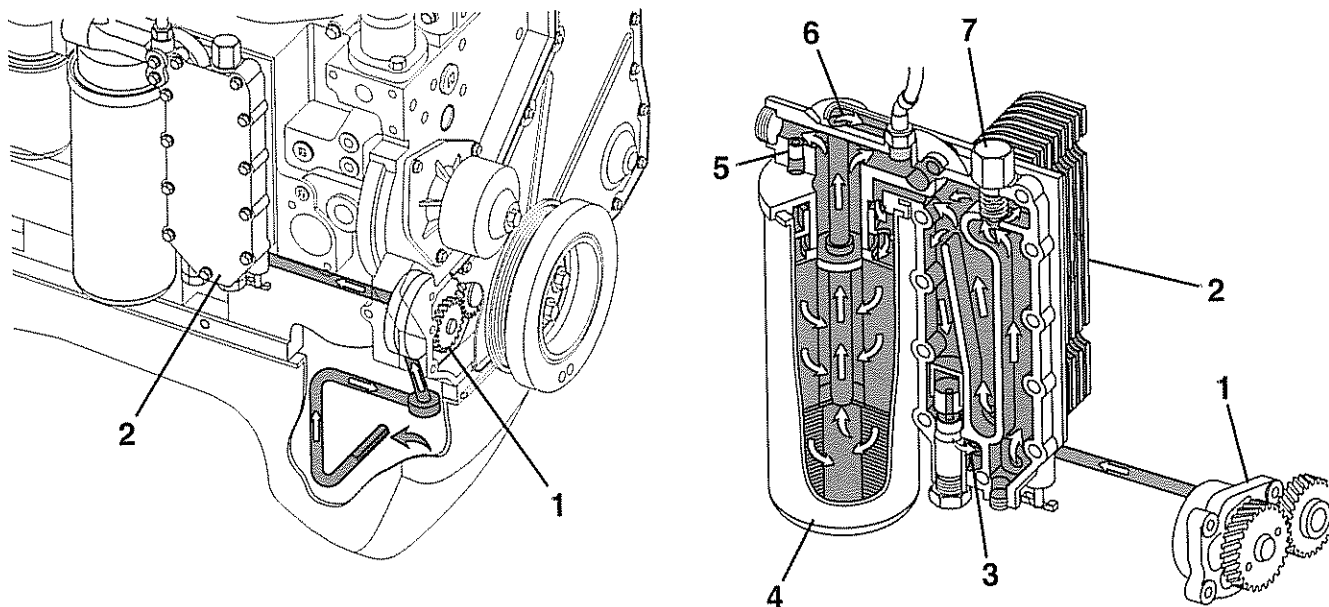
Cummins Common Rail Fuel System

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Flow Diagram, Lubricating Oil System

General Information



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Lubricating Oil Cooler Flow

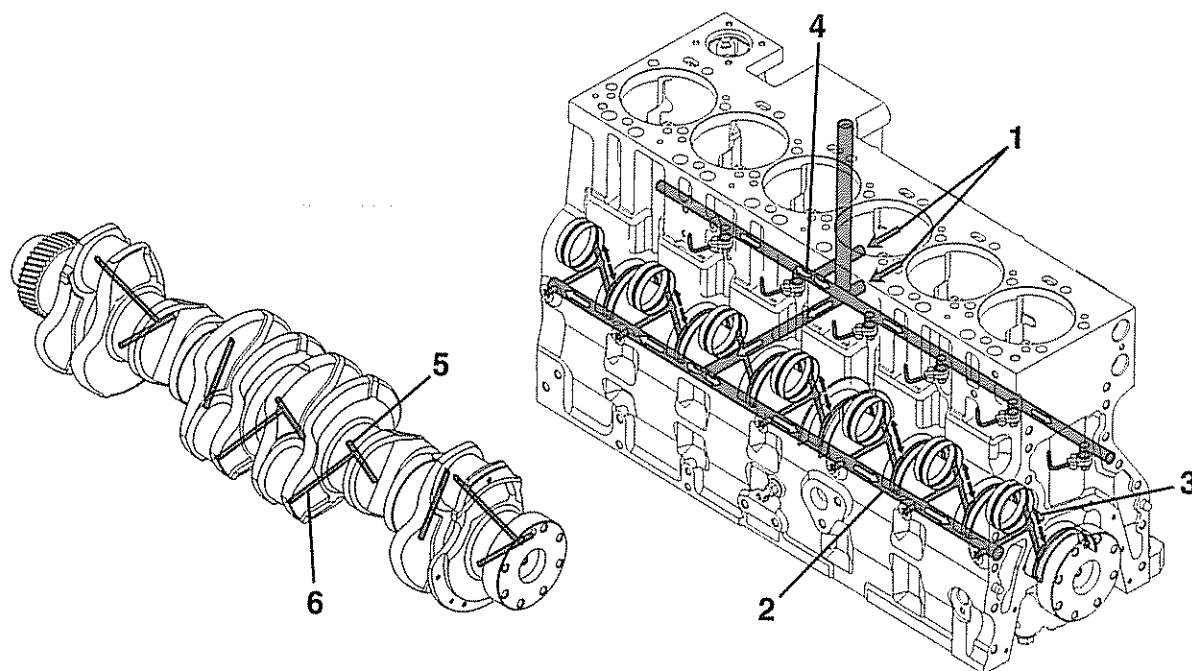
07d00183

1. Gerotor lubricating oil pump
2. Lubricating oil cooler
3. To lubricating oil pan
4. Full flow lubricating oil filter
5. Filter bypass valve
6. From lubricating oil filter



Flow Diagram, Lubricating Oil System

General Information



07d00185

Lubrication for Power Components (All ISL engines and ISC engines with CM850 Electronic Control Module)

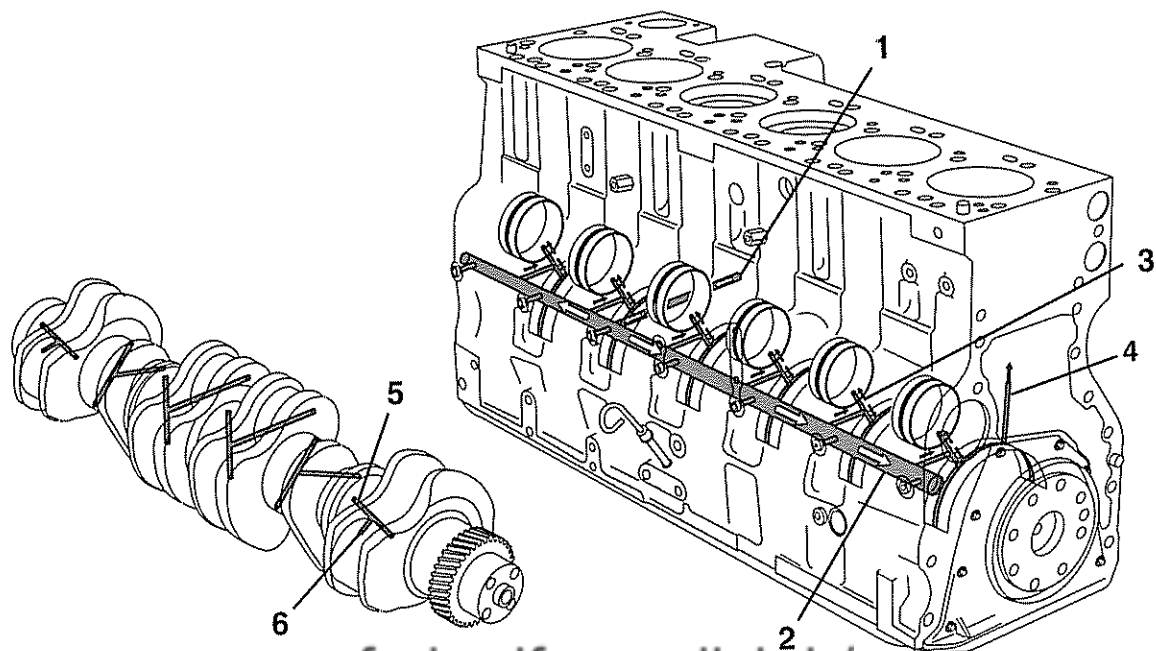
1. From lubricating oil cooler
2. Main lubricating oil rifle
3. To camshaft
4. To piston cooling nozzle
5. From main lubricating oil rifle
6. To connecting rod bearing.

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Flow Diagram, Lubricating Oil System

General Information



07d00001

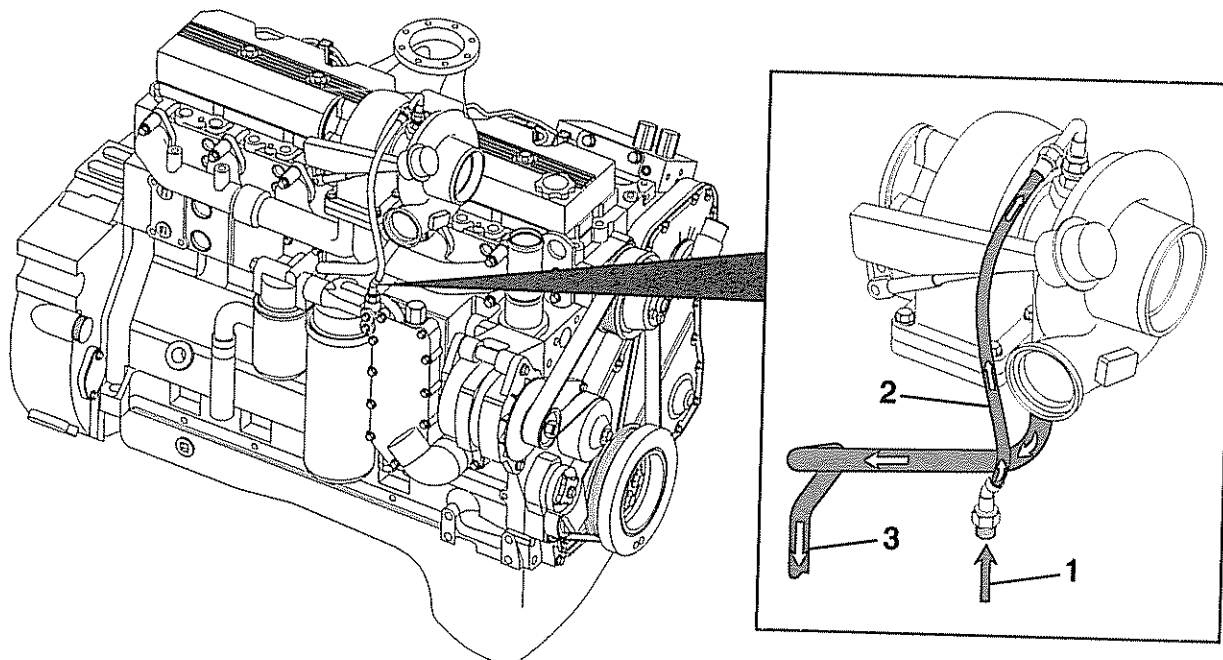
Lubrication for Power Components (ISC engines without CM850 Electronic Control Module)

1. From lubricating oil cooler
2. Main lubricating oil rifle
3. To camshaft
4. To piston cooling nozzle
5. From main lubricating oil rifle
6. To connecting rod bearing.



Flow Diagram, Lubricating Oil System

General Information



07d00184

Lubrication for Turbocharger

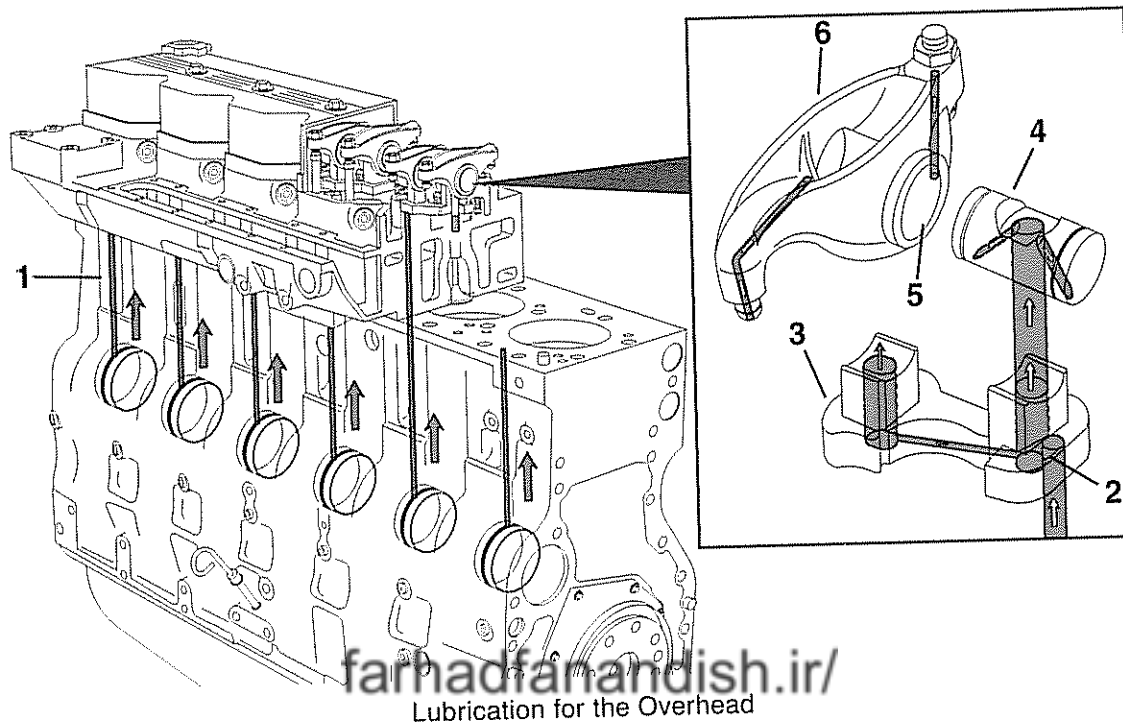
1. Lubricating oil supply from filter
2. Turbocharger lubricating oil supply
3. Turbocharger lubricating oil drain

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Flow Diagram, Lubricating Oil System

General Information



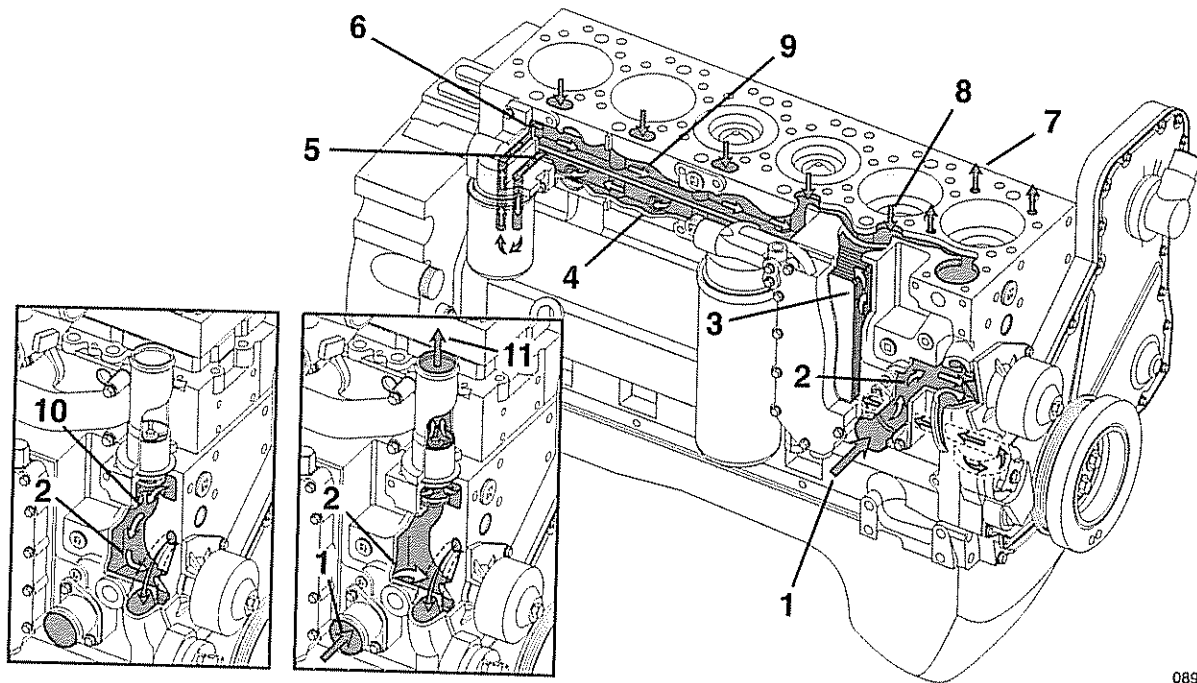
07d00002

1. From cam bushings
2. Transfer slot
3. Rocker lever support
4. Rocker lever shaft
5. Rocker lever bore
6. Rocker lever.



Flow Diagram, Cooling System

General Information



08900119

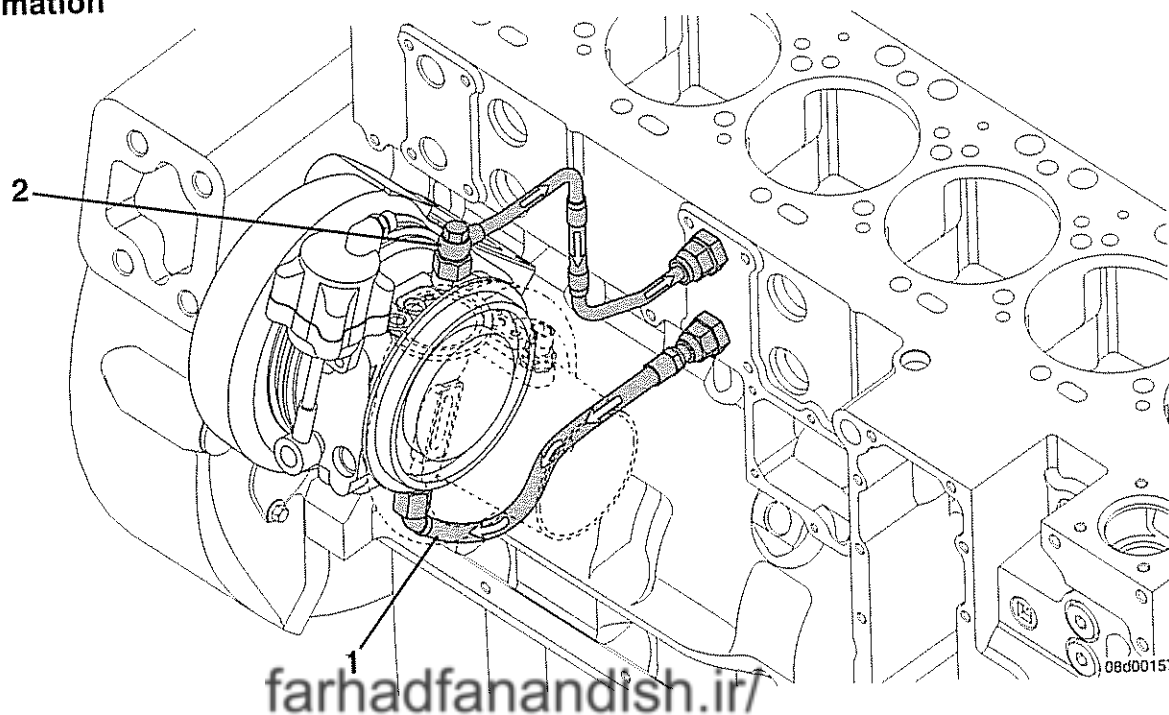
1. Coolant inlet from radiator
2. Water pump suction
3. Coolant flow through lubricating oil cooler
4. Block lower water manifold (to cylinders)
5. Coolant filter inlet (optional)
6. Coolant filter outlet (optional)
7. Coolant supply to cylinder head
8. Coolant return from cylinder head
9. Block upper water manifold
10. Thermostat bypass
11. Coolant return to radiator

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Flow Diagram, Cooling System

General Information

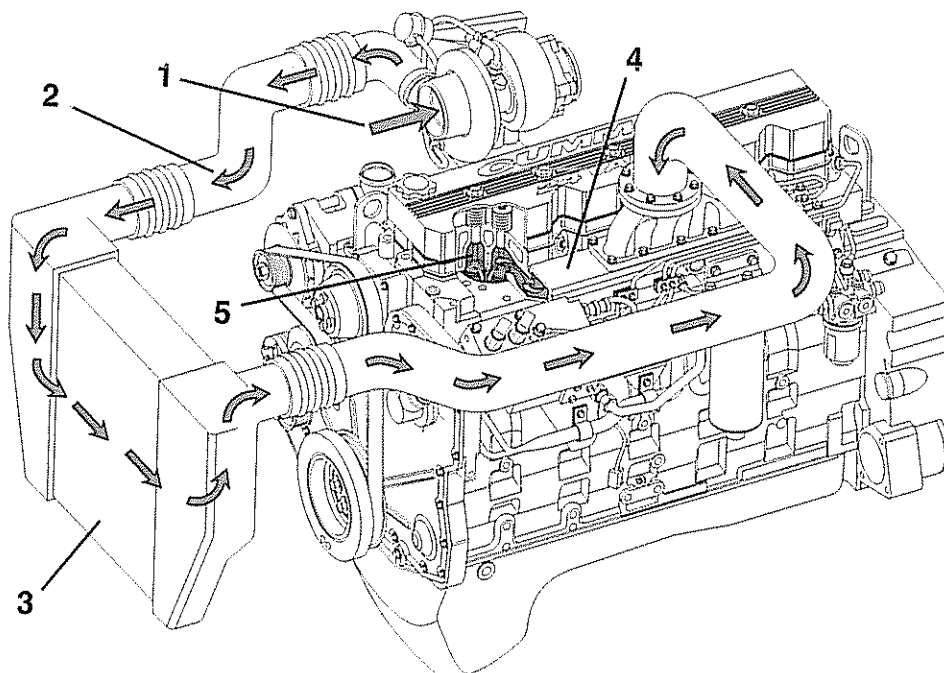


1. Turbocharger coolant supply
2. Turbocharger coolant drain



Flow Diagram, Air Intake System

General Information



10900225

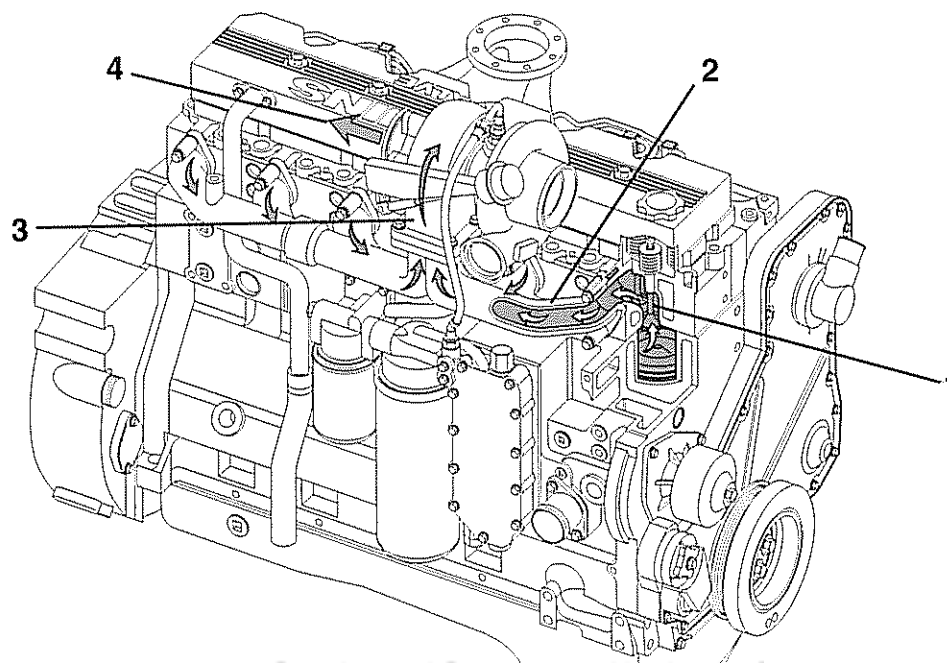
1. Intake Air Inlet to Turbocharger
2. Turbocharger Air to Charge Air Cooler
3. Charge Air Cooler
4. Intake Manifold (integral part of cylinder head)
5. Intake Valve.

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Flow Diagram, Exhaust System

General Information



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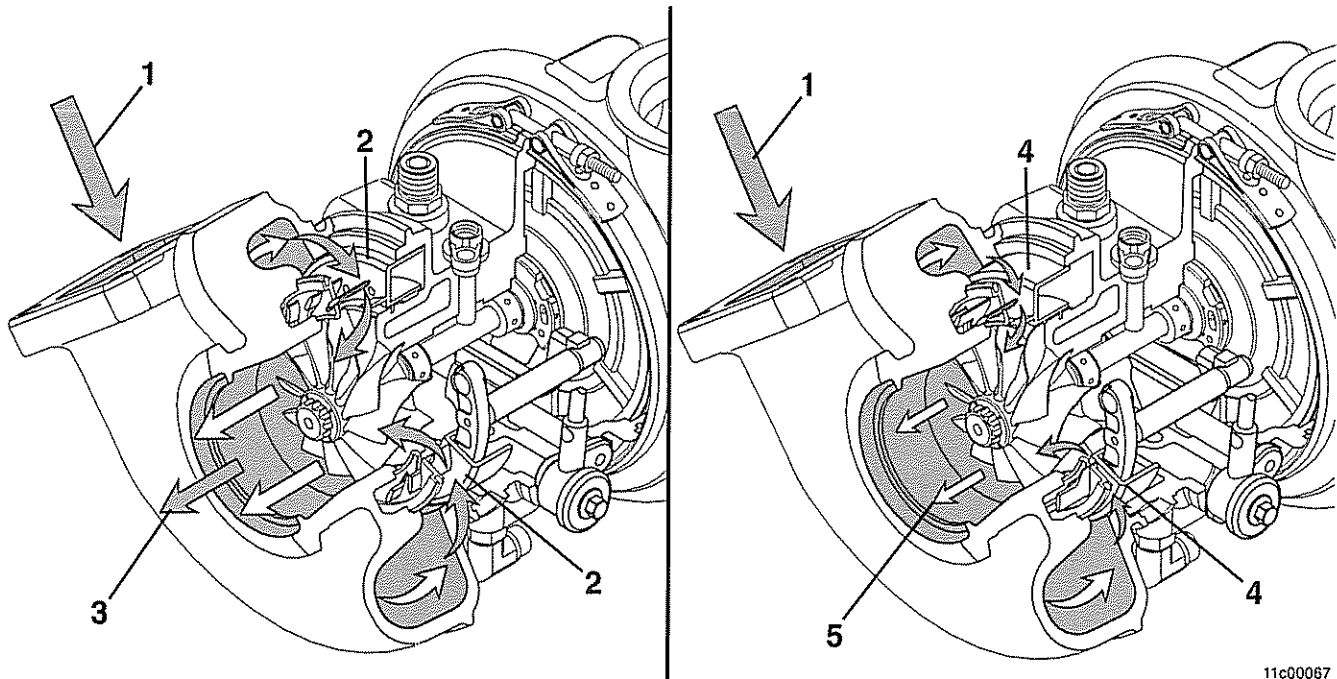
11d00001

- 1. Exhaust valve
- 2. Exhaust manifold (pulse type)
- 3. Dual-entry turbocharger
- 4. Turbocharger exhaust outlet.



Flow Diagram, Exhaust System

General Information



Variable Geometry Turbocharger

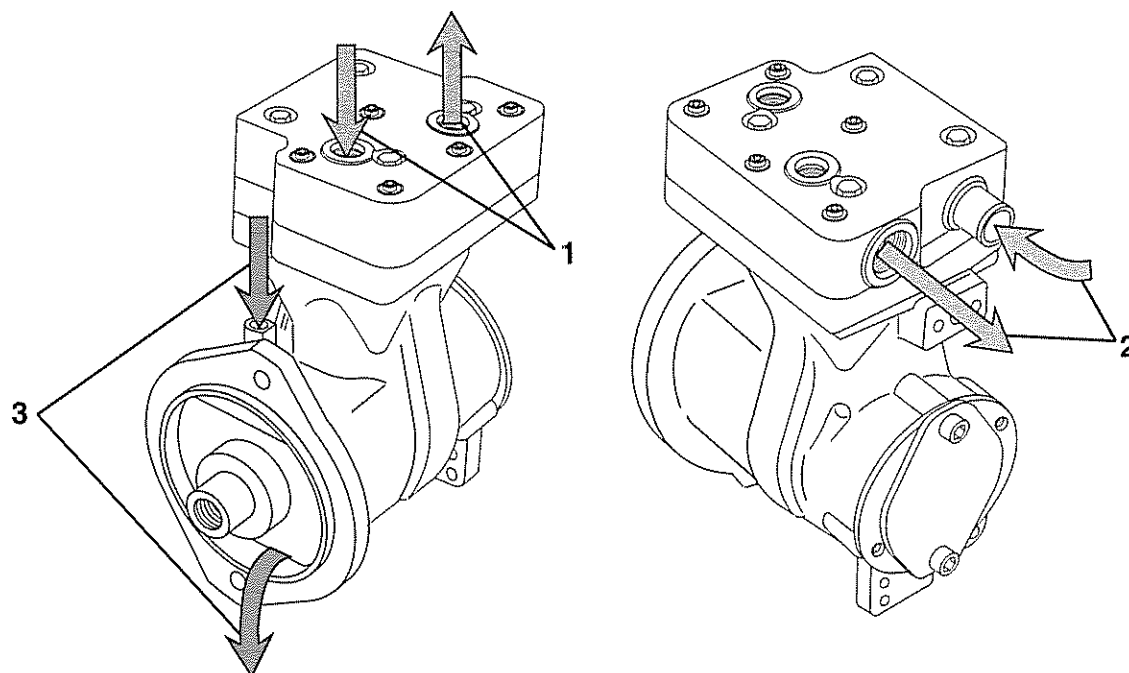
1. Exhaust in
2. Sliding nozzle open
3. Exhaust gas low velocity flow
4. Sliding nozzle closed
5. Exhaust gas high velocity flow

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Flow Diagram, Compressed Air System

General Information



12d00033

- 1. Coolant
- 2. Air
- 3. Lubricant

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Notes

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Section L - Service Literature

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Ordering On-Line.....	L-3
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Contact Information.....	L-2

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Additional Service Literature

General Information

The following publications can be purchased.

Bulletin Number	Title of Publication
4021416	Troubleshooting and Repair Manual, CM850 Electronic Control System
4021418	Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines
3666271	Troubleshooting and Repair Manual, ISC, QSC8.3, ISL Electronic Control System
4021421	Wiring Diagram, ISC and ISL CM850 Electronic Control Module
3666267	ISC Wiring and Fault Code Diagram
3666395	Wiring Diagram, QSC
3666416	Wiring Diagram, ISL
3666478	Wiring Diagram, QSL9
4021427	Owners Manual, ISC and ISL Engines
3379001	Fuel for Cummins Engines
3810340	Cummins Engine Oil Recommendations
3666132	Coolant Requirements and Maintenance
3379000	Air for Your Engines
3387622	Cold Weather Operation

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Service Literature Ordering Location Contact Information

Region

United States and Canada

U.K., Europe, Mid-East, Africa,
and Eastern European Countries

South and Central America
(excluding Brazil and Mexico)

Brazil and Mexico

Far East (excluding
Australia and New Zealand)

Australia and New Zealand

Ordering Location

Cummins Distributors

or

Credit Cards at 1-800-646-5609

or

Order online at www.powerstore.cummins.com

Cummins Engine Co., Ltd.

Royal Oak Way South

Daventry

Northants, NN11 5NU, England

Cummins Americas, Inc.

16085 N.W. 52nd Avenue

Hialeah, FL 33104

Cummins Inc.

International Parts Order Dept., MC 40931

Box 3005

Columbus, IN 47202-3005

Cummins Diesel Sales Corp.

Literature Center

8 Tanjong Penjuru

Jurong Industrial Estate

Singapore

Cummins Diesel Australia

Maroondah Highway, P.O.B. 139

Ringwood 3134

Victoria, Australia

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Cummins Customized Parts Catalog

General Information

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

The catalog cover, as well as the content, is customized with you in mind. You can use it in your shop, at your worksite, or as a coffee table book in your RV or boat. The cover contains your name, company name, address, and telephone number. Your name and engine model identification even appears on the catalog spine. Everybody will know that Cummins created a catalog specifically for you.

This new catalog was designed to provide you with the exact information you need to order parts for your engine. This will be valuable for customers that do not have easy access to the Cummins Electronic Parts Catalog or the Cummins Parts Microfilm System.

Additional Features of the Customized Catalog include:

- Engine Configuration Data
- Table of Contents
- Separate Option and Parts Indexes
- Service Kits (when applicable)
- ReCon Part Numbers (when applicable)

Ordering the Customized Parts Catalog

Ordering by Telephone

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

Ordering On-Line

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

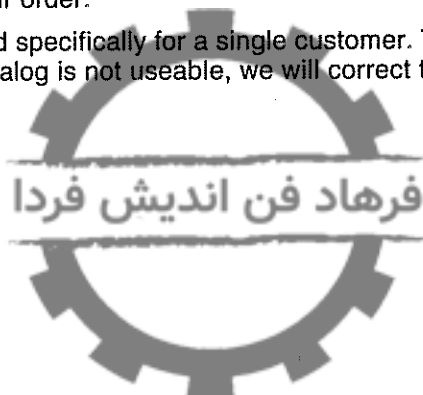
Contact GDMS or the CUMMINS POWERSTORE for the current price; Freight may be an additional expense.

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

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

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

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



Notes

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Component Manufacturers' Addresses

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

Air Compressors

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

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

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

Air Cylinders

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

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

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

Air Heaters

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

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

Air Starting Motors

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

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

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

Alternators

Robert Bosch Ltd.
P.O. Box 98
Broadwater Park
North Orbital Road
Denham
Uxbridge
Middlesex UD9 5HG
England
Telephone: (0)1895-838883

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

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

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

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

Auxiliary Brakes

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

Belts

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

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

Gates Rubber Company
900 S. Broadway
Denver, CO 80217

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

Catalytic Converters

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

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

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

Coolant Level Switches

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

Clutches

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

Twin Disc Incorporated
1328 Racine Street
Racine, WI 53403

Coolant Heaters

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

Drive Plates

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

Electric Starting Motors

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

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

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

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

Electronic Switches

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

Engine Protection Controls

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

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

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

Fan Clutches

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

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

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

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

Fans

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

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

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

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

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

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

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

Fault Lamps

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

Filters

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

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

Flexplates

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

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

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

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

Fuel Coolers

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

Fuel Pumps

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

Fuel Warmers

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

Gauges

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

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

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

Governors

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

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

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

Heat Sleeves

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

Hydraulic and Power Steering Pumps

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

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

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

In-Line Connectors

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

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

Oil Heaters

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

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

Prelubrication Systems

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

Radiators

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

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

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

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

Throttle Assemblies

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

Torque Converters

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

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

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

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

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Section S - Service Assistance

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Routine Service and Parts

General Information

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

Emergency and Technical Service

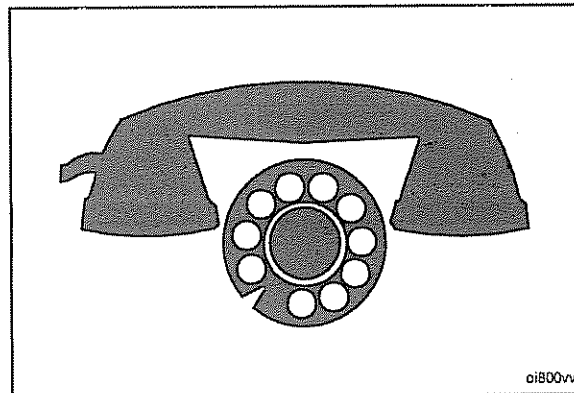
General Information

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

If additional assistance is required, call Toll-Free:

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

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



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Problem Solving

General Information

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

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

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



Division and Regional Offices - Locations

NOTE: The following list contains offices in U.S., Canada, Australia, New Zealand, and Puerto Rico.

United States	Southern Division Office	Cummins Engine Company, Inc. 425 Franklin Road S.W. Suite 500 Marietta, GA 30067 Telephone: (770) 423-1108 FAX: (770) 499-8240
United States	Plains Regional Office	Cummins Engine Company, Inc. 1901 Central Drive Suite 356 Bedford, TX 76021 Telephone: (817) 267-3172 FAX: N/A
Canada	Canadian Division Office	Cummins Diesel of Canada, Ltd. 5575 North Service Road Burlington, Ontario L7Z6M1 Telephone: (905) 331-5944 FAX: (905) 331-0276
Canada	Western Canada Regional Office	Cummins Diesel of Canada, Ltd. 18452 - 96th Avenue Surrey, B.C. V3T 4W2 Telephone: (604) 882-5727 FAX: (604) 882-9110
Canada	Eastern Canada Regional Office	Cummins Diesel of Canada Ltd. 7200 Trans Canada Hwy. Pt. Cuaire, Quebec H9R 1C0 Telephone: (514) 695-2402 FAX: (514) 695-8917
Canada	Central Canada Regional Office	Cummins Diesel of Canada Ltd. 4887 - 35th Street SE Calgary, Alberta T2B 3C6 FAX: (403) 569-9974
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 Latin America	3088 N. Commerce Parkway MPC #14, Building A Miramar, FL 33025 Telephone: (305) 621-1300 NOTE: This office serves Puerto Rico and South America excluding Brazil.



Distributors and Branches - United States

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

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

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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Distributors and Branches - Canada

Alberta	Edmonton Distributor and Branch	Cummins Alberta 11751 - 181 Street Edmonton, AB T5S 2K5 Telephone: (780) 455-2151 FAX: (780) 454-9512
Alberta	Calgary Branch	Cummins Alberta 4887 - 35th Street S.E. Calgary, Alberta T2B 3H6, Canada Telephone: (403) 569-1122 FAX: (403) 569-0027
Alberta	Grande Prairie	Cummins Alberta - Grande Prairie RR2, Site 9, Box 22 Sexsmith, AB CN T0H 3C0 Telephone: (780) 568-3359 FAX: (780) 568-2263
Alberta	Hinton Branch	Cummins Alberta 135 Veats Avenue Hinton, Alberta T7V 1S8, Canada Telephone: (780) 865-5111 FAX: (780) 865-5714
Alberta	Lethbridge Branch	Cummins Alberta 240 - 24th Street North Lethbridge, Alberta T1H 3T8, Canada Telephone: (403) 329-6144 FAX: (403) 320-5383
British Columbia	Vancouver Distributor	Cummins British Columbia 18452 - 96th Avenue Surrey, B.C., Canada V4N 3P8 Telephone: (604) 882-5000 FAX: (604) 882-5080
British Columbia	Kamloops Branch	Cummins British Columbia 976 Laval Crescent Kamloops, B.C. Canada V2C 5P5 Telephone: (250) 828-2388 FAX: (250) 828-6713
British Columbia	Prince George Branch	Cummins British Columbia 102- 3851- 18th Avenue Prince George, B.C. V2N 1B1 Telephone: (250) 564-9111 FAX: (250) 564-5853
British Columbia	Sparwood Branch	Cummins British Columbia 731 Douglas Fir Road Sparwood, B.C. V0B 2G0, Canada Telephone: (250) 425-0522 FAX: (250) 425-0323
British Columbia	Tumbler Ridge Branch	Cummins British Columbia Industrial Site, Box 226 Tumbler Ridge, B.C. Canada V0C 2W0 Telephone: (250) 242-4217 FAX: (250) 242-4906

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

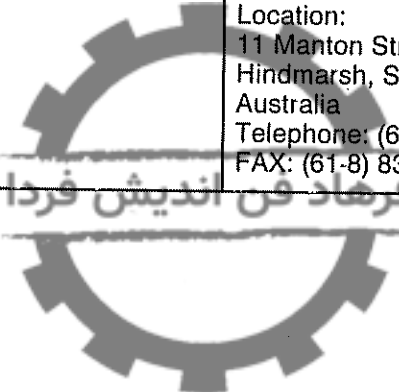
Ontario	Whitby Branch	Cummins Ontario Inc. 1311 Hopkins Street Whitby, Ontario L1N 2C2, Canada Telephone: (905) 668-6886 FAX: (905) 668-1375
Quebec	Montreal Distributor	Cummins Eastern Canada, Inc. 7200 Trans Canada Highway Pointe Claire, Quebec H9R 1C2, Telephone: (514) 695-8410 FAX: (514) 695-8917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

Distributors and Branches - Australia

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

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

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



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

Distributors and Branches - New Zealand

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 16-149 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



Regional Offices - International - Locations

European Regional Office - Mechelen

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Bogota Regional Office - Columbia									
Cummins Engine Co. de Colombia S.A. Carrera 11A No. 90-15 Of. 601/602 Bogota, D.E., Colombia Telephone: (57-1) 610-4849	Mailing Address: Apartado Aereo 90988 Bogota D.E., Colombia								
<p>Countries Covered:</p> <table> <tr> <td>Argentina</td> <td>Ecuador</td> </tr> <tr> <td>Bolivia</td> <td>Paraguay</td> </tr> <tr> <td>Chile</td> <td>Peru</td> </tr> <tr> <td>Colombia</td> <td>Uruguay</td> </tr> </table>		Argentina	Ecuador	Bolivia	Paraguay	Chile	Peru	Colombia	Uruguay
Argentina	Ecuador								
Bolivia	Paraguay								
Chile	Peru								
Colombia	Uruguay								

Gross-Gerau Regional Office - Germany															
Cummins Diesel Deutschland GmbH Odenwaldstr. 23 D-4521 Gross-Gerau Germany Telephone: (49-6152) 174-0															
<p>Countries Covered:</p> <table> <tr> <td>Albania</td> <td>Poland</td> </tr> <tr> <td>Bulgaria</td> <td>Romania</td> </tr> <tr> <td>Latvia</td> <td>Lithuania</td> </tr> <tr> <td>Germany</td> <td>Estonia</td> </tr> <tr> <td>Luxembourg</td> <td>Croatia</td> </tr> <tr> <td>Slovenia</td> <td>Bosnia</td> </tr> <tr> <td>Macedonia</td> <td></td> </tr> </table>		Albania	Poland	Bulgaria	Romania	Latvia	Lithuania	Germany	Estonia	Luxembourg	Croatia	Slovenia	Bosnia	Macedonia	
Albania	Poland														
Bulgaria	Romania														
Latvia	Lithuania														
Germany	Estonia														
Luxembourg	Croatia														
Slovenia	Bosnia														
Macedonia															

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



Pune Kirloskar Regional Office - India	
Kirloskar Cummins Limited Kothrud Pune - 411 029, India Telephone: (91-212) 33-0240, 33-5435, 33-1105	
Countries Covered:	Bhutan India Nepal

Milan Regional Office - Italy	
Cummins Diesel Italia S.P.A. Piazza Locatelli 8 Zona Industriale 20098 San Giuliano Milanese Milan, Italy Telephone: (+ 39-02) 98-83-111	
Country Covered:	Italy

North Asia Regional Office - Japan	
Cummins Diesel Sales Corporation 1-12-10 Shintomi Chuo-ku, Tokyo 104 Japan Telephone: (81-3) 3555-3131/2/3/4/5	
Country Covered:	Japan

Seoul Regional Office - Korea	
Cummins Korea Ltd. 5th Floor, Hye Sung Building 35-26 Sam Sung Dong, Kang Nam Ku Seoul, South Korea Telephone: (82-2) 516-0431/2/3, 517-3370/1	
Country Covered:	South Korea



Cummsa Regional Office - Mexico	
Cummins, S.A. de C.V. Arquimedes No. 209 Col. Polanco 11560 Mexico, D.F. Mexico Telephone: (52-5) 254-3822/3783/3622	Mailing/Shipping Address: Gonzalez de Castilla Inc. P.O. Box 1391 4605 Modern Lane Modern Industrial Park Laredo, TX 78040 Telephone: (512) 722-5207
Country Covered: Mexico	

Moscow Regional Office - Russia															
Cummins Engine Co., Inc. Park Place Office E708 Leninsky Prospect 113 Russia 117198 Telephone: (7-502) 256-5122 or 256-5123															
Countries Covered: <table border="0"> <tr> <td>Armenia</td> <td>Moldova</td> </tr> <tr> <td>Azerbaijan</td> <td>Russia</td> </tr> <tr> <td>Belarus</td> <td></td> </tr> <tr> <td>Tajikistan</td> <td></td> </tr> <tr> <td>Georgia</td> <td>Turkmenistan</td> </tr> <tr> <td>Kyrgyzstan</td> <td>Ukraine</td> </tr> <tr> <td>Kazakhstan</td> <td>Uzbekistan</td> </tr> </table>		Armenia	Moldova	Azerbaijan	Russia	Belarus		Tajikistan		Georgia	Turkmenistan	Kyrgyzstan	Ukraine	Kazakhstan	Uzbekistan
Armenia	Moldova														
Azerbaijan	Russia														
Belarus															
Tajikistan															
Georgia	Turkmenistan														
Kyrgyzstan	Ukraine														
Kazakhstan	Uzbekistan														

South And East Asia Area Office - Singapore															
Cummins Diesel Sales Corporation 8 Tanjong Penjuru Jurong Industrial Estate Singapore 2260 Telephone: (65) 265-0155															
Countries Covered: <table border="0"> <tr> <td>Bangladesh</td> <td>Malaysia</td> </tr> <tr> <td>Brunei</td> <td>Mongolia</td> </tr> <tr> <td>Burma/Myanmar</td> <td>Philippines</td> </tr> <tr> <td>Cambodia</td> <td>Singapore</td> </tr> <tr> <td></td> <td>Sri Lanka</td> </tr> <tr> <td>Indonesia</td> <td>Thailand</td> </tr> <tr> <td>Laos</td> <td>Vietnam</td> </tr> </table>		Bangladesh	Malaysia	Brunei	Mongolia	Burma/Myanmar	Philippines	Cambodia	Singapore		Sri Lanka	Indonesia	Thailand	Laos	Vietnam
Bangladesh	Malaysia														
Brunei	Mongolia														
Burma/Myanmar	Philippines														
Cambodia	Singapore														
	Sri Lanka														
Indonesia	Thailand														
Laos	Vietnam														



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

Middle East Regional Office	
Cummins Diesel FZE Units ZF 5 & 6, Jebel Ali Free Zone Dubai United Arab Emirates Telephone: (971) 4 883-8998 Fax: (971) 4 883-8997 E-mail: cdfze@emirates.net.ae)	
Countries Covered: MIDEAST Afghanistan Bahrain Cyprus Djibouti Egypt Iraq Iran	

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Jordan	Saudi Arabia
Kuwait	Sudan
Lebanon	Syria
Oman	U.A.E.
Pakistan	United Kingdom
Qatar	Yemen
Turkey	



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

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

Countries Covered:

NORTH/WEST/EAST AND CENTRAL AFRICA

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

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Latin America Regional Office - Miramar (U.S.A.)

Cummins Americas, Inc.
Miramar Park of Commerce
3450 Executive Way
Miramar, FL 33025
Telephone: (305) 431-5511

Countries

Covered:	Argentina	Guatemala
	Bolivia	Honduras
	Chile	Nicaragua
	Colombia	Panama
	Costa Rica	Paraguay
	Dominican Republic	Peru
	El Salvador	Uruguay
	Ecuador	Venezuela



Caracas Regional Office - Venezuela		
Cummins Engine Company Oficina de Delegado Torre La Primera, Oficina 5-D Av. Francisco de Miranda Chacao, Caracas 1060		Mailing Address: Cummins Engine Company M-227 c/o Jet Cargo International P.O. Box 020010 Miami, FL 33102-0010 U.S.A. Telephone: (58-2) 32-0563, 32-718
Countries Covered:	Costa Rica Dominican Republic El Salvador Guatemala	Honduras Nicaragua Panama Venezuela

Southern Africa Regional Office		
Cummins Diesel South Africa (Pty) Ltd 13 Eastern Service Road Kelvin View 2054 South Africa Telephone: (00 27 11) 321 8700 (from U.K.) Fax: (00 27 11 444 1899)		Mailing Address: Wendywood 2144 Gauteng South Africa
Countries Covered:	Angola Botswana Comoros Island Lesotho Madagascar Malawi Mauritius Mozambique Namibia	Swaziland South Africa ST. Helena Tanzania Zambia Zimbabwe



Distributors - International - Locations

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

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

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

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

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

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

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

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

GREECE	Athens	Ergotrak Box 51528 14 Km. National Rd. Athens-Lamia 14510 Kifissia, Greece Telephone: (30-1) 6293400/41
GREENLAND		- See Denmark
GRENADA	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
GUADELOUPE	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
GUAM	Barrigada	Mid-Pac Far East, Inc. Airport Industrial Park 825 Tiyan Parkway Barrigada, Guam 96921 Telephone: (671) 632-5160
GUATEMALA	Guatemala City	Maquinaria y Equipos, S.A. P.O. Box 2304 Guatemala City, Guatemala Location: Carretera Amatitlan Km 12 zona 12 Telephone: (502-2) 773334/7/9
GUINEA	Brussels (Office in Belgium)	BIA s.a. Rameistraat, 123 B-3090 - Overijse, Belgium Telephone: (32-2) 6892811
GUINEA BISSAU		- See North/West/East and Central Africa Regional Office - Daventry
GUYANA	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
GUYANA, FRENCH	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
HAITI	Miami (Office in U.S.A.)	Cummins Southeastern Power, Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
HOLLAND		- See Netherlands



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

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

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

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

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

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



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

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

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

TRINIDAD and TOBAGO	Miami (Office in U.S.A.)	Cummins Southeastern Power Inc. 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200
TURKEY	Istanbul	Hamamcioglu Muesseseleri Okul Cad. No. 9 81474 Orhanli - Tuzia Istanbul, Turkey Telephone: (90) 216-394-3210
UKRAINE		- See Moscow Regional Office - Moscow
UNITED ARAB EMIRATES	Dhabi	Cummins Diesel FZE P.O. Box 17636 Units ZF516, Jebel Ali Free Zone Dhabi, United Arab Emirates Telephone: (971) 4-883-8998
UNITED KINGDOM	Wellingborough	Cummins Diesel Rutherford Drive Park Farm South Wellingborough Northants NN8 2QH, England Telephone: (44-1933) 334200
URUGUAY	Montevideo	Santaro S.A. P.O. Box 379 Montevideo Uruguay Location: Avenida Millan No. 2441 Telephone: (598-2) 293908
VATICAN CITY		- See Italy
VENEZUELA	Caracas	Sudimat Apartado Postal 1322 Carmelitas Caracas 1010 Venezuela Location: Final Avenida San Martin Urb. la Quebradita Caracas 1061 Telephone: (58-2) 442-6161/2647
VIETNAM	Hanoi	Diethelm & Co. Ltd. Engineering Room No. 1, 2nd Floor 8 Trang Thi Street Hanoi, Vietnam Telephone: (84-4) 260-332, 244-394
VIETNAM	Ho Chi Minh City	Diethelm & Co. Ltd. Engineering 3rd Floor, IBC Building 1 Me Linh Square District 1 Ho Chi Minh City, Vietnam Telephone: (84-8) 294-102, 294-103
WESTERN SAMOA		- See South Pacific Regional Office - Melbourne

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

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Notes

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Section TS - Troubleshooting Symptoms

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Troubleshooting Procedures and Techniques

General Information

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

▲ WARNING ▲

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

Follow the suggestions below for troubleshooting:

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

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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.

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Air Compressor Air Pressure Rises Slowly

Cause

Correction

STEP 1

Air intake system restriction to air compressor is excessive

Replace the air compressor air cleaner (if installed). Check the air intake piping. Check engine air intake restriction if the air compressor inlet is plumbed to the vehicle or equipment intake system. Refer to Procedures 010-059 and 010-028.

OK

Go To Next Step

STEP 2

Air system leaks

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

OK

Go To Next Step

STEP 3

Air governor is malfunctioning or **not** set correctly

Check the air governor for correct operation. Make sure the air governor is located less than 0.6 m [2 ft] from the air compressor. Refer to the OEM service manual.

OK

Go To Next Step

STEP 4

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

Check for carbon buildup. Replace the air compressor discharge line, if necessary. Refer to Procedures 012-014 and .

OK

Go To Next Step

STEP 5

Air system component is malfunctioning

Check the operation of check valves, alcohol evaporators, air dryers, and other OEM-installed air system components. Refer to the manufacturer's instructions.

OK

Go To Next Step

STEP 6

Unloader valve is malfunctioning

Check the unloader valve and unloader body seal. Refer to the OEM service manual.



Air Compressor Cycles Frequently

Cause	Correction
<p>STEP 1 Air system leaks</p> <p>OK Go To Next Step</p>	<p>Block the vehicle wheels and check the air system for leaks with spring brakes applied and released. Check for leaks from the air compressor gaskets and the air system hoses, fittings, tanks, and valves. Refer to the OEM service manual.</p>
<p>STEP 2 Air governor is malfunctioning or not set correctly</p> <p>OK Go To Next Step</p>	<p>Check the air governor for correct operation. Make sure the air governor is located less than 0.6 m [2 ft] from the air compressor. Refer to the OEM service manual.</p>
<p>STEP 3 Air system component is malfunctioning</p> <p>OK Go To Next Step</p>	<p>Check the operation of check valves, alcohol evaporators, air dryers, and other OEM-installed air system components. Refer to the manufacturer's instructions.</p>
<p>STEP 4 E-type system is not plumbed correctly</p> <p>OK Go To Next Step</p>	<p>Install an Econ valve, a check valve, and system hoses. Refer to the OEM service manual.</p>
<p>STEP 5 Carbon buildup is excessive in the air discharge line, check valve, or cylinder head</p> <p>OK Go To Next Step</p>	<p>Check for carbon buildup. Replace the air compressor discharge line, if necessary. Refer to Procedures 012-014 and 010-033.</p>
<p>STEP 6 Air compressor pumping time is excessive</p> <p>OK Go To Next Step</p>	<p>Replace the desiccant cartridge on the Turbo/CR 2000 air dryer. Refer to the OEM service manual. Check the air compressor duty cycle. Install a larger air compressor, if necessary. Refer to the OEM service manual.</p>
<p>STEP 7 Air dryer outlet check valve is sticking</p>	<p>Lubricate or replace the air dryer outlet check valve assembly. Refer to the manufacturer's instructions.</p>



Air Compressor Noise is Excessive

Cause

Correction

STEP 1

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

Check for carbon buildup. Replace the air compressor discharge line, if necessary. Refer to Procedures 012-014 and 010-033.

OK

Go To Next Step

STEP 2

Ice buildup in the air system components

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

OK

Go To Next Step

STEP 3

Air compressor mounting hardware is loose, worn, or broken

Check air compressor mounting hardware. Refer to Procedure 012-014.

OK

Go To Next Step

STEP 4

Air compressor is sending air pulses into the air tanks

Install a ping tank between the air dryer and the wet tank. Refer to the OEM instructions.

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Air Compressor Pumping Excess Lubricating Oil into the Air System

Cause

Correction

STEP 1

Lubricating oil drain interval is excessive

Verify the correct lubricating oil drain interval. Refer to Procedure 102-002.

OK

Go To Next Step

STEP 2

Air intake system restriction to air compressor is excessive

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

OK

Go To Next Step

STEP 3

Contaminants are building up in the system reservoirs

Drain the reservoirs daily. Refer to Procedure 102-002

OK

Go To Next Step

STEP 4

E-type system is **not** plumbed correctly

Install an Econ valve, a check valve, and system hoses. Refer to the OEM service manual.

OK

Go To Next Step

STEP 5

Air compressor pumping time is excessive

Replace the desiccant cartridge on the Turbo/CR 2000 air dryer. Refer to the OEM service manual. Check the air compressor duty cycle. Install a larger air compressor, if necessary. Refer to the OEM service manual.

OK

Go To Next Step

STEP 6

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

Check for carbon buildup. Replace the air compressor discharge line, if necessary. Refer to Procedure 012-014 and 010-033.

OK

Go To Next Step

STEP 7

Lubricating oil pressure is above specification

Check the oil pressure. Refer to the Lubricating Oil Pressure High symptom tree.

OK

Go To Next Step

STEP 8

Air compressor runs hot

If coolant temperature is above normal, refer to the Coolant Temperature Above Normal - Gradual Overheat symptom tree.

OK

Go To Next Step

STEP 9

Air compressor pumping too high air pressure

Check the air governor for correct operation. Refer to the OEM service manual.

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

Cause

Correction

STEP 1
Air system leaks

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

OK
Go To Next Step

STEP 2
Air governor is malfunctioning or **not** set correctly

Check the air governor for correct operation. Refer to the OEM service manual.

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Air Compressor Will Not Stop Pumping

Cause

Correction

STEP 1

Air system leaks

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

OK

Go To Next Step

STEP 2

Air governor is malfunctioning or **not** set correctly

Check the air governor for correct operation. Make sure the air governor is located less than 0.6 m [2 ft] from the air compressor. Refer to the OEM service manual.

OK

Go To Next Step

STEP 3

Unloader valve is malfunctioning

Check the unloader valve and unloader body seal. Refer to the OEM service manual.

OK

Go To Next Step

STEP 4

Air governor signal line or actuator line is plugged

Inspect the signal line and actuator line. Refer to the manufacturer's instructions.

OK

Go To Next Step

STEP 5

Air system component is malfunctioning

Check the operation of check valves, alcohol evaporators, air dryers, and other OEM-installed air system components. Refer to the manufacturer's instructions.



Alternator Not Charging or Insufficient Charging

Cause

Correction

STEP 1

Vehicle gauge is malfunctioning

Check the vehicle gauge. Refer to the OEM service manual.

OK

Go To Next Step

STEP 2

Alternator belt is loose

Check the alternator belt tension. Refer to Procedure 013-005.

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 the manufacturer's wiring diagrams.

OK

Go To Next Step

STEP 4

Battery cables or connections are loose, broken, or corroded (excessive resistance)

Check the battery cables and connections.

OK

Go To Next Step

STEP 5

Batteries have malfunctioned

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

OK

Go To Next Step

STEP 6

Alternator or voltage regulator is malfunctioning

Test the alternator output. Replace the alternator or voltage regulator if necessary. Refer to the OEM service manual.

OK

Go To Next Step

STEP 7

Alternator is overloaded, or alternator capacity is below specification

Install an alternator with a higher capacity. Refer to the OEM service manual.



Alternator Overcharging

Cause

Correction

STEP 1

Battery cell is damaged (open circuit)

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

OK

Go To Next Step

STEP 2

Voltage regulator is malfunctioning

Check the voltage regulator. Replace the voltage regulator, if necessary. Refer to the OEM service manual.

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Coolant Loss - External

Cause	Correction
<p>STEP 1 Coolant level is above specification</p> <p>OK Go To Next Step</p>	<p>Check the coolant level. Refer to the OEM service manual.</p>
<p>STEP 2 External coolant leak</p> <p>OK Go To Next Step</p>	<p>Inspect the engine for coolant leaking from hoses, draincocks, water manifold, expansion and pipe plugs, fittings, radiator core, exhaust heat shield, heat exchanger, air compressor and cylinder head gaskets, lubricating oil cooler, water pump seal, and OEM-mounted components that have coolant flow.</p>
<p>STEP 3 Radiator cap is not correct, is malfunctioning, or has low-pressure rating</p> <p>OK Go To Next Step</p>	<p>Check the radiator pressure cap. Refer to the OEM service manual.</p>
<p>STEP 4 Cooling system hose is collapsed, restricted, or leaking</p> <p>OK Go To Next Step</p>	<p>Inspect the hoses. Refer to Procedure 008-018.</p>
<p>STEP 5 Coolant fill line is restricted or obstructed</p> <p>OK Go To Next Step</p>	<p>Check the coolant fill line for restrictions or obstructions. Refer to the OEM service manual.</p>
<p>STEP 6 Engine is overheating</p>	<p>Refer to the Coolant Temperature Above Normal - Gradual Overheat and the Coolant Temperature Above Normal - Sudden Overheat symptom trees.</p>



Coolant Temperature Above Normal - Gradual Overheat

Cause

Correction

STEP 1

Cold weather radiator cover or winterfront is closed

Open the cold weather radiator cover or the winterfront. Maintain a minimum of 384 cm² [60 in²] or approximately 19.6 x 19.6 cm [7.5 x 7.5 in] of opening at all times. Refer to .

OK

Go To Next Step

STEP 2

Charge air cooler fins, radiator fins, or air conditioner condenser fins are damaged or obstructed with debris

Inspect the charge air cooler, air conditioner condenser, and radiator fins. Clean, if necessary. Refer to the OEM service manual.

OK

Go To Next Step

STEP 3

Coolant level is below specification

Inspect the engine and cooling system for external coolant leaks. Repair if necessary. Add coolant. Refer to Coolant Recommendations and Specification, Procedure 018-004.

OK

Go To Next Step

STEP 4

Coolant mixture of antifreeze and water is **not** correct

Verify the concentration of antifreeze in the coolant. Add antifreeze or water to correct the concentration. Refer to Coolant Recommendations and Specification, Procedure 018-004.

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 broken or loose

Check the fan drive belt. Replace the belt if necessary. Refer to Procedure 008-002.

OK

Go To Next Step

STEP 7

Coolant temperature gauge is malfunctioning

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

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

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Coolant Temperature Above Normal - Gradual Overheat

Cause

Correction

STEP 9

Cooling system hose is collapsed, restricted, or leaking

Inspect the hoses. Refer to Procedure 008-018.

OK

Go To Next Step

STEP 10

Fill line or vent lines are restricted, obstructed, or **not** routed correctly

Check the vent lines and the fill line for correct routing and for restriction. Refer to the OEM service manual.

OK

Go To Next Step

STEP 11

Intake manifold air temperature is above specification

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

OK

Go To Next Step

STEP 12

Lubricating oil level is above or below specification

Check the oil level. Add or drain oil, if necessary. Refer to Procedure 007-043.

OK

Go To Next Step

STEP 13

Thermostat is **not** correct or is malfunctioning

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

OK

Go To Next Step

STEP 14

Lubricating oil is contaminated with coolant or fuel

Contact a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 15

Water pump is malfunctioning

Check the water pump for correct operation. Replace the water pump if necessary.

OK

Go To Next Step

STEP 16

Radiator core is internally obstructed or damaged, or the check valve or J-tube is malfunctioning

Inspect the radiator and clean if necessary. Refer to the OEM service manual.

OK

Go To Next Step

STEP 17

Torque converter is malfunctioning

Check the torque converter. Refer to the OEM service manual.

OK

Go To Next Step

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Coolant Temperature Above Normal - Gradual Overheat

Cause

Correction

STEP 18

Torque converter cooler or hydraulic oil cooler is malfunctioning

Remove and inspect the cooler cores and o-rings. Refer to the OEM service manual.

OK

Go To Next Step

STEP 19

Vehicle cooling system is **not** adequate

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

OK

Go To Next Step

STEP 20

Engine is overfueled

Check the engine fuel rate. Refer to the Fuel Consumption Excessive symptom tree.

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Coolant Temperature Above Normal - Sudden Overheat

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.

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

Fan drive belt is broken or loose

Check the fan drive belt. Replace the belt if necessary. Refer to Procedure 008-002.

OK

Go To Next Step

STEP 4

Cold weather radiator cover or winterfront is closed

Open the cold weather radiator cover or the winterfront. Maintain a minimum of 384 cm² [60 in²] or approximately 19.6 x 19.6 cm [7.5 x 7.5 in] of opening at all times. Refer to Procedure 101-004.

OK

Go To Next Step

STEP 5

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

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

OK

Go To Next Step

STEP 6

Charge air cooler fins, radiator fins, or air conditioner condenser fins are damaged or obstructed with debris

Inspect the charge air cooler, air conditioner condenser, and radiator fins. Clean, if necessary. Refer to Procedure 010-027.

OK

Go To Next Step

STEP 7

Coolant temperature gauge is malfunctioning

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

OK

Go To Next Step

STEP 8

Cooling system hose is collapsed, restricted, or leaking

Inspect the hoses. Refer to Procedure 008-018.

OK

Go To Next Step

STEP 9

Fill line or vent lines are restricted, obstructed, or **not** routed correctly

Check the vent lines and the fill line for correct routing and for restriction. Refer to the OEM service manual.

OK

<p align="center">STEP 10</p> <p>Thermostat is not correct or is malfunctioning</p>	<p>Check the thermostat for the correct part number and for correct operation. Contact a Cummins Authorized Repair Facility.</p>
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Coolant Temperature Below Normal

Cause	Correction
<p>STEP 1 Coolant temperature gauge or sensor is malfunctioning</p> <p>OK Go To Next Step</p>	<p>Test the gauge and the sensor. Repair or replace, if necessary. Refer to the OEM service manual.</p>
<p>STEP 2 Excessive coolant flow through OEM plumbing and heater cores</p> <p>OK Go To Next Step</p>	<p>Close valves to heater cores. Run engine. If engine operates at normal temperature, refer to the OEM service manual.</p>
<p>STEP 3 Engine is operating at low ambient temperature</p> <p>OK Go To Next Step</p>	<p>Check the winterfront, shutters, and under-the-hood air. Use under-the-hood intake air in cold weather. Refer to the OEM service manual.</p>
<p>STEP 4 Fan drive or fan controls are malfunctioning</p> <p>OK Go To Next Step</p>	<p>Check the fan drive and controls. Refer to the OEM service manual.</p>
<p>STEP 5 Thermostat is not correct or is malfunctioning</p>	<p>Check the thermostat for the correct part number and for correct operation. Contact a Cummins Authorized Repair Facility.</p>

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Cranking Fuel Pressure is Low

Cause

Correction

STEP 1

Fuel connections on the low-pressure side of the pump are loose

Tighten all fuel fittings and connections between the fuel tanks and the fuel pump.

OK

Go To Next Step

STEP 2

Fuel level is low in the tank

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

OK

Go To Next Step

STEP 3

Fuel suction standpipe in the fuel tank is broken

Check and repair the standpipe, if necessary. Refer to the OEM service manual.

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Engine Acceleration or Response Poor

Cause

Correction

STEP 1

Operator technique is **not** correct

Refer to Operating Instructions, Section 1.

OK

Go To Next Step

STEP 2

Fuel level is low in the tank

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

OK

Go To Next Step

STEP 3

Vehicle parasitics are excessive

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

OK

Go To Next Step

STEP 4

Clutch is malfunctioning or is **not** correct

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

OK

Go To Next Step

STEP 5

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

Check for correct gearing and drivetrain components. Refer to the OEM service manual.

OK

Go To Next Step

STEP 6

Electronic fault codes are active

For instructions on how to read active fault codes, refer to Diagnostic Fault Codes in Section 1. If fault codes are active, contact a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 7

Fuel leak

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

OK

Go To Next Step

STEP 8

Intake manifold air temperature is above specification

Refer to Intake Manifold Air Temperature Above Specification symptom tree.

OK

Go To Next Step

STEP 9

Fuel supply line restriction between the fuel pump and the injectors

Check the fuel supply line from the fuel pump to the cylinder head for sharp bends that can cause restrictions. Refer to the OEM service manual.

OK

Go To Next Step

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Engine Acceleration or Response Poor

Cause

Correction

STEP 10

Charge air cooler is restricted or leaking

Inspect the charge air cooler for air restrictions or leaks. Refer to Procedure 010-027.

OK

Go To Next Step

STEP 11

Air intake or exhaust leaks

Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to Procedures 010-033.

OK

Go To Next Step

STEP 12

Air intake system restriction is above specification

Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to the Intake Manifold Air Temperature Above Specification symptom tree.

OK

Go To Next Step

STEP 13

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

Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications, Procedure 018-002.

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

Cause

Correction

<p>STEP 1 Fuel level is low in the tank</p> <p>OK Go To Next Step</p>	<p>Fill the supply tank. Refer to the OEM service manual.</p>
<p>STEP 2 Electronic fault codes are active</p> <p>OK Go To Next Step</p>	<p>For instructions on how to read active fault codes, refer to Diagnostic Fault Codes in Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.</p>
<p>STEP 3 Starting aid is necessary for cold weather or starting aid is malfunctioning</p> <p>OK Go To Next Step</p>	<p>Check for the correct operation of the starting aid. Refer to the manufacturer's instructions. Refer to Diagnostic Fault Codes in Procedure 101-007 Section 1.</p>
<p>STEP 4 Engine block heater is malfunctioning (if equipped)</p> <p>OK Go To Next Step</p>	<p>Check the electrical sources and wiring to the cylinder block heater. Replace the block heater, if necessary. Refer to the OEM service manual.</p>
<p>STEP 5 Fuel heater is malfunctioning (if equipped)</p> <p>OK Go To Next Step</p>	<p>Check the fuel heater and replace, if necessary. Refer to the OEM service manual.</p>
<p>STEP 6 Battery voltage is low</p> <p>OK Go To Next Step</p>	<p>Check the batteries and the unswitched battery supply circuit. Refer to Procedure 013-007 and the OEM service manual.</p>
<p>STEP 7 Engine cranking speed is too slow</p> <p>OK Go To Next Step</p>	<p>If the cranking speed is slower than 150 rpm, refer to the OEM service manual.</p>
<p>STEP 8 Vehicle parasitics are excessive</p> <p>OK Go To Next Step</p>	<p>Check the vehicle brakes for dragging, transmission malfunction, cooling fan operation cycle time, and engine-driven units. Refer to the OEM service manual.</p>
<p>STEP 9 Fuel leak</p> <p>OK Go To Next Step</p>	<p>Check the fuel lines, fuel connections, and fuel filters for leaks. Check the fuel lines to the supply tanks. Refer to the OEM service manual.</p>

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

Cause

Correction

STEP 10

Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe, and fuel filters as necessary.

OK

Go To Next Step

STEP 11

Air intake system restriction is above specification

Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Intake Manifold Air Temperature Above Specification symptom tree.

OK

Go To Next Step

STEP 12

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

Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications, Procedure 018-002.

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

Cause

Correction

<p>STEP 1 Fuel level is low in the tank</p>	<p>Fill the supply tank. Refer to the OEM service manual.</p>
<p>OK Go To Next Step</p>	
<p>STEP 2 Electronic fault codes are active</p>	<p>For instructions on how to read active fault codes, refer to Diagnostic Fault Codes, Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.</p>
<p>OK Go To Next Step</p>	
<p>STEP 3 OEM engine protection system is malfunctioning</p>	<p>Isolate the OEM engine protection system. Follow the OEM service manuals to check for a malfunction.</p>
<p>OK Go To Next Step</p>	
<p>STEP 4 Battery voltage is low</p>	<p>Check the batteries and the unswitched battery supply circuit. Refer to Procedure 013-007 and the OEM service manual.</p>
<p>OK Go To Next Step</p>	
<p>STEP 5 Battery voltage supply to the electronic control module (ECM) is low, interrupted, or open</p>	<p>Check the battery connections, the fuses, and the unswitched battery supply circuit. Refer to Procedure 013-009 and the OEM service manual.</p>
<p>OK Go To Next Step</p>	
<p>STEP 6 Air in the fuel system</p>	<p>Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe, and fuel filters as necessary.</p>



Engine Noise Excessive

Cause	Correction
<p>STEP 1 Fan drive belt is loose</p> <p>OK Go To Next Step</p>	<p>Check the belt tension and tighten if necessary.</p>
<p>STEP 2 Fan is loose, damaged, or not balanced</p> <p>OK Go To Next Step</p>	<p>Check the fan. Refer to Procedure 008-040.</p>
<p>STEP 3 Fan clutch, hydraulic pump, or refrigerant compressor noise is excessive</p> <p>OK Go To Next Step</p>	<p>Isolate each component and check for noise. Refer to the OEM service manual.</p>
<p>STEP 4 Air intake or exhaust leaks</p> <p>OK Go To Next Step</p>	<p>Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to Procedure 010-033.</p>
<p>STEP 5 Air intake or exhaust piping is contacting the chassis or cab</p> <p>OK Go To Next Step</p>	<p>Inspect the air piping, chassis, and cab for contact points. Refer to the OEM service manual.</p>
<p>STEP 6 Lubricating oil level is above or below specification</p> <p>OK Go To Next Step</p>	<p>Check the oil level. Add or drain oil, if necessary. Refer to Procedure 007-043.</p>
<p>STEP 7 Lubricating oil is thin or diluted</p> <p>OK Go To Next Step</p>	<p>Refer to Lubricating Oil Contaminated symptom tree.</p>
<p>STEP 8 Lubricating oil pressure is below specification</p> <p>OK Go To Next Step</p>	<p>Check the oil pressure. If the pressure is low, refer to Lubricating Oil Contaminated symptom tree.</p>
<p>STEP 9 Vibration damper is damaged</p> <p>OK Go To Next Step</p>	<p>Inspect the vibration damper. Refer to Procedure 001-051 or 001-052.</p>
<p>STEP 10 Coolant temperature is above specification</p> <p>OK Go To Next Step</p>	<p>Refer to the Coolant Temperature Above Normal - Gradual Overheat symptom tree.</p>

Engine Noise Excessive

Cause	Correction
<p>STEP 11 Drivetrain noise is excessive</p> <p>OK Go To Next Step</p>	<p>Disconnect the drivetrain. Check for engine noise. Refer to the OEM service manual.</p>
<p>STEP 12 Engine mounts are worn, damaged, or not correct</p> <p>OK Go To Next Step</p>	<p>Check the engine mounts. Refer to the OEM service manual.</p>
<p>STEP 13 Overhead adjustments are not correct</p> <p>OK Go To Next Step</p>	<p>Measure and adjust the overhead settings. Refer to Procedure 003-004.</p>
<p>STEP 14 Air compressor noise is excessive</p> <p>OK Go To Next Step</p>	<p>Refer to the Air Compressor Noise Excessive symptom tree.</p>
<p>STEP 15 Combustion noise excessive</p>	<p>Refer to the Engine Noise Excessive - Combustion Knocks symptom tree.</p>



Engine Noise Excessive — Combustion Knocks

Cause

Correction

STEP 1

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

Operate the engine from a tank of high-quality fuel. Refer to Fuel for Cummins Engines, Bulletin 3379001.

OK

Go To Next Step

STEP 2

Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe, and fuel filters as necessary.

OK

Go To Next Step

STEP 3

Coolant temperature is above specification

Refer to Coolant Temperature Above Normal - Gradual Overheat and Coolant Temperature Above Normal - Sudden Overheat symptom trees.

OK

Go To Next Step

STEP 4

Overhead adjustments are **not** correct

Measure and adjust the overhead settings. Refer to Procedure 003-004.

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Engine Power Output Low

Cause

Correction

STEP 1

Electronic fault codes are active

For instructions on how to read active fault codes, refer to Diagnostic Fault Codes, Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.

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

Engine is operating above recommended altitude

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

OK

Go To Next Step

STEP 4

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 the OEM service manual.

OK

Go To Next Step

STEP 5

Air intake system restriction is above specification

Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-033.

OK

Go To Next Step

STEP 6

Air intake or exhaust leaks

Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to Procedure 010-033.

OK

Go To Next Step

STEP 7

Fuel leak

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

OK

Go To Next Step

STEP 8

Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe, and fuel filters as necessary.

OK

Go To Next Step

Engine Power Output Low

Cause

Correction

STEP 9

Vehicle parasitics are excessive

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

OK

Go To Next Step

STEP 10

Charge air cooler is restricted or leaking

Inspect the charge air cooler for air restrictions or leaks. Refer to Procedure 010-027.

OK

Go To Next Step

STEP 11

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 the Lubricating Oil Level is Above Specification symptom tree.

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Engine Runs Rough at Idle

Cause	Correction
<p>STEP 1 Engine is cold</p> <p>OK Go To Next Step</p>	<p>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.</p>
<p>STEP 2 Electronic fault codes are active</p> <p>OK Go To Next Step</p>	<p>For instructions on how to read active fault codes, refer to Diagnostic Fault Codes Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.</p>
<p>STEP 3 Air in the fuel system</p> <p>OK Go To Next Step</p>	<p>Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe, and fuel filters as necessary.</p>
<p>STEP 4 Fuel supply line or passage restriction between the fuel pump and the injectors</p> <p>OK Go To Next Step</p>	<p>Check the fuel supply line or passage for sharp bends or restriction. Diagnostic Fault Codes Procedure 101-007</p>
<p>STEP 5 Engine mounts are worn, damaged, or not correct</p> <p>OK Go To Next Step</p>	<p>Check the engine mounts. Refer to Procedure 000-008.</p>
<p>STEP 6 Moisture in the wiring harness connectors</p> <p>OK Go To Next Step</p>	<p>Dry the connectors with Cummins electronic cleaner, Part Number 3824510.</p>
<p>STEP 7 Fuel grade is not correct for the application or the fuel quality is poor</p>	<p>Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications Procedure 018-002.</p>



Engine Runs Rough or Misfires

Cause

Correction

STEP 1

Engine is cold

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

OK

Go To Next Step

STEP 2

Electronic fault codes are active

For instructions on how to read active fault codes, refer to Diagnostic Fault Codes Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 3

Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe, and fuel filters as necessary.

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. Diagnostic Fault Codes Procedure 101-007

OK

Go To Next Step

STEP 5

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

Check the engine mounts. Refer to Procedure 000-008.

OK

Go To Next Step

STEP 6

Moisture in the wiring harness connectors

Dry the connectors with Cummins electronic cleaner, Part Number 3824510.



Engine Shuts Off Unexpectedly or Dies During Deceleration

Cause	Correction
<p style="text-align: center;">STEP 1</p> <p style="text-align: center;">Fuel level is low in the tank</p> <p style="text-align: center;">OK Go To Next Step</p>	<p>Fill the supply tank. Refer to the OEM service manual.</p>
<p style="text-align: center;">STEP 2</p> <p style="text-align: center;">Electronic fault codes are active</p> <p style="text-align: center;">OK Go To Next Step</p>	<p>For instructions on how to read active fault codes, refer to Diagnostic Fault Codes Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.</p>
<p style="text-align: center;">STEP 3</p> <p style="text-align: center;">Idle shutdown or PTO shutdown features are activated</p> <p style="text-align: center;">OK Go To Next Step</p>	<p>Check the time limit on idle and PTO shutdowns with an electronic service tool. Refer to Electronic Controlled Fuel System Procedure 101-007.</p>
<p style="text-align: center;">STEP 4</p> <p style="text-align: center;">Moisture in the wiring harness connectors</p> <p style="text-align: center;">OK Go To Next Step</p>	<p>Dry the connectors with Cummins electronic cleaner, Part Number 3824510.</p>
<p style="text-align: center;">STEP 5</p> <p style="text-align: center;">OEM engine protection system is malfunctioning</p> <p style="text-align: center;">OK Go To Next Step</p>	<p>Isolate the OEM engine protection system. Follow the OEM service manuals to check for a malfunction.</p>
<p style="text-align: center;">STEP 6</p> <p style="text-align: center;">Air in the fuel system</p>	<p>Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe, and fuel filters as necessary.</p>

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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

Electronic fault codes are active

For instructions on how to read active fault codes, refer to Diagnostic Fault Codes Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 3

Moisture in the wiring harness connectors

Dry the connectors with Cummins electronic cleaner, Part Number 3824510.

OK

Go To Next Step

STEP 4

Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe, and fuel filters as necessary.

OK

Go To Next Step

STEP 5

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

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



Engine Speed Surges Under Load or in Operating Range

Cause

Correction

STEP 1

Fuel level is low in the tank

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

OK

Go To Next Step

STEP 2

Electronic fault codes are active

For instructions on how to read active fault codes, refer to Diagnostic Fault Codes Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 3

Moisture in the wiring harness connectors

Dry the connectors with Cummins electronic cleaner, Part Number 3824510.

OK

Go To Next Step

STEP 4

Air in the fuel system

Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe, and fuel filters as necessary.

OK

Go To Next Step

STEP 5

Idling with excessive load

Use the PTO feature for loaded conditions at low engine speeds. Refer to Engine speed Surges in PTO or Cruise Control symptom tree.

OK

Go To Next Step

STEP 6

Vehicle parasitics are excessive

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

OK

Go To Next Step

STEP 7

Clutch is malfunctioning or is **not** correct

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

OK

Go To Next Step

STEP 8

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

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

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Engine Speed Surges in PTO or Cruise Control

Cause

Correction

STEP 1

Engine speed also surges at idle

Refer to Engine Speed Surges at Low or High Idle symptom tree.

OK

Go To Next Step

STEP 2

Engine speed surges while in the normal operating range and **not** in PTO or cruise control

Refer to Engine Speed Surges Under Load or in Operating Range symptom tree.

OK

Go To Next Step

STEP 3

Electronic fault codes are active

For instructions on how to read active fault codes, refer to Diagnostic Fault Codes Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 4

Moisture in the wiring harness connectors

Dry the connectors with Cummins electronic cleaner, Part Number 3824510.

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Engine Starts But Will Not Keep Running

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

Battery voltage supply to the electronic control module (ECM) is low, interrupted, or open

Check the battery connections, the fuses, and the unswitched battery supply circuit. Refer to Procedure 013-009 and the OEM service manual.

OK

Go To Next Step

STEP 3

Electronic fault codes are active

For instructions on how to read active fault codes, refer to Diagnostic Fault Codes Procedure 101-007. If fault codes are active, contact a Cummins

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Engine Vibration Excessive

Cause

Correction

STEP 1

Belt-driven accessories are malfunctioning

Check the fan hub, alternator, refrigerant compressor, and hydraulic pump for interference. Isolate belt-driven accessories and check for vibration. Refer to Procedure 008-036, 013-001, and the OEM service manual.

OK

Go To Next Step

STEP 2

Engine idle speed is set too low (electronically controlled fuel systems)

Verify the correct idle speed setting. Increase the idle speed with the idle increment switch or an electronic service tool. Refer to a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 3

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

Check the engine mounts. Refer to Procedure 000-008.

OK

Go To Next Step

STEP 4

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

Check the fan. Refer to Procedure 008-040.

OK

Go To Next Step

STEP 5

Engine is misfiring

Refer to the Engine Runs Rough or Misfires symptom tree.

OK

Go To Next Step

STEP 6

Electronic fault codes are active

For instructions on how to read active fault codes, refer to Diagnostic Fault Codes Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 7

Vibration damper is damaged

Inspect the vibration damper. Refer to Procedure 001-051 or 001-052.

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Engine Will Not Crank or Cranks Slowly (Air Starter)

Cause

Correction

STEP 1

Air pressure is low in the air tanks

Increase air pressure with an external air source. Refer to the OEM service manual.

OK

Go To Next Step

STEP 2

Engine-driven units are engaged

Disengage engine-driven units.

OK

Go To Next Step

STEP 3

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 Lubricating Oil Level is Above Specification symptom tree.

OK

Go To Next Step

STEP 4

Lubricating oil does **not** meet specifications for operating conditions

Change the oil and filters. Refer to Lubricating Oil Does Not Meet Specification symptom tree or Procedure 018-003.

OK

Go To Next Step

STEP 5

Starting motor is malfunctioning or starting motor is **not** correct

Check the starting motor operation. Compare the starting motor with the engine and vehicle specifications. Refer to the manufacturer's instructions.

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Engine Will Not Crank or Cranks Slowly (Electric Starter)

Cause

Correction

STEP 1

Battery voltage is low

Check the batteries and the unswitched battery supply circuit. Refer to Procedure 013-007.

OK

Go To Next Step

STEP 2

Battery cables or connections are loose, broken, or corroded (excessive resistance)

Check the battery cables and connections.

OK

Go To Next Step

STEP 3

Battery capacity is below specification

Refer to Procedure 013-007. Replace the batteries if necessary.

OK

Go To Next Step

STEP 4

Battery cables are **not** the correct gauge or length

Replace the battery cables with larger gauge or shorter length cables. Refer to Procedure 013-009.

OK

Go To Next Step

STEP 5

OEM starter interlock devices engaged

Check the starter interlock devices. Refer to the OEM service manual.

OK

Go To Next Step

STEP 6

Lubricating oil pressure switch, gauge, or sensor is malfunctioning or is **not** in the correct location

Check the oil pressure switch, gauge, or sensor for correct operation and location. Refer to the OEM service manual.

OK

Go To Next Step

STEP 7

Engine-driven units are engaged

Disengage engine-driven units.

OK

Go To Next Step

STEP 8

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 the Lubricating Oil Level is Above Specification symptom tree.

OK

Go To Next Step

STEP 9

Lubricating oil does **not** meet specifications for operating conditions

Change the oil and filters. Refer to Procedure 018-024.

Engine Will Not Reach Rated Speed (RPM)

Cause

Correction

STEP 1

Electronic fault codes are active

For instructions on how to read active fault codes, refer to Diagnostic Fault Codes Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 2

Vehicle parasitics are excessive

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

OK

Go To Next Step

STEP 3

Engine power output is low

Refer to the Engine Power Output Low symptom tree.

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Fault Code Warning Lamps Stay On (No Apparent Reason)

Cause

Correction

STEP 1

Diagnostic shorting plug is installed

Remove the diagnostic shorting plug.

OK

Go To Next Step

STEP 2

Drivetrain components are malfunctioning or are
not correct

Compare the drivetrain components to the engine and equipment specifications. Isolate the drivetrain components and check for vibrations. Refer to the OEM service manual.

OK

Go To Next Step

STEP 3

Electronic fault codes are active

For instructions on how to read active fault codes, refer to Diagnostic Fault Codes Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.

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Fault Code Warning Lamps Do Not Illuminate

Cause

Correction

<p>STEP 1 Keyswitch is in the OFF position</p>	<p>Turn the keyswitch to the ON position.</p>
<p>OK Go To Next Step</p>	
<p>STEP 2 Battery voltage supply to the electronic control module (ECM) is low, interrupted, or open</p>	<p>Check the battery connections, the fuses, and the unswitched battery supply circuit. Refer to Procedure 013-009.</p>
<p>OK Go To Next Step</p>	
<p>STEP 3 Idle shutdown or PTO shutdown features are activated</p>	<p>Check the time limit on idle and PTO shutdowns with an electronic service tool. Refer to the appropriate electronic service tool.</p>

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Fuel Consumption Excessive

Cause	Correction
<p>STEP 1 Operator technique is not correct</p> <p>OK Go To Next Step</p>	<p>Explain correct engine operation to the operator. Refer to Operating Instructions, Procedure 101-999.</p>
<p>STEP 2 Electronic fault codes are active</p> <p>OK Go To Next Step</p>	<p>For instructions on how to read active fault codes, refer to Diagnostic Fault Codes, Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.</p>
<p>STEP 3 Fuel leak</p> <p>OK Go To Next Step</p>	<p>Check the fuel lines, fuel connections, and fuel filters for leaks. Check the fuel lines to the supply tanks. Refer to the OEM service manual.</p>
<p>STEP 4 Hubometer or odometer is miscalibrated</p> <p>OK Go To Next Step</p>	<p>Check the hubometer and odometer calibrations. Calibrate or replace the hubometer or odometer, if necessary. Calculate fuel consumption with new mileage figures.</p>
<p>STEP 5 Air intake or exhaust leaks</p> <p>OK Go To Next Step</p>	<p>Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to Procedure 010-033.</p>
<p>STEP 6 Air intake system restriction is above specification</p> <p>OK Go To Next Step</p>	<p>Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-058.</p>
<p>STEP 7 Equipment and environmental factors are affecting fuel consumption</p> <p>OK Go To Next Step</p>	<p>Consider ambient temperatures, wind, tire size, axle alignment, routes, and use of aerodynamic aids when evaluating fuel consumption.</p>
<p>STEP 8 Lubricating oil level is above specification</p>	<p>Check the oil level. Verify the dipstick calibration and oil pan capacity. Fill the system to the specified level. Refer to Procedure 007-043.</p>

Fuel in Coolant

Cause

STEP 1

Bulk coolant supply is contaminated

Correction

Check the bulk coolant supply. Drain the coolant and replace with noncontaminated coolant. Replace the coolant filters. Replace the coolant filter. Refer to Procedure 008-006.

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Fuel in the Lubricating Oil

Cause

STEP 1

Bulk oil supply is contaminated

OK

Go To Next Step

STEP 2

Engine idle time is excessive

Correction

Check the bulk oil supply. Drain the oil and replace with noncontaminated oil. Replace the oil filters.

Low oil and coolant temperatures can be caused by long idle time (greater than 10 minutes). Shut off the engine rather than idle for long periods. If idle time is necessary, raise the idle speed.

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Intake Manifold Air Temperature Above Specification

Cause

Correction

STEP 1

Fan drive belt is broken

Check the fan drive belt. Replace the belt, if necessary. Refer to Procedure 008-036.

OK

Go To Next Step

STEP 2

Fan drive belt is loose

Check the belt tension and tighten if necessary.

OK

Go To Next Step

STEP 3

Cold weather radiator cover or winterfront is closed

Open the cold weather radiator cover or the winterfront. Maintain a minimum of 387 cm² [60 in²] of opening at all times. Refer to Procedure 101-004.

OK

Go To Next Step

STEP 4

Charge air cooler fins, radiator fins, or air conditioner condenser fins are damaged or obstructed with debris

Inspect the charge air cooler, air conditioner condenser, and radiator fins. Clean, if necessary. Refer to Procedure 010-027 and the OEM service manual.

OK

Go To Next Step

STEP 5

Intake manifold temperature gauge is malfunctioning, if equipped

Test the temperature gauge. Refer to the OEM service manual.

OK

Go To Next Step

STEP 6

Electronic fault codes are active

For instructions on how to read active fault codes, refer to Diagnostic Fault Codes, Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 7

Programmable parameters or selected features are **not** correct

Check the programmable parameters and the selected features with an electronic service tool. Set the parameters and features again if necessary. Refer to a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 8

Fan drive or fan controls are malfunctioning

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

OK

Go To Next Step

Intake Manifold Air Temperature Above Specification

Cause

Correction

STEP 9

Fan is **not** correct

Check the fan part number and compare it to the OEM-specified part number. Replace fan if necessary. Refer to the OEM service manual.

OK

Go To Next Step

STEP 10

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 11

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 12

Exhaust system leaking hot air into engine compartment

Check the exhaust plumbing for leaks or broken components. Refer to the OEM service manual.

OK

Go To Next Step

STEP 13

Vehicle cooling system is **not** adequate

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

OK

Go To Next Step

STEP 14

Fan is **not** an adequate size for the application

Verify that the fan is the correct size. Refer to the OEM service manual.



Intake Manifold Pressure (Boost) is Below Normal

Cause

Correction

<p>STEP 1 Air intake or exhaust leaks</p>	<p>Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to Procedure 010-033.</p>
<p>OK Go To Next Step</p>	
<p>STEP 2 Air intake system restriction is above specification</p>	<p>Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-058.</p>
<p>OK Go To Next Step</p>	
<p>STEP 3 Charge air cooler is restricted or leaking</p>	<p>Inspect the charge air cooler for air restrictions or leaks. Refer to Procedure 010-027.</p>
<p>OK Go To Next Step</p>	
<p>STEP 4 Electronic fault codes are active</p>	<p>For instructions on how to read active fault codes, refer to Diagnostic Fault Codes, Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.</p>
<p>OK Go To Next Step</p>	
<p>STEP 5 Engine power output is low</p>	<p>Refer to Engine Power Output is Low symptom tree.</p>



Lubricating Oil Consumption Excessive

Cause	Correction
<p>STEP 1 Verify the oil consumption rate</p> <p>OK Go To Next Step</p>	<p>Check the amount of oil added versus the mileage.</p>
<p>STEP 2 Lubricating oil leak (external)</p> <p>OK Go To Next Step</p>	<p>Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to Lubricating Oil Recommendations and Specifications.</p>
<p>STEP 3 Crankcase ventilation system is plugged</p> <p>OK Go To Next Step</p>	<p>Check and clean the crankcase breather and vent tube. Refer to Procedure 003-018.</p>
<p>STEP 4 Lubricating oil does not meet specifications for operating conditions</p> <p>OK Go To Next Step</p>	<p>Change the oil and filters. Refer to Procedure 007-002. Use the oil recommended in Section V.</p>
<p>STEP 5 Lubricating oil drain interval is excessive</p> <p>OK Go To Next Step</p>	<p>Verify the correct lubricating oil drain interval. Refer to Procedure 102-002.</p>
<p>STEP 6 Air compressor is pumping lubricating oil into the air system</p> <p>OK Go To Next Step</p>	<p>Check the air lines for carbon buildup and lubricating oil. Refer to Procedure 012-014.</p>
<p>STEP 7 Lubricating oil level is above specification</p> <p>OK Go To Next Step</p>	<p>Check the oil level. Verify the dipstick calibration and oil pan capacity. Fill the system to the specified level. Refer to Procedure 007-002.</p>
<p>STEP 8 Turbocharger oil seal is leaking</p> <p>OK Go To Next Step</p>	<p>Check the turbocharger compressor and turbine seals. Contact a Cummins Authorized Repair Facility.</p>
<p>STEP 9 Lubricating oil is contaminated with coolant or fuel</p>	<p>Contact a Cummins Authorized Repair Facility.</p>

Lubricating Oil Contaminated

Cause	Correction
STEP 1 Fuel in the lubricating oil	Refer to the Fuel in the Lubricating Oil symptom tree.
OK Go To Next Step	
STEP 2 Internal coolant leaks	Refer to the Coolant Loss - Internal symptom tree.
OK Go To Next Step	
STEP 3 Bulk oil supply is contaminated	Check the bulk oil supply. Drain the oil and replace with noncontaminated oil. Replace the oil filters.

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Lubricating Oil Pressure High

Cause	Correction
<p>STEP 1 Coolant temperature is below specification</p> <p>OK Go To Next Step</p>	<p>Refer to the Coolant Temperature is Below Normal symptom tree.</p>
<p>STEP 2 Lubricating oil does not meet specifications for operating conditions</p> <p>OK Go To Next Step</p>	<p>Change the oil and filters. Refer to Procedure 007-002. Use the oil recommended in Section V.</p>
<p>STEP 3 Lubricating oil pressure switch, gauge, or sensor is malfunctioning or is not in the correct location</p> <p>OK Go To Next Step</p>	<p>Check the oil pressure switch, gauge, or sensor for correct operation and location. Refer to the OEM service manual.</p>
<p>STEP 4 Lubricating oil pressure sensor or circuit is malfunctioning (electronic controlled fuel system)</p> <p>OK Go To Next Step</p>	<p>Check the lubricating oil pressure sensor and circuit. Refer to a Cummins Authorized Repair Facility.</p>
<p>STEP 5 Electronic fault codes are active</p>	<p>For instructions on how to read active fault codes, refer to Diagnostic Fault Codes, Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.</p>



Lubricating Oil Pressure Low

Cause	Correction
<p>STEP 1 Lubricating oil pressure switch, gauge, or sensor is malfunctioning or is not in the correct location</p> <p>OK Go To Next Step</p>	<p>Check the oil pressure switch, gauge, or sensor for correct operation and location. Refer to the OEM service manual.</p>
<p>STEP 2 Lubricating oil level is above or below specification</p> <p>OK Go To Next Step</p>	<p>Check the oil level. Add or drain oil, if necessary. Refer to Procedure 007-002.</p>
<p>STEP 3 Lubricating oil filter is plugged</p> <p>OK Go To Next Step</p>	<p>Change the oil and filter. Refer to Section Procedure 007-002. Review the oil change interval. Refer to Section V.</p>
<p>STEP 4 Lubricating oil leak (external)</p> <p>OK Go To Next Step</p>	<p>Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to Procedure 018-003.</p>
<p>STEP 5 Lubricating oil does not meet specifications for operating conditions</p> <p>OK Go To Next Step</p>	<p>Change the oil and filters. Refer to Procedure 007-002. Use the oil recommended in Section V.</p>
<p>STEP 6 Lubricating oil is contaminated with coolant or fuel</p> <p>OK Go To Next Step</p>	<p>Contact a Cummins Authorized Repair Facility.</p>
<p>STEP 7 Engine angularity during operation exceeds specification</p> <p>OK Go To Next Step</p>	<p>Refer to the engine performance curves and data sheet.</p>
<p>STEP 8 Lubricating oil pressure sensor or circuit is malfunctioning (electronic controlled fuel system)</p> <p>OK Go To Next Step</p>	<p>Check the lubricating oil pressure sensor and circuit. Refer to the OEM service manual.</p>
<p>STEP 9 Electronic fault codes are active</p>	<p>For instructions on how to read active fault codes, refer to Diagnostic Fault Codes, Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.</p>

Lubricating Oil Sludge in the Crankcase Excessive

Cause

Correction

STEP 1

Bulk oil supply is contaminated

Check the bulk oil supply. Drain the oil and replace with noncontaminated oil. Replace the oil filters.

OK

Go To Next Step

STEP 2

Coolant temperature is below specification

Refer to the Coolant Temperature Below Normal symptom tree.

OK

Go To Next Step

STEP 3

Crankcase ventilation system is plugged

Check and clean the crankcase breather and vent tube. Refer to Procedure 003-018.

OK

Go To Next Step

STEP 4

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

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

OK

Go To Next Step

STEP 5

Lubricating oil does **not** meet specifications for operating conditions

Change the oil and filters. Refer to Procedure 018-003. Use the oil recommended in Section V.

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Smoke, Black — Excessive

Cause	Correction
<p>STEP 1 Electronic fault codes are active</p> <p>OK Go To Next Step</p>	<p>For instructions on how to read active fault codes, refer to Diagnostic Fault Codes Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.</p>
<p>STEP 2 Air intake system restriction is above specification</p> <p>OK Go To Next Step</p>	<p>Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-033.</p>
<p>STEP 3 Air intake or exhaust leaks</p> <p>OK Go To Next Step</p>	<p>Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to the OEM service manual.</p>
<p>STEP 4 Charge air cooler is restricted or leaking</p>	<p>Inspect the charge air cooler for air restrictions or leaks. Refer to Procedure 010-027.</p>



Smoke, White — Excessive

Cause	Correction
<p style="text-align: center;">STEP 1 Engine is cold</p>	<p>Allow the engine to warm to operating temperature. If the engine will not reach operating temperature, refer to Coolant Temperature Below Normal symptom tree.</p>
<p style="text-align: center;">OK Go To Next Step</p>	
<p style="text-align: center;">STEP 2 Engine is operating at low ambient temperature</p>	<p>Check the winterfront, shutters, and under-the-hood air. Use under-the-hood intake air in cold weather. Refer to Cold Weather Operation, Bulletin 3387266.</p>
<p style="text-align: center;">OK Go To Next Step</p>	
<p style="text-align: center;">STEP 3 Starting aid is necessary for cold weather or starting aid is malfunctioning</p>	<p>Check for the correct operation of the starting aid. Refer to the manufacturer's instructions. Refer to Cold Weather Starting Procedure 101-004 Section 1.</p>
<p style="text-align: center;">OK Go To Next Step</p>	
<p style="text-align: center;">STEP 4 Electronic fault codes are active</p>	<p>For instructions on how to read active fault codes, refer to Diagnostic Fault Codes Procedure 101-007. If fault codes are active, contact a Cummins Authorized Repair Facility.</p>
<p style="text-align: center;">OK Go To Next Step</p>	
<p style="text-align: center;">STEP 5 Fuel grade is not correct for the application or the fuel quality is poor</p>	<p>Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications Procedure 018-002.</p>
<p style="text-align: center;">OK Go To Next Step</p>	
<p style="text-align: center;">STEP 6 Air intake or exhaust leaks</p>	<p>Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to Procedure 010-033.</p>
<p style="text-align: center;">OK Go To Next Step</p>	
<p style="text-align: center;">STEP 7 Air intake system restriction is above specification</p>	<p>Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-058.</p>
<p style="text-align: center;">OK Go To Next Step</p>	
<p style="text-align: center;">STEP 8 Charge air cooler is restricted or leaking</p>	<p>Inspect the charge air cooler for air restrictions or leaks. Refer to Procedure 010-027.</p>

Turbocharger Leaks Engine Oil or Fuel

Cause

Correction

STEP 1

Engine is operating for extended periods under light- or no-load conditions (slobbering)

Review the engine operating instructions in Section 1.

OK

Go To Next Step

STEP 2

Air intake system restriction is above specification

Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-058.

OK

Go To Next Step

STEP 3

Exhaust system restriction is **not** within specification

Check the exhaust system for restrictions. Contact a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 4

Lubricating oil lines leak oil

Check all oil lines and fittings for leaks. Tighten loose fittings and replace leaking oil lines if necessary.

OK

Go To Next Step

STEP 5

Crankcase ventilation system is plugged

Check and clean the crankcase breather and vent tube. Refer to Procedure 003-018.

OK

Go To Next Step

STEP 6

Turbocharger oil seal is leaking

Check the turbocharger compressor and turbine seals. Contact a Cummins Authorized Repair Facility.

OK

Go To Next Step

STEP 7

Lubricating oil or fuel is entering the turbocharger

Remove the intake and exhaust piping, and check for oil or fuel.

OK

Go To Next Step

STEP 8

White smoke is present

Refer to the Smoke, White - Excessive symptom tree.

Notes

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Section V - Maintenance Specifications

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General Engine

Specifications

Listed below are the general specifications for this engine.

Horsepower.....	Refer to engine dataplate
Firing Order.....	1.5.3.6.2.4
Crankshaft Rotation (viewed from front of engine).....	Clockwise
Displacement.....	8.3 liters [504.5 in ³]
Displacement.....	8.9 liters [540 in ³]
Bore and Stroke	
8.3 liters.....	114 mm [4.49 in] x 135 mm [5.32 in]
8.9 liters.....	114 mm [4.49 in] x 144.5 mm [5.69 in]
Dry Weight	
8.3 liters.....	694 kg [1530 lb]
8.9 liters.....	706 kg [1555 lb]
Wet Weight	
8.3 liters.....	723 kg [1595 lb]
8.9 liters.....	738 kg [1625 lb]
Overhead Adjustment	
Intake Valve Adjustment.....	0.305 mm [0.012 in]
Exhaust Valve Adjustment.....	0.559 mm [0.022 in]
Engine Brake Adjustment.....	2.286 mm [0.090 in]

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Fuel System

Specifications

Cummins Common Rail Fuel System

Maximum Fuel Return Line Pressure.....	254 mm Hg [10 in Hg]
Maximum Fuel Inlet Restriction (gear pump inlet).....	254 mm Hg [10 in Hg]
Maximum Fuel Inlet Restriction - Dirty Filter (OEM connection point).....	152 mm Hg [6 in Hg]
Minimum Gear Pump Pressure (during cranking).....	69 kPa [10 psi]
Maximum Filter Pressure Drop.....	138 kPa [20 psi]
Minimum Lift Pump Pressure (gear pump inlet during cranking).....	35 kPa [5 psi]
Minimum Engine Cranking Speed.....	150 rpm

CAPS Fuel System

Maximum Fuel Inlet Restriction at Rated (measured at lift pump inlet).....	102 mm Hg [4 in Hg]
Maximum Fuel Inlet Restriction at Rated (measured at CAPS pump inlet).....	254 mm Hg [10 in Hg]
Minimum Lift Pump Pressure.....	35 kPa [5 psi]
Maximum Filter Pressure Drop at Rated.....	102 mm Hg [4 in Hg]
Minimum Gear Pump Pressure (during cranking).....	69 kPa [10 psi]
Minimum Engine Cranking Speed.....	150 rpm

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Lubricating Oil System

Specifications

All Applications Except Marine

Oil Pressure	
At Low Idle (minimum allowable)	69 kPa [10 psi]
At Rated Speed (minimum allowable)	207 kPa [30 psi]
Regulated Oil Pressure	517 kPa [75 psi]
Lubricating Oil Filter Capacity	3.78 liters [4 qt]
Oil Pan Capacity, Low to High (8.3 liter engines)	
Standard Oil Pan	15.1 to 18.9 liters [16 to 20 qt]
Standard Oil Pan with Cylinder Block Stiffener Plate	16.1 to 19.9 liters [17 to 21 qt]
Total System Capacity (Oil Pan and New Oil Filter) (8.3 liter engines)	
Standard Oil Pan	22.7 liters [24 qt]
Standard Oil Pan with Cylinder Block Stiffener Plate	23.7 liters [25 qt]
Oil Pan Capacity, Low to High (8.9 liter engines)	
Standard Oil Pan	18.9 to 22.7 liters [20 to 24 qt]
Standard Oil Pan with Cylinder Block Stiffener Plate	19.9 to 23.7 liters [21 to 25 qt]
Total System Capacity (Oil Pan and New Oil Filter) (8.9 liter engines)	
Standard Oil Pan	26.5 liters [28 qt]
Standard Oil Pan with Cylinder Block Stiffener Plate	27.4 liters [29 qt]

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Cooling System

Specifications

All Applications Except Marine

Coolant Capacity (engine only).....	11.1 liters [11.7 qt]
Standard Modulating Thermostat Range.....	82 to 93°C [180 to 200°F]
Minimum Recommended Pressure Cap.....	48 kPa [7 psi]
Minimum Fill Rate (without low-level alarm).....	19 liters/min [5 gpm]
Maximum Deaeration Time.....	25 minutes
Winterfronts - Automotive Only	
Air Passage Area.....	774 cm ² [120 in ²]

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Air Intake System

Specifications



Engine intake air must be filtered to prevent dirt and debris from entering the engine. If the air intake piping is damaged or loose, unfiltered air will enter the engine and cause premature wear.

Maximum Intake Restriction (clean air filter element).....	254 mm H ₂ O [10.0 in H ₂ O]
Maximum Intake Restriction (dirty air filter element).....	635 mm H ₂ O [25.0 in H ₂ O]
Charge Air Cooler Restriction (maximum).....	152 mm Hg [6.0 in Hg]

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Exhaust System

Specifications

Maximum Exhaust Back Pressure.....76 mm Hg [3 in Hg]

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Electrical System

Specifications

Minimum Recommended Battery Capacity:.....0.00075 ohms

System Voltage	Ambient Temperatures	
	• 18°C [0°F]	
	Cold Cranking Amperes	Reserve Capacity* (Minutes)
12-VDC	1800	640
24-VDC**	900	320

* The number of plates within a given battery size determines reserve capacity. Reserve capacity is the length of time for which a battery at 27°C [80°F] can supply 25 amperes at 10.5 volts or greater.

** CCA ratings are based on two 12-VDC batteries in series.

Batteries (Specific Gravity)

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

Maximum Starting Circuit Resistance.....0.00075 ohms
12-VDC System.....0.00200 ohms
24-VDC System.....



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 non-genuine filters that do **not** meet Cummins performance or durability requirements.

Filter Part Numbers (All Applications Except Marine)

	Water-separating Filter	Fuel Filter	Lubricating Oil Filter
Without CM850			
Cummins Part Number	3944269	N/A	3401544
Fleetguard® Part Number	FS1022	N/A	LF9009
With CM850			
Cummins Part Number	4070801	3959612	3401544
Fleetguard® Part Number	FS1003	FF5488	LF9009

NOTE: LF9009 **must** be used. A venturi type filter **must** be used in order to benefit from the bypass filtration section of the oil filter. Do **not** use LF3000. Engine durability will be reduced by using the wrong lubricating oil filter.

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Fuel Recommendations and Specifications

Fuel Recommendations



WARNING

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



CAUTION

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

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

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

NOTE: Lighter fuels can reduce fuel economy.

NOTE: Engines equipped with diesel particulate filters require the use of diesel fuel with 30 ppm sulfur maximum. There are no acceptable substitutes.

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

The following chart lists acceptable substitute fuels for this engine.

Acceptable Substitute Fuels									
Number 1D Diesel ⁽¹⁾ (2) (3)	Number 2D Diesel ⁽³⁾	Number 1K Kerosene	Jet-A	Jet-A1	JP-5	JP-8	Jet-B	JP-4	CITE
A	OK	Not OK	A	A	A	A	Not OK	Not OK	Not OK
<ul style="list-style-type: none"> An "A" means OK only if fuel lubricity is adequate. This means the BOCLE number is 3100 or greater as measured by ASTM specification D6078, Scuffing Load Ball On Cylinder Evaluator (SLBOCLE). Lubricity can also be measured by ASTM, specification D6079, ISO 12156, High Frequency Reciporating Rig (HFRR) in which the fuel must have a wear scar diameter of 0.45 mm [0.02 in] or less. 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 2D diesel fuels 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.



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.

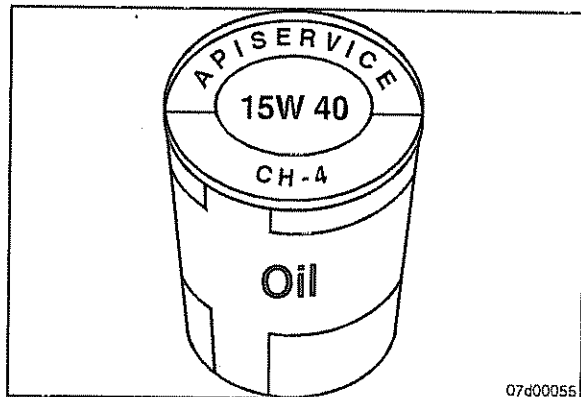
The use of quality engine lubricating oils, combined with appropriate oil drain and filter change intervals, is a critical factor in maintaining engine performance and durability.

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 CH-4/SJ or CG-4/SH oils are **not** available, refer to Oil Drain Intervals in Section 2.

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.

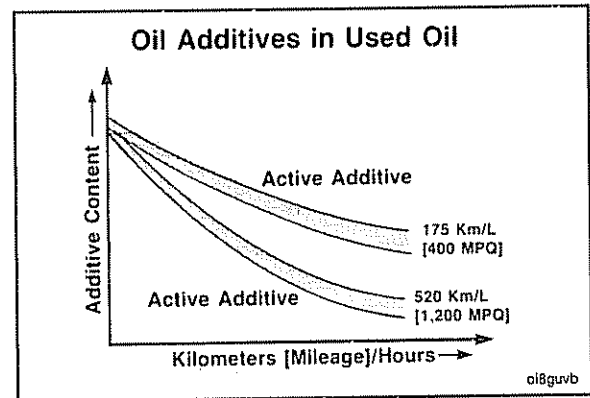
The center section identifies the SAE oil viscosity grade.



As the engine oil becomes contaminated, essential oil additives are depleted. Lubricating oils protect the engine as long as these additives are functioning properly. Progressive contamination of the oil between oil and filter change intervals is normal. The amount of contamination will vary depending on the operation of the engine, kilometers or miles on the oil, fuel consumed, and new oil added.

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

Refer to the oil drain chart in this section to determine which oil drain interval to use for your application.



New Engine Break-in Oils

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

Additional information regarding lubricating oil availability throughout the world is available in the EMA Lubricating Oils Data Book for Heavy-Duty Automotive and Industrial Engines. The data book can be ordered from the Engine Manufacturers Association, Two North LaSalle Street - Suite 2200, Chicago, IL, U.S.A. 60602. The telephone number is (312) 827-8733.

Arctic Operation

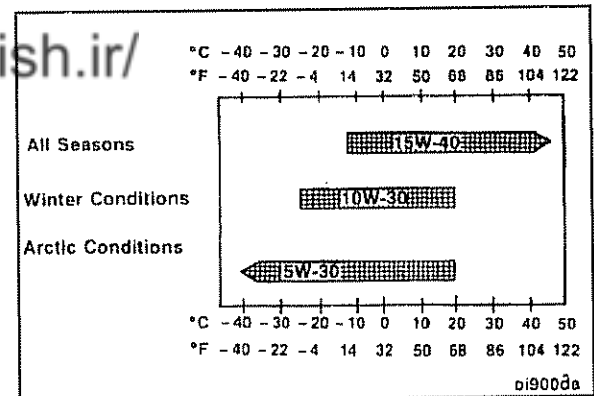


The use of a synthetic-base oil does not justify extended oil change intervals. Extended oil change intervals can decrease engine life due to factors such as corrosion, deposits, and wear.

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



Drive Belt Tension

Tension Chart

SAE Belt Size	Belt Tension Gauge Part No.		Belt Tension New		Belt Tension Range Used*	
	Click-type	Burroughs	N	lbf	N	lbf
0.380 in	3822524		620	140	270 to 490	60 to 110
0.440 in	3822524		620	140	270 to 490	60 to 110
1/2 in	3822524	ST-1138	620	140	270 to 490	60 to 110
11/16 in	3822524	ST-1138	620	140	270 to 490	60 to 110
3/4 in	3822524	ST-1138	620	140	270 to 490	60 to 110
7/8 in	3822524	ST-1138	620	140	270 to 490	60 to 110
4 rib	3822524	ST-1138	620	140	270 to 490	60 to 110
5 rib	3822524	ST-1138	670	150	270 to 530	60 to 120
6 rib	3822525	ST-1293	710	160	290 to 580	65 to 130
8 rib	3822525	ST-1293	890	200	360 to 710	80 to 160
10 rib	3822525	3823138	1110	250	440 to 890	100 to 200
12 rib	3822525	3823138	1330	300	530 to 1070	120 to 240
12 rib K section	3822525	3823138	1330	300	890 to 1070	200 to 240

NOTE: This chart does not apply to automatic belt tensioners.

* A belt is considered used if it has been in service for ten minutes or longer.

* If used belt tension is less than the minimum value, tighten the belt to the maximum used belt value.

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Engine Component Torque Values

Torque Table

Component	Torque Value	
	N•m	ft-lb
Alternator Link	24	18
Alternator Mounting Bolt	43	32
Belt Tensioner Mounting	43	32
Crankshaft Damper and Pulley	200	148
Crossover Clamp	5	44 in-lb
Tee Bolt Type Clamp	8	71 in-lb
Exhaust Outlet Pipe, V Band Clamp	8	71 in-lb
Fan Bracket Mounting	24	18
Fan Pulley	43	32
Fuel Filter	Refer to Manufacturer's Specifications	
Lubricating Oil Filter	Refer to Manufacturer's Specifications	
Lubricating Oil Pan Drain Plug		
Steel Oil Pan	80	59
Cast Aluminum Oil Pan	60	44
Composite Oil Pan	60	44
Lubricating Oil Pan Heater Plug	120	89
Starting Motor Mounting	43	32
Rocker Lever Cover	12	106 in-lb



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)

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Capscrew Markings and Torque Values

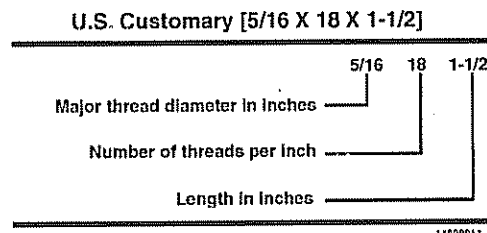
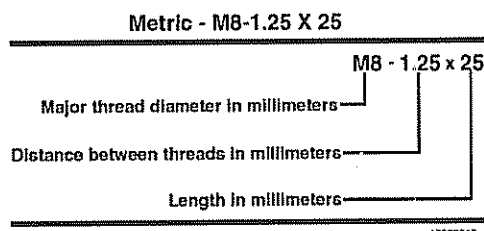
General Information



When replacing capscrews, always use a capscrew of the same measurement and strength as the capscrew being replaced. Using the wrong capscrews can result in engine damage.

Metric capscrews and nuts are identified by the grade number stamped on the head of the capscrew or on the surface of the nuts. U.S. Customary capscrews are identified by radial lines stamped on the head of the capscrew.

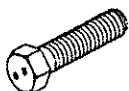

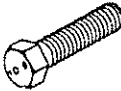

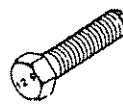

The following examples indicate how capscrews are identified:







NOTES:

1. Always use the torque values listed in the following tables when specific torque values are not available.
2. Do not use the torque values in place of those specified in other sections of this manual.
3. The torque values in the table are based on the use of lubricated threads.
4. When the ft-lb value is less than 10, convert the ft-lb value to in-lb to obtain a better torque with an in-lb torque wrench. Example: 6 ft-lb equals 72 in-lb.

Capscrew Markings and Torque Values - Metric

Commercial Steel Class													
8.8				10.9				12.9					
Capscrew Head Markings													
													
Body Size		Torque				Torque				Torque			
Diameter		Cast Iron		Aluminum		Cast Iron		Aluminum		Cast Iron		Aluminum	
mm		N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
6		9	5	7	4	13	10	7	4	14	9	7	4
7		14	9	11	7	18	14	11	7	23	18	11	7
8		23	17	18	14	33	25	18	14	40	29	18	14
10		45	33	30	25	65	50	30	25	70	50	30	25
12		80	60	55	40	115	85	55	40	125	95	55	40
14		125	90	90	65	180	133	90	65	195	145	90	65
16		195	140	140	100	280	200	140	100	290	210	140	100
18		280	200	180	135	390	285	180	135	400	290	180	135
20		400	290	—	—	550	400	—	—	—	—	—	—

Capscrew Markings and Torque Values - U.S. Customary

SAE Grade Number		5				8			
Capscrew Head Markings									
These are all SAE Grade 5 (3 line)									
		Capscrew Torque - Grade 5 Capscrew				Capscrew Torque - Grade 8 Capscrew			
Capscrew Body Size	Cast Iron		Aluminum		Cast Iron		Aluminum		
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	
1/4 - 20	9	7	8	6	15	11	8	6	
1/4 - 28	12	9	9	7	18	13	9	7	
5/16 - 18	20	15	16	12	30	22	16	12	
5/16 - 24	23	17	19	14	33	24	19	14	
3/8 - 16	40	30	25	20	55	40	25	20	
3/8 - 24	40	30	35	25	60	45	35	25	
7/16 - 14	60	45	45	35	90	65	45	35	
7/16 - 20	65	50	55	40	95	70	55	40	
1/2 - 13	95	70	75	55	130	95	75	55	
1/2 - 20	100	75	80	60	150	110	80	60	
9/16 - 12	135	100	110	80	190	140	110	80	
9/16 - 18	150	110	115	85	210	155	115	85	
5/8 - 11	180	135	150	110	255	190	150	110	
5/8 - 18	210	155	160	120	290	215	160	120	
3/4 - 10	325	240	255	190	460	340	255	190	
3/4 - 16	365	270	285	210	515	380	285	210	
7/8 - 9	490	360	380	280	745	550	380	280	
7/8 - 14	530	390	420	310	825	610	420	310	
1 - 8	720	530	570	420	1100	820	570	420	
1 - 14	800	590	650	480	1200	890	650	480	



Section W - Warranty

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All Engines United States and Canada Industrial (Off-Highway)

Coverage

Products Warranted

This warranty applies to new Engines sold by Cummins and delivered to the first user on or after April 1, 1999, that are used in industrial (off-highway) applications in the United States* and Canada, except for Engines used in marine, generator drive and certain defense applications, for which different warranty coverage is provided.

Base Engine Warranty

This warranty covers any failures of the Engine, under normal use and service, which result from a defect in material or factory workmanship (Warrantable Failures).

Coverage begins with the sale of the Engine by Cummins. Coverage continues for two years or 2,000 hours of operation, whichever occurs first, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first. If the 2,000 hour limit is exceeded during the first year, Coverage continues until the end of the first year.

Extended Major Components Warranty

The Extended Major Components Warranty covers Warrantable Failures of the Engine cylinder block, camshaft, crankshaft and connecting rods (Covered Parts).

Bushing and bearing failures are not covered.

This Coverage begins with the expiration of the Base Engine Warranty and ends three years or 10,000* hours of operation from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or from when the Engine has been operated for 50 hours, whichever occurs first.

*3,000 hours for A series engines.

Consumer Products

The warranty on Consumer Products in the United States is a LIMITED warranty. **CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.** Any implied warranties applicable to Consumer Products in the United States terminate concurrently with the expiration of the express warranties applicable to the product. In the United States, some states do not allow the exclusion of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the limitations or exclusions herein may not apply to you.

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

Cummins' Responsibilities

During The Base Engine Warranty

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

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

Cummins will pay reasonable costs for mechanics to travel to and from the equipment site, including meals, mileage and lodging, when the repair is performed at the site of the failure.

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

During The Extended Major Components Warranty

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

Owner's Responsibilities

During The Base Engine Warranty

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

During The Extended Major Components Warranty

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

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

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

During The Base Engine and Extended Major Components Warranties

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

Before the expiration of the applicable warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility. Locations in the United States and Canada are listed in the Cummins Off Highway Authorized Dealer Directory.

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

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

Limitations

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

For power units and fire pumps (package units), this warranty applies to accessories, except for clutches and filters, supplied by Cummins which bear the name of another company.

Except for power units and fire pumps, this warranty does not apply to accessories which bear the name of another company. Such non-warranted accessories include, but are not limited to: alternators, starters, fans**, air conditioning compressors, clutches, filters, transmissions, torque converters, steering pumps, and non-Cummins fan drives, engine compression brakes and air compressors.

Cummins Compusave units are covered by a separate warranty.

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

Failures of belts and hoses supplied by Cummins are not covered beyond the first 500 hours or one year of operation, whichever occurs first.

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

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

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

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

Emission Warranty

Products Warranted

This emission warranty applies to new Engines marketed by Cummins that are used in the United States* in vehicles designed for Industrial off-highway use. This warranty applies to Engines delivered to the ultimate purchaser on or after April 1, 1999 for engines up to 750 horsepower, on or after January 1, 2000 for engines 751 horsepower and over.

Coverage

Cummins warrants to the ultimate purchaser and each subsequent purchaser that the Engine is designed, built and equipped so as to conform at the time of sale by Cummins with all U.S. Federal emission regulations applicable at the time of manufacture and that it is free from defects in workmanship or material which would cause it not to meet these regulations within the longer of the following periods: (A) Five years or 3,000 hours of operation, whichever occurs first, as measured from the date of delivery of the Engine to the ultimate purchaser, or (B) The Base Engine Warranty.

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

Limitations

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

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

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

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

** Alternators, starters, and fans ARE covered for the duration of the base engine warranty on A series and B3.3 engines.



All Engines International Industrial (Off-Highway)

Coverage

PRODUCTS WARRANTED

This warranty applies to new Engines sold by Cummins and delivered to the first user on or after April 1, 1999, that are used in industrial (off-highway) applications anywhere in the world where Cummins-approved service is available, except the United States* and Canada. Different warranty coverage is provided for Engines used in marine, generator drive and certain defense applications.

BASE ENGINE WARRANTY

This warranty covers any failures of the Engine, under normal use and service, which result from a defect in material or factory workmanship (Warrantable Failure).

Coverage begins with the sale of the Engine by Cummins. Coverage continues for two years or 2,000 hours of operation, whichever occurs first, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first. If the 2,000 hour limit is exceeded during the first year, coverage continues until the end of the first year.

EXTENDED MAJOR COMPONENTS WARRANTY

The Extended Major Components Warranty covers Warrantable Failures of the Engine cylinder block, camshaft, crankshaft and connecting rods (Covered Parts).

Bushing and bearing failures are not covered.

This coverage begins with the expiration of the Base Engine Warranty and ends three years or 10,000* hours of operation, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or from when the Engine has been operated for 50 hours, whichever occurs first.

*3,000 hours for A series engines.

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

Cummins' Responsibilities

DURING THE BASE ENGINE WARRANTY

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

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

Cummins will pay reasonable costs for mechanics to travel to and from the equipment site, including meals, mileage and lodging, when the repair is performed at the site of the failure.

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

DURING THE EXTENDED MAJOR COMPONENTS WARRANTY

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

Owner's Responsibilities

DURING THE BASE ENGINE WARRANTY

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

DURING THE EXTENDED MAJOR COMPONENTS WARRANTY

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

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

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

DURING THE BASE ENGINE AND EXTENDED MAJOR COMPONENTS WARRANTIES

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

Before the expiration of the applicable warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the product available for repair by such facility. Locations are listed in the Cummins International Sales and Service Directory.

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

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

Limitations

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

For power units and fire pumps (package units) the warranty applies to accessories, except for clutches and filters supplied by Cummins which bear the name of another company.

Starters, alternators, power steering pumps and non-Cummins air compressors supplied by Cummins on B or C Series Engines that are not supplied as part of a package unit are covered for six months* from the date of delivery of the Engine to the first user, or the date the Engine is first leased, rented or loaned, or from when the Engine has been operated for 50 hours, whichever occurs first.

Except for the accessories noted previously, Cummins does not warrant accessories which bear the name of another company. Such non-warranted accessories include, but are not limited to: alternators, starters, fans*, air conditioning compressors, clutches, filters, transmissions, torque converters, steering pumps, non-Cummins fan drives, and air cleaners.

Cummins Compusave units are covered by a separate warranty.

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

Failures of belts and hoses supplied by Cummins are not covered beyond the first 500 hours or one year of operation, whichever occurs first.

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

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

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

In case of consumer sales, in some countries, the Owner has statutory rights which cannot be affected or limited by the terms of this warranty.

Nothing in this warranty excludes or restricts any contractual rights the Owner may have against third parties.

* Alternators, starters, and fans ARE covered for the duration of the base engine warranty on A series and B3.3 engines.

California Emission Control System Warranty, Off-Highway

Products Warranted

This Emission Control System Warranty applies to off-road diesel engines certified with the California Air Resources Board beginning with the year 1996 for engines up to 750 horsepower, beginning with the year 2000 for 751 horsepower and over, marketed by Cummins, and registered in California for use in industrial off-highway applications.

Your Warranty Rights and Obligations

The California Air Resources Board and Cummins Engine Company, Inc., are pleased to explain the emission control system warranty on your engine. In California, new off-road diesel engines must be designed, built and equipped to meet the State's stringent anti-smog standards. Cummins must warrant the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

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

Where a warrantable condition exists, Cummins will repair your off-road diesel engine at no cost to you including diagnosis, parts and labor.

Manufacturer's Warranty Coverage

This warranty coverage is provided for 5 years or 3,000 hours of engine operation, whichever first occurs from the date of delivery of the engine to the first user. If any emission-related part on your engine is defective, the part will be repaired or replaced by Cummins.

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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

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Owner's Warranty Responsibilities

As the off-road diesel engine owner, you are responsible for the performance of the required maintenance listed in your Cummins Operation and Maintenance Manual. Cummins recommends that you retain all receipts covering maintenance on your off-road diesel engine, but Cummins cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

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

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

Your engine is designed to operate on diesel fuel only. Use of any other fuel may result in your engine no longer operating in compliance with California's emissions requirements.

If you have any questions regarding your warranty rights and responsibilities, you should contact Cummins Customer Assistance Department at 1-800-343-7357 (1-800-DIESELS) or the California Air Resources Board at 9528 Telstar Avenue, El Monte, CA 91731.

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

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

Owner is responsible for business costs and losses, "downtime" expenses, and cargo damage resulting from a warrantable failure. CUMMINS IS NOT RESPONSIBLE FOR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDE BUT ARE NOT LIMITED TO FINES, THEFT, VANDALISM OR COLLISIONS.

Replacement Parts

Cummins recommends that any service parts used for maintenance, repair or replacement of emission control systems be new, genuine Cummins or Cummins approved rebuilt parts and assemblies, and that the engine be serviced by a Cummins distributor, authorized dealer or the repair location approved by Cummins. The owner may elect to have maintenance, replacement or repair of the emission control parts performed by a facility other than a Cummins distributor, an authorized dealer or a repair location approved by Cummins, and may elect to use parts other than new genuine Cummins or Cummins approved rebuilt parts and assemblies for such maintenance, replacement or repair; however, the cost of such service or parts will not be covered under this emission control system warranty.

Cummins Responsibilities

Repairs and service will be performed by any Cummins distributor, authorized dealer or other repair location approved by Cummins using new, genuine Cummins or Cummins approved rebuilt parts and assemblies. Cummins will repair any of the emission control parts found by Cummins to be defective without charge for parts or labor (including diagnosis which results in determination that there has been a failure of a warranted emission control part).

Emergency Repairs

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

Warranty Limitations

Cummins is not responsible for failures resulting from Owner or operator abuse or neglect, such as: operation without adequate coolant, fuel or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or air intake systems; improper storage, starting, warm-up, run-in or shutdown practices.

The manufacturer warrants to the ultimate purchaser and each subsequent purchaser that the engine is designed, built, and equipped so as to conform with all applicable regulations adopted by the Air Resources Board, and that it is free from defects in materials and workmanship which cause the failure of a warranted part.

Any warranted part which is not scheduled for replacement as required maintenance, or which is scheduled only for regular inspection to the effect of "repair or replace as necessary" is warranted for the warranty period.

Any warranted part which is scheduled for replacement as required maintenance is warranted for the period of time prior to the first scheduled replacement point for that part.

The owner will not be charged for diagnostic labor which leads to the determination that a warranted part is defective, if the diagnostic work is performed at a warranty station.

The manufacturer is liable for damages to other engine components caused by the failure under warranty of any warranted part.

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

These warranties, together with the express commercial warranties and emission warranty are the sole warranties of Cummins. There are no other warranties, express or implied, or of merchantability or fitness for a particular purpose.

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QSB5.9/QSC8.3/QSL9/QSM11 Commercial Applications Marine Propulsion
Worldwide

Coverage

Engines Included in this Coverage

Marine Propulsion

QSB5.9

QSC8.3

QSL9

QSM11

Products Warranted

This warranty applies to new QSB5.9, QSC8.3, QSL9 and QSM11 Engines sold by Cummins MerCruiser Diesel LLC., herein after "CMD", that are branded as Cummins MerCruiser Diesel products and used in Marine propulsion applications anywhere in the world where CMD approved service is available* and delivered to the first user on or after Jan 1, 2004. This warranty excludes all engines branded and sold as Cummins Marine Diesel products. The 'Product' consists of a new CMD Engine, as well as accessories, which are approved and supplied by CMD and which are either installed by CMD or a CMD authorized distributor. These Products have the following designation:

MARINE PROPULSION

Intermittent Rating

This power rating is intended for intermittent use in variable load applications where full power is limited to two hours out of every eight hours of operation. Also, reduced power operations must be at or below 200 RPM of the maximum rated RPM. This rating is an ISO3046 Fuel Stop Power Rating and is for applications that operate less than 1500 hours per year.

Medium Continuous Rating

This power rating is intended for continuous use in variable load applications where full power is limited to six hours out of every twelve hours of operation. Also, reduced power operations must be at or below 200 RPM of the maximum rated RPM. This rating is an ISO3046 Fuel Stop Power Rating and is for applications that operate less than 3000 hours per year.

Heavy Duty Rating

This power rating is intended for continuous use in variable load applications where full power is limited to eight hours out of every ten hours of operation. Also, reduced power must be at least 200 RPM below the maximum rated RPM. This rating is an ISO3046 Fuel Stop Power Rating and is for applications that operate less than 5,000 hours per year.

Continuous Rating

This power rating is intended for continuous use in applications requiring uninterrupted service at full power. This rating is an ISO3046 Standard Power Rating.

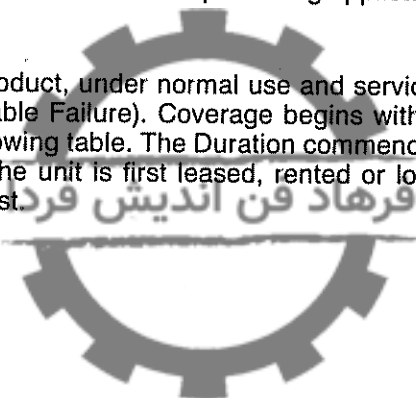
Government Service (GS) Rating

Intended for use in variable load applications where full power is limited to one hour out of every eight hours of operation. Also reduced power must be at or below 200 RPM of the maximum rated RPM. This power rating is only for use in National, State or Local government non-revenue producing applications.

Base Engine Warranty

This warranty covers any failures of the Product, under normal use and service, which result from a defect in CMD material or factory workmanship (Warrantable Failure). Coverage begins with the sale of the Engine by CMD and continues for the Duration stated in the following table. The Duration commences on either the date of delivery of the Product to the first end-user, or the date the unit is first leased, rented or loaned, or when the Product has been operated for 50 hours, whichever occurs first.

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Warranty Coverage Periods				
Rating	QSB, QSC, QSL		QSM11	
	Note: Coverage ends at which ever occurs first, months or hours of usage.		Note: Coverage ends at which ever occurs first, months or hours of usage.	
	Months	Hours	Months	Hours
Intermittent	24	3000	24	3000
Medium Continuous Duty	24	5000	24	6000
Heavy Duty	24	5500	24	8000
Continuous	24	6500	24	9000

Cummins MerCruiser Diesel Responsibilities During Engine Warranty

CMD will pay for all parts and labor needed to repair the damage to the Product resulting from a Warrantable Failure when performed during normal business hours. All labor costs will be paid in accordance with Cummins published Standard Repair Time guidelines.

When it is necessary for mechanics to make on-site warranty repairs CMD will pay reasonable travel expenses, including meals, mileage and lodging, for mechanics to travel to and from the repair dock.

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

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

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Owner Responsibilities During the Engine Warranty

Owner is responsible for the operation and maintenance of the Product as specified in the applicable CMD Operation and Maintenance Manual. Owner is also responsible for providing proof that all recommended maintenance has been performed. This warranty does not cover normal wear and tear of covered parts.

Before the expiration of the applicable warranty, Owner must notify a CMD service provider, distributor, authorized dealer, or other repair location approved by CMD of any Warrantable Failure and make the Engine available for repair by such facility. Locations in the United States and Canada are listed in the Cummins U.S. and Canada Sales and Service Directory; other locations are listed in the Cummins International Sales and Service Directory.

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.

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

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

In the event of any Product failure, Owner is responsible for the cost of towing the boat to the repair dock and for all associated docking and harbor charges.

Owner is responsible for maintaining the Engine hourmeter in good working order at all times and to ensure that the hourmeter accurately reflects the total hours of operation of the Product.

Owner is responsible for the costs to investigate complaints, unless the problem is caused by a defect in Cummins material or factory workmanship.

Limitations

1. Maintenance Component Limitations

CMD will replace certain maintenance components if they fail within 90 days or less after the base coverage starts. Maintenance components include but are not limited to: sea water pump impellers, zinc plugs, oil filters, fuel filters, air filters, water filters, fuel/water separator filters, expansion tank pressure caps, belts, hoses.

2. Other Component Limitations

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- Instruments
• Panels & Gauges
• Electrical Switches
• Alternators (non Cummins branded)
• Senders/Sensors
• Engine Controls
• Electrical harness
• Exhaust elbows/connections
• Accessory drives/hydraulic pumps
• Sea water pump (not including impeller)

3. Cummins branded alternators and starters limitation

Warranty coverage is limited to 2 years or 2000 hours, whichever expires first.

Except for the accessories noted previously, CMD does not warrant accessories which bear the name of or are manufactured by another company.

Consumer Products

The warranty on Consumer Products in the United States is a limited warranty. CMD IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. Any implied warranties applicable to Consumer Products terminate concurrently with the expiration of the express warranties applicable to the Product.

CMD is not responsible for failures or damage resulting from what CMD 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.

CMD is not responsible for failures resulting from:

- 1. Use or application of the Product inconsistent with its rating designation set forth above.
2. Incorrect installation.

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

CMD is not responsible for failures of maintenance components supplied by CMD beyond 90 days after the coverage duration start date. Maintenance components include, but are not limited to: sea water pump impellers; zinc plugs; oil filters; fuel filters; air filters; water filters; fuel/water separator filters; expansion tank pressure caps.

Failure of belts and hoses supplied by CMD are not covered beyond 90 days after the date of delivery of the Product to the first user, or the date the unit is first leased, rented or loaned, or when the Product has been operated for 50 hours, whichever occurs first.

Parts used in warranty repairs may be new CMD parts, CMD-approved rebuilt parts, or repaired parts. CMD is not responsible for failures resulting from the use of parts not supplied by CMD.

A new CMD or CMD-approved rebuilt part used to replace a Warranted Part assumes the identity of the Warranted Part it replaced and is entitled to the remaining coverage hereunder.

CMD DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CMD IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

Emission Warranty

Products Warranted

This Emission Warranty applies to new Engines certified to United States EPA 40 CFR 94 sold by CMD that are installed in vessels flagged or registered in the United States**.

Coverage

CMD 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 CMD with all U.S. Federal emission regulations applicable at the time of manufacture and that it is free from defects in workmanship or material which would cause it not to meet these regulations within the longer of the following periods: (A) Five years or 5,000 hours of operation, whichever occurs first, The Emissions Warranty starts from the date of delivery of the Engine to the first user, or the date the unit is first leased, rented, or loaned, or when the Engine has been operated for 50 hours, whichever occurs first, or (B) The Base Engine Warranty.

Limitations

The owner may elect to have maintenance, replacement, or repair of the emission control parts performed by a facility other than a CMD distributor, an authorized dealer or a repair location approved by CMD, and may elect to use parts other than new genuine CMD or CMD-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.

Failures, except those resulting from a defect in materials, or factory workmanship, are not covered by this WARRANTY.

CMD IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

In the United States** and Canada, this warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Outside the United States** and Canada, in case of consumer sales, in some countries the Owner has statutory rights which cannot be affected or limited by the terms of this warranty.

Nothing in this warranty excludes or restricts any contractual rights the Owner may have against third parties.

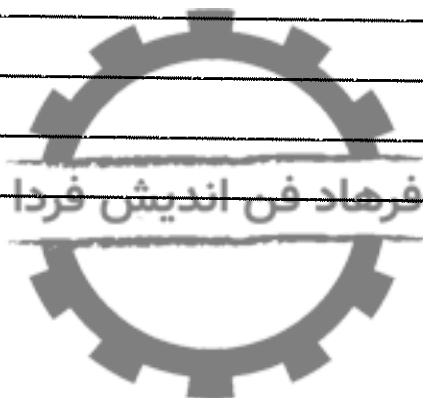
* Locations in the United States and Canada are listed in the Cummins United States and Canada Sales and Service Directory; other locations are listed in the Cummins International Sales and Service Directory.

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



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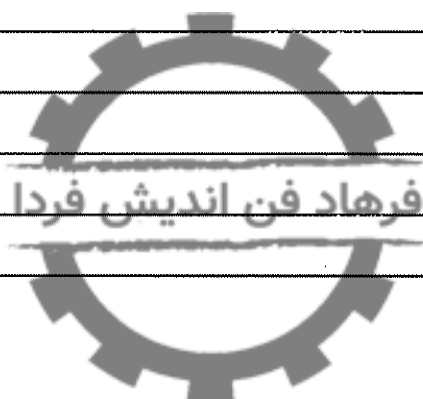
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