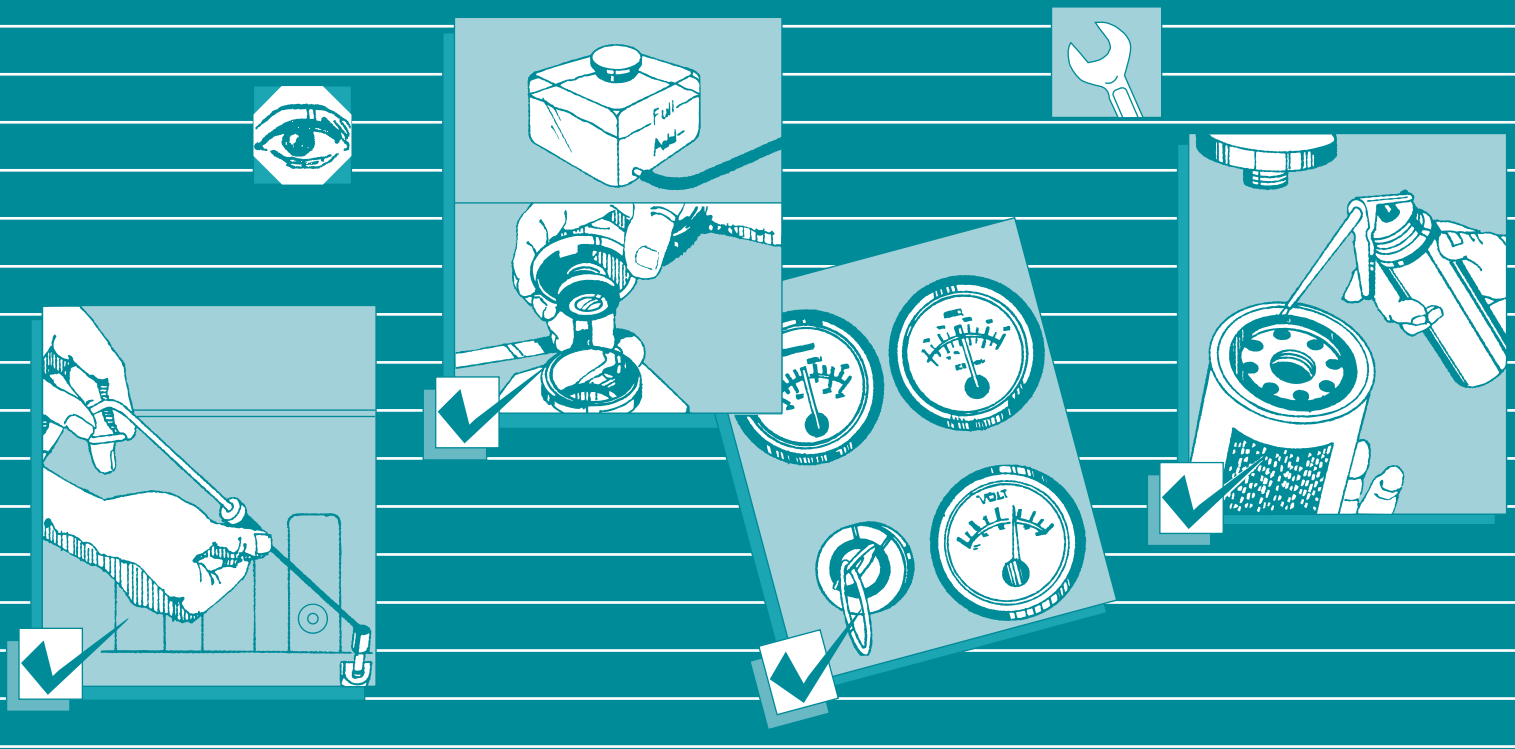
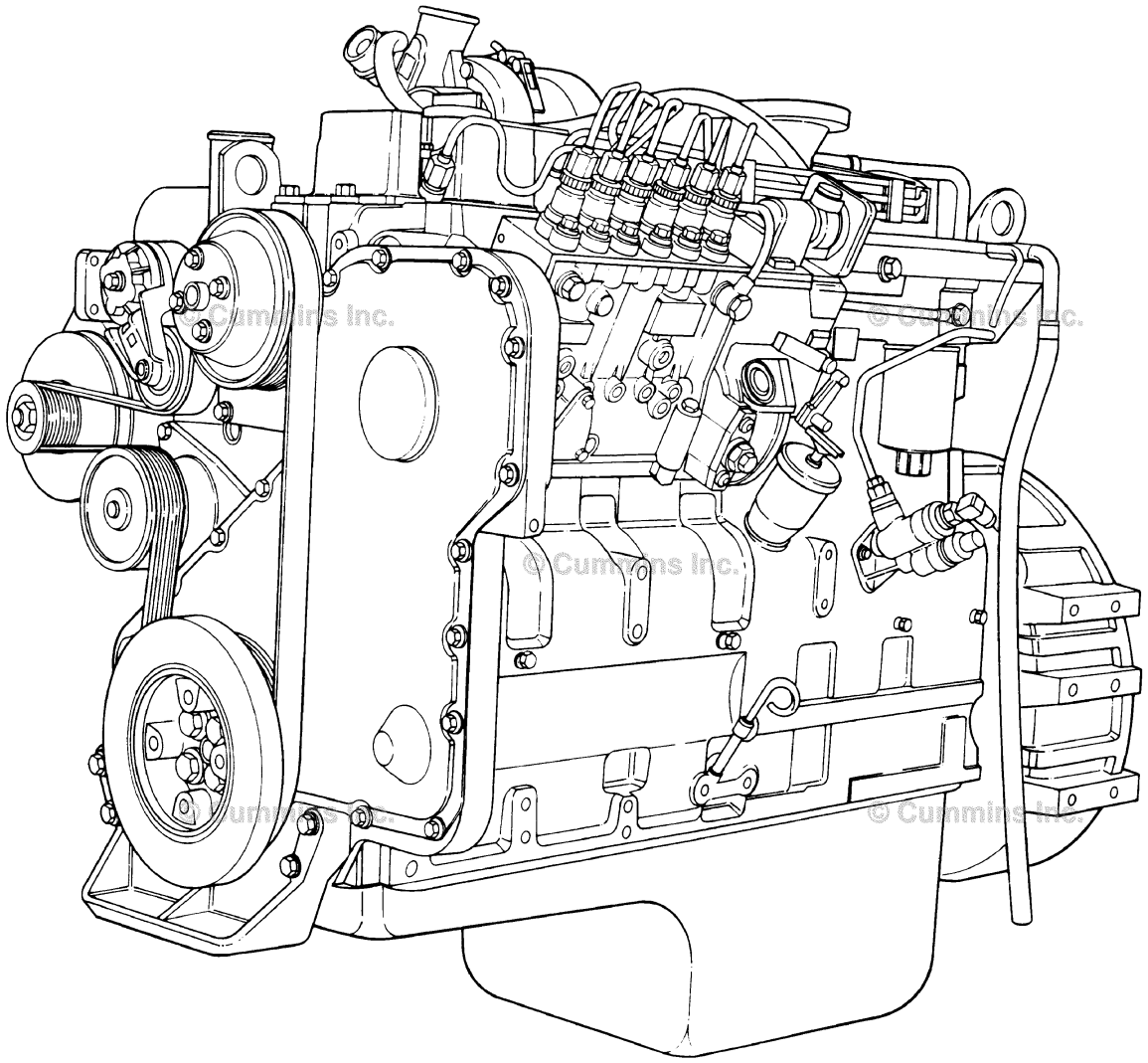
Operation and Maintenance Manual
Commercial Marine and Industrial C8.3



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

Operation and Maintenance Manual
Commercial Marine and Industrial C8.3



ew900gu

Bulletin 4021330
Printed 26-AUGUST-2013

Foreword

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

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

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

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

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

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

Table of Contents

Important Reference Numbers

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

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

Section i - Introduction

Section Contents

This Page Left Intentionally Blank

To the Owner and Operator

General Information

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

Keep records of regularly scheduled maintenance.

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

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

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

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

⚠CAUTION⚠

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

About the Manual

General Information

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

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

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

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

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

How to Use the Manual

General Information

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

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

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

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

Symbols

General Information

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

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

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

Indicates a **REMOVAL or DISASSEMBLY** step.

Indicates an **INSTALLATION or ASSEMBLY** step.

INSPECTION is required.

CLEAN the part or assembly.

PERFORM a mechanical or time **MEASUREMENT**.

LUBRICATE the part or assembly.

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

TIGHTEN to a specific torque.

PERFORM an electrical **MEASUREMENT**.

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

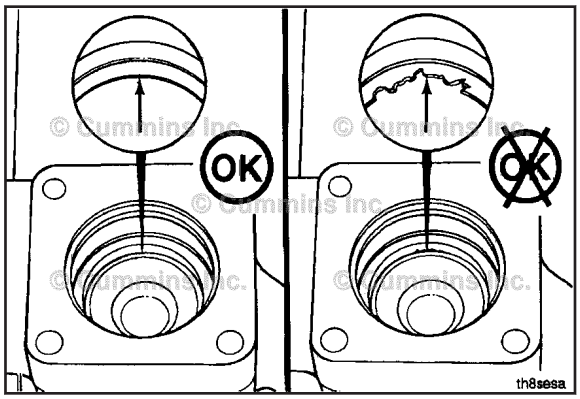
The component weighs 23 kg [50 lb] or more. To avoid personal injury, use a hoist or get assistance to lift the component.

17800009

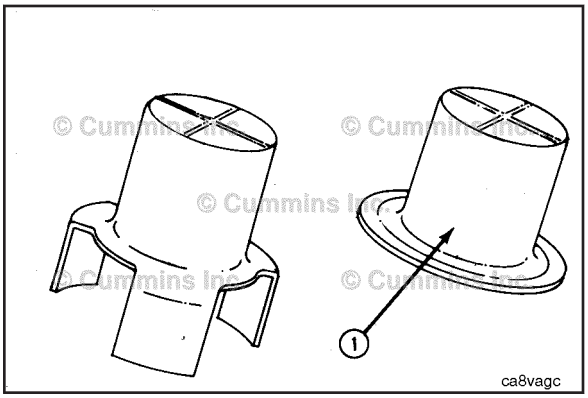
Illustrations

General Information

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



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



General Safety Instructions

Important Safety Notice

⚠ WARNING ⚠

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

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

- Work in an area surrounding the product that is dry, well lit, ventilated, free from clutter, loose tools, parts, ignition sources and hazardous substances. Be aware of hazardous conditions that can exist.
- **Always** wear protective glasses and protective shoes when working.
- Rotating parts can cause cuts, mutilation or strangulation.
- Do **not** wear loose-fitting or torn clothing. Remove all jewelry when working.
- Disconnect the battery (negative [-] cable first) and discharge any capacitors before beginning any repair work. Disconnect the air starting motor if equipped to prevent accidental engine starting. Put a "Do **Not** Operate" tag in the operator's compartment or on the controls.
- Use ONLY the proper engine barring techniques for manually rotating the engine. Do **not** attempt to rotate the crankshaft by pulling or prying on the fan. This practice can cause serious personal injury, property damage, or damage to the fan blade(s) causing premature fan failure.
- If an engine has been operating and the coolant is hot, allow the engine to cool before slowly loosening the filler cap to relieve the pressure from the cooling system.
- **Always** use blocks or proper stands to support the product before performing any service work. Do **not** work on anything that is supported ONLY by lifting jacks or a hoist.
- Relieve all pressure in the air, oil, fuel, and cooling systems before any lines, fittings, or related items are removed or disconnected. Be alert for possible pressure when disconnecting any device from a system that utilizes pressure. Do **not** check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.
- To reduce the possibility of suffocation and frostbite, wear protective clothing and ONLY disconnect liquid refrigerant (Freon) lines in a well ventilated area. To protect the environment, liquid refrigerant systems **must** be properly emptied and filled using equipment that prevents the release of refrigerant gas (fluorocarbons) into the atmosphere. Federal law requires capturing and recycling refrigerant.
- To reduce the possibility of personal injury, use a hoist or get assistance when lifting components that weigh 23 kg [50 lb] or more. Make sure all lifting devices such as chains, hooks, or slings are in good condition and are of the correct capacity. Make sure hooks are positioned correctly. **Always** use a spreader bar when necessary. The lifting hooks **must not** be side-loaded.
- Corrosion inhibitor, a component of SCA and lubricating oil, contains alkali. Do **not** get the substance in eyes. Avoid prolonged or repeated contact with skin. Do **not** swallow internally. In case of contact, immediately wash skin with soap and water. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. IMMEDIATELY CALL A PHYSICIAN. KEEP OUT OF REACH OF CHILDREN.
- Naptha and Methyl Ethyl Ketone (MEK) are flammable materials and **must** be used with caution. Follow the manufacturer's instructions to provide complete safety when using these materials. KEEP OUT OF REACH OF CHILDREN.
- To reduce the possibility of burns, be alert for hot parts on products that have just been turned off, exhaust gas flow, and hot fluids in lines, tubes, and compartments.
- **Always** use tools that are in good condition. Make sure you understand how to use the tools before performing any service work. Use ONLY genuine Cummins® or Cummins ReCon® replacement parts.
- **Always** use the same fastener part number (or equivalent) when replacing fasteners. Do **not** use a fastener of lesser quality if replacements are necessary.
- When necessary, the removal and replacement of any guards covering rotating components, drives, and/or belts should only be carried out be a trained technician. Before removing any guards the engine **must** be turned off and any starting mechanisms **must** be isolated. All fasteners **must** be replaced on re-fitting the guards.
- Do **not** perform any repair when fatigued or after consuming alcohol or drugs that can impair your functioning.

- Some state and federal agencies in the United States of America have determined that used engine oil can be carcinogenic and can cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil.
- Do **not** connect the jumper starting or battery charging cables to any ignition or governor control wiring. This can cause electrical damage to the ignition or governor.
- **Always** torque fasteners and fuel connections to the required specifications. Overtightening or undertightening can allow leakage. This is critical to the natural gas and liquefied petroleum gas fuel and air systems.
- **Always** test for fuel leaks as instructed, as odorant can fade.
- Close the manual fuel valves prior to performing maintenance and repairs, and when storing the vehicle inside.
- Coolant is toxic. If **not** reused, dispose of in accordance with local environmental regulations.
- The catalyst reagent contains urea. Do **not** get the substance in your eyes. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. Avoid prolonged contact with skin. In case of contact, immediately wash skin with soap and water. Do **not** swallow internally. In the event the catalyst reagent is ingested, contact a physician immediately.
- The catalyst substrate contains Vanadium Pentoxide. Vanadium Pentoxide has been determined by the State of California to cause cancer. Always wear protective gloves and eye protection when handling the catalyst assembly. Do not get the catalyst material in your eyes. In Case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. Avoid prolonged contact with skin. In case of contact, immediately wash skin with soap and water.
- The Catalyst substrate contains Vanadium Pentoxide. Vanadium Pentoxide has been determined by the State of California to cause cancer. In the event the catalyst is being replaced, dispose of in accordance with local regulations.
- California Proposition 65 Warning - Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

General Repair Instructions

General Information

This engine or system 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.

⚠ WARNING ⚠

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

1 Air Compressor
2 Air Controls
3 Air Shutoff Assemblies
4 Balance Weights
5 Cooling Fan
6 Fan Hub Assembly
7 Fan Mounting Bracket(s)
8 Fan Mounting Capscrews
9 Fan Hub Spindle
10 Flywheel
11 Flywheel Crankshaft Adapter
12 Flywheel Mounting Capscrews
13 Fuel Shutoff Assemblies
14 Fuel Supply Tubes
15 Lifting Brackets
16 Throttle Controls
17 Turbocharger Compressor Casing
18 Turbocharger Oil Drain Line(s)
19 Turbocharger Oil Supply Line(s)
20 Turbocharger Turbine Casing
21 Vibration Damper Mounting Capscrews
22 Manual Service Disconnect
23 High Voltage Interlock Loop
24 High Voltage Connectors/Connections and Harnesses
25 High Voltage Battery System
26 Power Inverter
27 Generator Motor
28 Clutch Pressure Plate

- Follow all safety instructions noted in the procedures
- Follow the manufacturer's recommendations for cleaning solvents and other substances used during repairs. Some solvents 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 or system and its components **must** be kept clean during any repair. Contamination of the engine, system or components will cause premature wear.
- All components **must** be kept clean during any repair. Contamination of the 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 service manual which can be ordered or purchased from a Cummins Authorized Repair Location. Refer to Section L — Service Literature for ordering instructions.

Welding on a Vehicle with an Electronic Controlled Fuel System

⚠CAUTION⚠

Disconnect both the positive (+) and negative (-) battery cables from the low voltage 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 clamp of the welder to any of the sensors, wiring harness, electronic control units or the components. Direct welding of any electronic components must not be attempted. Sensors, wiring harness, and electronic control unit should be removed if nearby welding will expose these components to temperatures beyond normal operation. Additionally, all electronic control unit connectors must be disconnected

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.

⚠WARNING⚠

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

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

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

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

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

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

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

⚠ WARNING ⚠

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

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

Gasket Surfaces

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

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

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

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

Solvent and Acid Cleaning

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

⚠ WARNING ⚠

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

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

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

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

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

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

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

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

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

Steam Cleaning

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

⚠ WARNING ⚠

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

Do **not** steam clean the following components:

- Electrical Components
- Wiring Harnesses
- Belts and Hoses
- Bearings (ball or taper roller)
- Electronic Control Module (ECM)
- ECM Connectors
- Capacitive Coil Driver Module (CCD)
- Ignition Coils and Leads
- NOx Sensor
- Fuel Control Valve
- Throttle Driver and Actuator.

Plastic Bead Cleaning

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

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

△ CAUTION △

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

△ CAUTION △

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

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

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

1 Bead size: U.S. size Number 16 — 20 for piston cleaning with plastic bead media, Part Number 3822735

2 Operating Pressure — 270 kPa (40 psi) for piston cleaning. Pressure should not cause beads to break.

3 Steam clean or wash the parts with solvent to remove all of the foreign material and plastic beads after cleaning. Rinse with hot water. Dry with compressed air.

⚠CAUTION⚠

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

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

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

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

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

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

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

Fuel System

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

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

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

Choose lint free towels for fuel system work.

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

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

Fuel filters are rated in microns. The word micron is the abbreviation for a micrometer, or one millionth of a meter. The micron rating is the size of the smallest particles that will be captured by the filter media. As a reference, a human hair

is 76 microns [0.003 in] in diameter. One micron measures 0.001 mm [0.00004 in.]. The contaminants being filtered out are smaller than can be seen with the human eye, a magnifying glass, or a low powered microscope.

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

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

Acronyms and Abbreviations

General Information

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

ANSI	American National Standards Institute
API	American Petroleum Institute
ASTM	American Society of Testing and Materials
ATDC	After Top Dead Center
BTU	British Thermal Unit
BTDC	Before Top Dead Center
°C	Celsius
CAN	Controller Area Network
CO	Carbon Monoxide
CCA	Cold Cranking Amperes
CARB	California Air Resources Board
C.I.B.	Customer Interface Box
C.I.D.	Cubic Inch Displacement
CNG	Compressed Natural Gas
CPL	Control Parts List
cSt	Centistokes
DEF	Diesel Exhaust Fluid
DOC	Diesel Oxidation Catalyst
DPF	Diesel Particulate Filter
ECM	Engine Control Module
EFC	Electronic Fuel Control
EGR	Exhaust Gas Recirculation
EPA	Environmental Protection Agency
°F	Fahrenheit
ft-lb	Foot-Pound Force
FMI	Failure Mode Indentifier
GVW	Gross Vehicle Weight
Hg	Mercury
hp	Horsepower
H_2O	Water
inHg	Inches of Mercury
in H_20	Inches of Water
ICM	Ignition Control Module
IEC	International Electrotechnical Commission
km/l	Kilometers per Liter
kPa	Kilopascal
LNG	Liquid Natural Gas
LPG	Liquified Petroleum Gas
LTA	Low Temperature Aftercooling
MCRS	Modular Common Rail System
MIL	Malfunction Indicator Lamp
MPa	Megapascal
mph	Miles Per Hour
mpq	Miles Per Quart
N•m	Newton-meter

NOx	Mono-Nitrogen Oxides
NG	Natural Gas
O2	Oxygen
OBD	On-Board Diagnostics
OEM	Original Equipment Manufacturer
OSHA	Occupational Safety and Health Administration
PID	Parameter Identification Descriptions
ppm	Parts Per Million
psi	Pounds Per Square Inch
PTO	Power Takeoff
REPTO	Rear Power Take Off
RGT	Rear Gear Train
rpm	Revolutions Per Minute
SAE	Society of Automotive Engineers
SCA	Supplemental Coolant Additive
SCR	Selective Catalytic Reduction
STC	Step Timing Control
SID	Subsystem Identification Descriptions
TDC	Top Dead Center
VDC	Volts of Direct Current
VGT	Variable Geometry Turbocharger
VS	Variable Speed
VSS	Vehicle Speed Sensor

Section E - Engine System Identification

Section Contents

This Page Left Intentionally Blank

Engine Identification

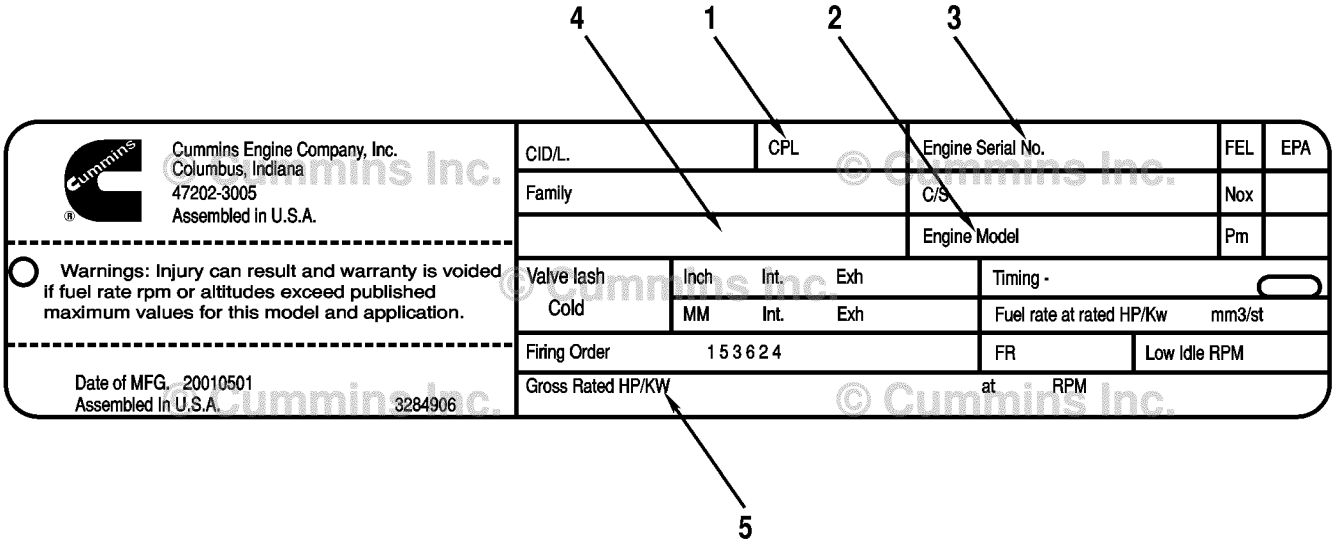
Engine Dataplate

Marine and Industrial Applications

The engine dataplates show specific information about your engine. The engine serial number and control parts list (CPL) provide information for ordering parts and service manuals.

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

The industrial engine 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. The information on the dataplate is **mandatory** when sourcing service parts.



00d00075

1 Control parts list (CPL)

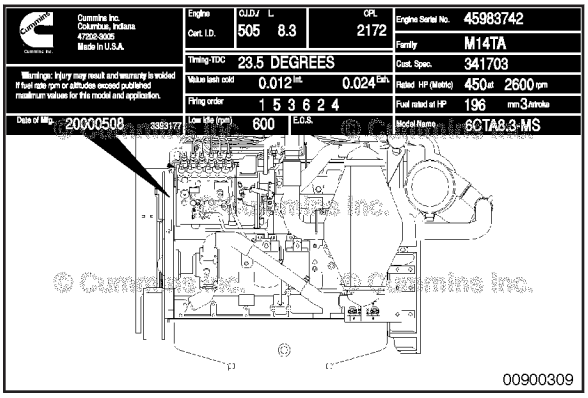
2 Model

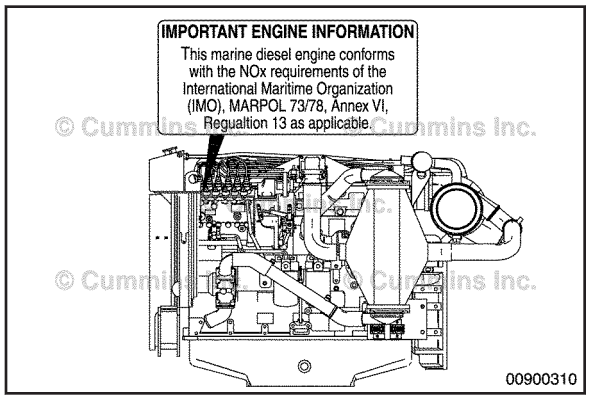
3 Engine serial number

4 Emissions certification

5 Horsepower and rpm rating.

Marine dataplate location.





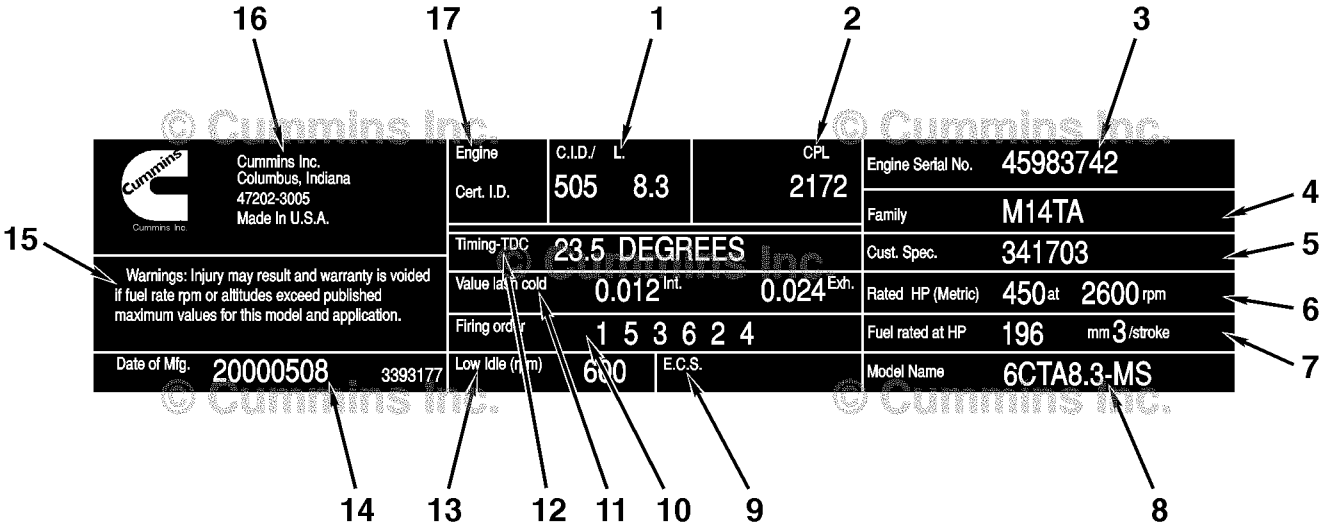
NOTE: This marine diesel engine conforms to the NOx requirements of the International Maritime Organization (IMO), MARPOL 73/78, Annex VI, Regulation 3 as applicable.

Engine Identification

Engine Dataplate

Marine and Industrial Applications

Use the information from the marine engine dataplate when discussing service or the source of parts for your engine.

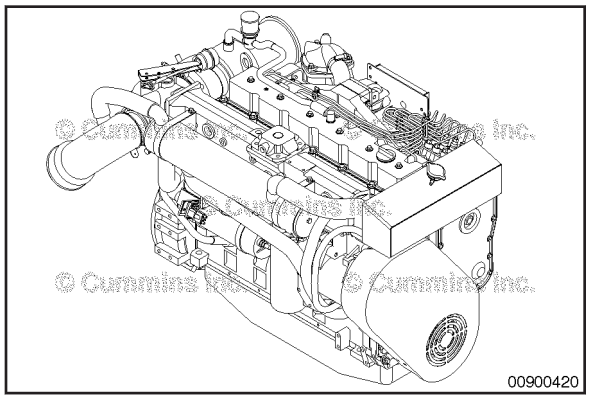


00900311

1 Cubic inch displacement and liter displacement
2 Control Parts List Number
3 Engine serial number
4 Emission family identification
5 Customer specification - base engine part number
6 Rated horsepower at rpm
7 Fuel rated at horsepower
8 Model name
9 Emission control system (currently **not** used on marine)
10 Firing order
11 Valve lash cold
12 Timing - top dead center
13 Low idle (rpm)
14 Date of manufacturing
15 Warning tag
16 Cummins address:

- Cummins Incorporated
- Columbus, Indiana
- 47202-3005
- Made in U.S.A.

21 Engine certification identification (currently **not** used on marine).

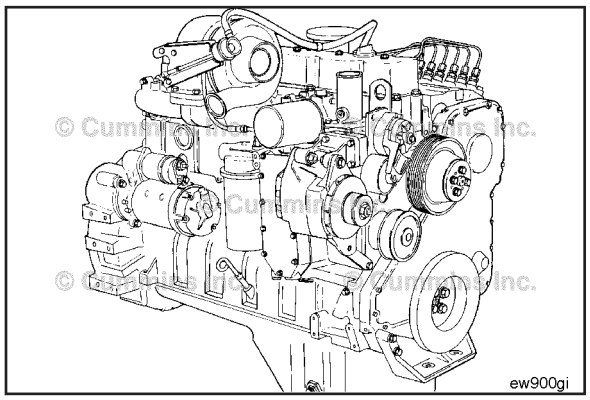


Cummins® Engine Nomenclature

Marine Applications

6CTA8.3M2 Marine Applications

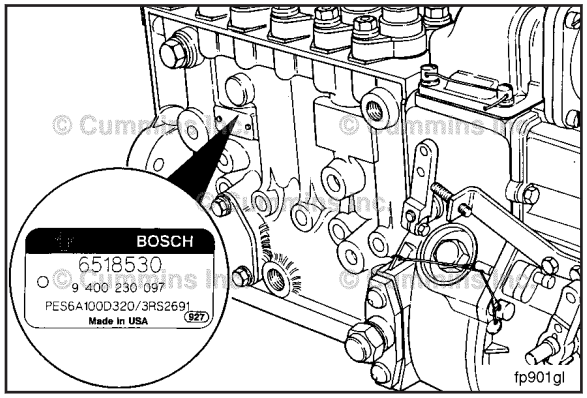
- 6 = number of cylinders
- C = engine series
- T = turbocharged
- A = aftercooled
- 8.3 = displacement in liters
- M = marine
- 3 = design phase



Industrial Applications

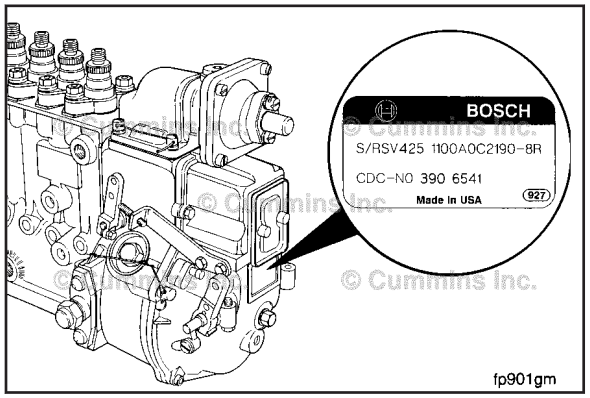
6CTAA8.3 Industrial Applications

- 8.3 = displacement in liters
- AA = charge air aftercooled
- T = turbocharged
- C = engine series
- 6 = number of cylinders



Fuel Injection Pump Dataplate

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

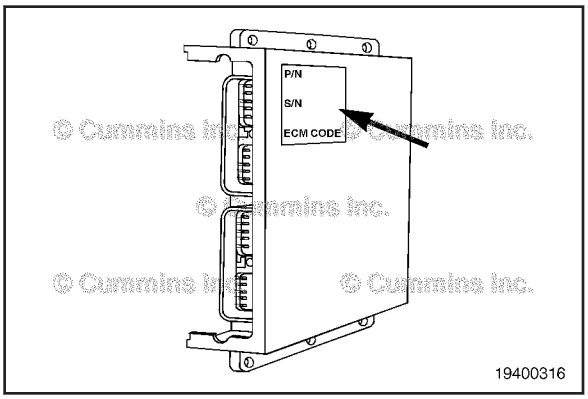


The Cummins part number for the fuel pump-governor combination is located on the governor dataplate.

ECM Dataplate

The external ECM dataplate is located on top of the ECM.

The dataplate contains the ECM part number (P/N), the ECM serial number (S/N), the manufacturing date code (D/C), the engine serial number (ESN), and the ECM code.



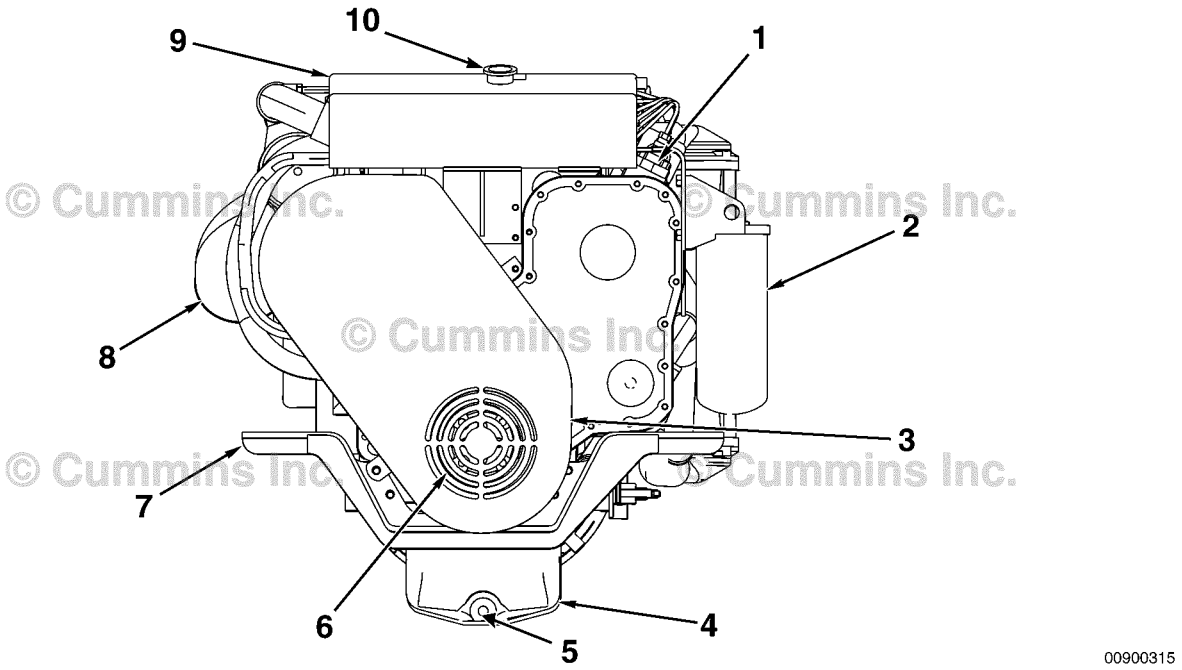
Engine Diagrams

Engine Views

Marine Applications

The following drawings illustrate the major components. Maintenance personnel **must** be familiar with each component to conduct the maintenance and service procedures discussed in this manual.

NOTE: The drawings in this section reflect a standard configuration. The engine can be equipped with optional accessories such as port-or starboard-side dipsticks. Location of optional items can be different from those shown.



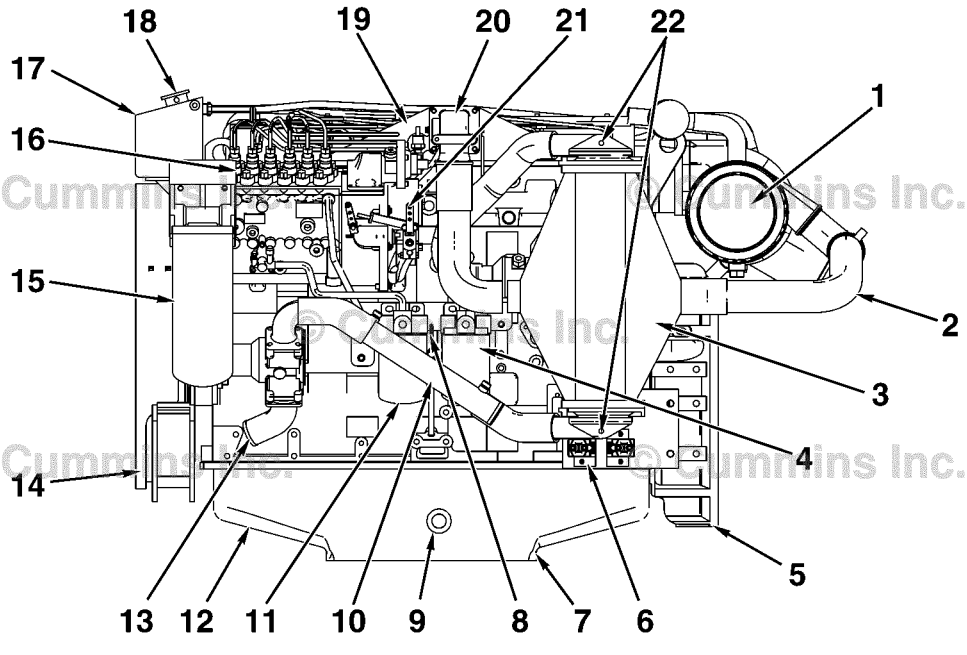
Front View, C Series, Six-Cylinder Sea Water Aftercooled 450C

1 Fuel pump
2 Remote mounted oil filter (optional)
3 Belt guard
4 Oil pan
5 Engine oil drain, front
6 Vibration damper (behind cover)
7 Engine mount, front
8 Exhaust elbow
9 Expansion tank
10 Coolant fill.

Engine Diagrams

Engine Views

Marine Applications



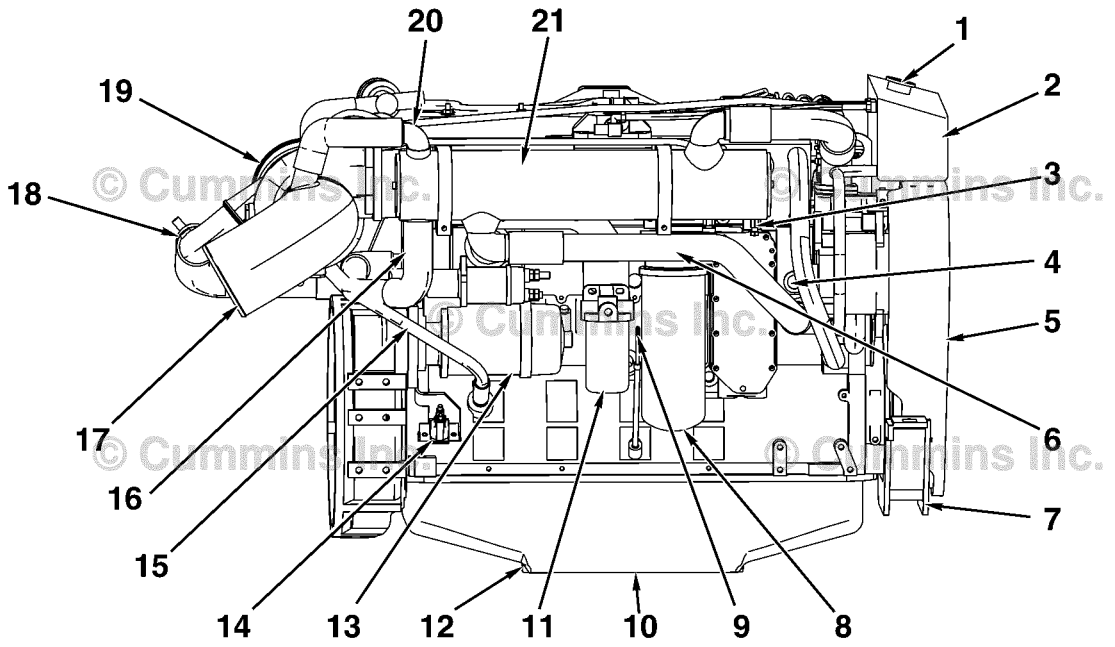
Port View, C 8.3, Six-Cylinder Sea Water Aftercooled 450C

1 Air cleaner
2 Inlet air crossover tube
3 Aftercooler (sea water-type)
4 Water (coolant) filter
5 Flywheel housing
6 Air heater control solenoids
7 Engine oil drain, rear
8 Dipstick (engine oil) port-side standard
9 Oil pan heater location (if equipped)
10 Fuel cooler
11 Fuel filter (standard)
12 Oil pan
13 Sea water pump inlet (rotatable)
14 Belt guard
15 Remote mounted oil filter (optional)
16 Fuel pump
17 Expansion tank
18 Coolant fill
19 Stop lever
20 Air heater
21 Throttle lever
22 Zinc plugs (aftercooler).

Engine Diagrams

Engine Views

Marine Applications



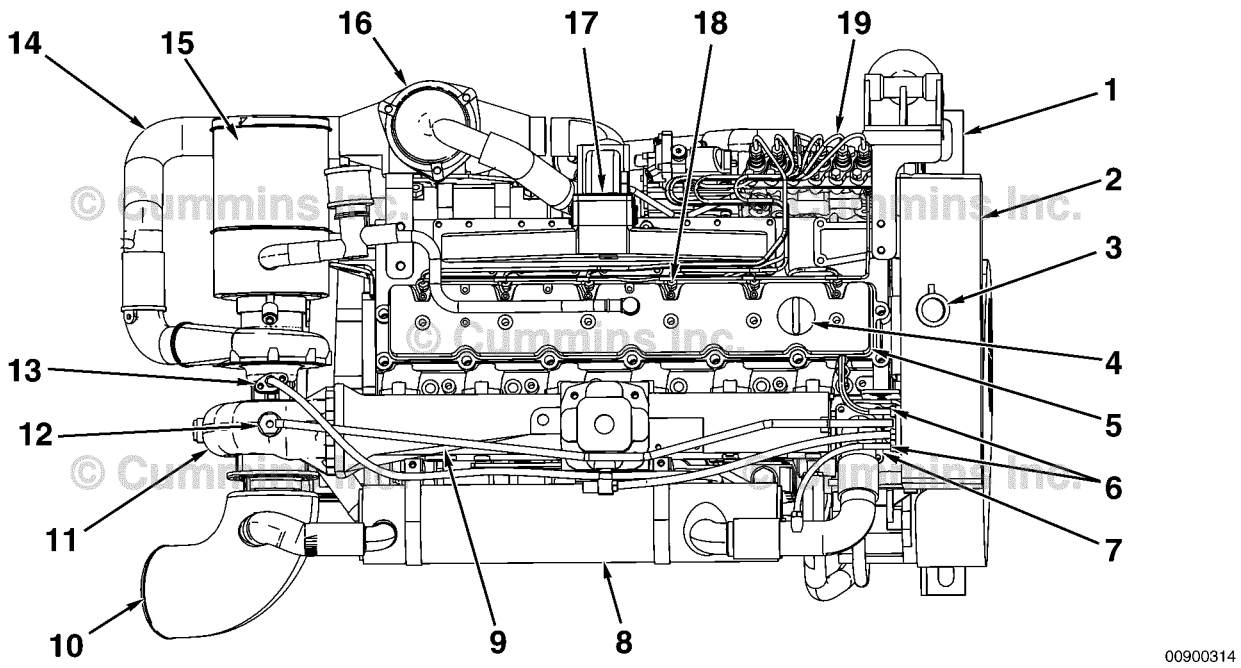
Starboard View, C 8.3, Six-Cylinder Sea Water Aftercooled 450C

1 Coolant fill
2 Expansion tank
3 Zinc plug (heat exchanger)
4 Coolant temperature sensor (coolant drain)
5 Belt guard
6 Heat exchanger coolant outlet tube
7 Engine mount (front)
8 Engine oil filter
9 Engine oil dipstick (optional starboard-side)
10 Oil pan
11 Fuel filter (optional starboard-side)
12 Engine oil drain, rear
13 Starter
14 Starter auxiliary magnetic switch
15 Turbocharger oil drain tube
16 Sea water inlet to heat exchanger
17 Exhaust outlet elbow
18 Inlet air crossover tube
19 Turbocharger (water cooled)
20 Sea water outlet to exhaust
21 Heat exchanger.

Engine Diagrams

Engine Views

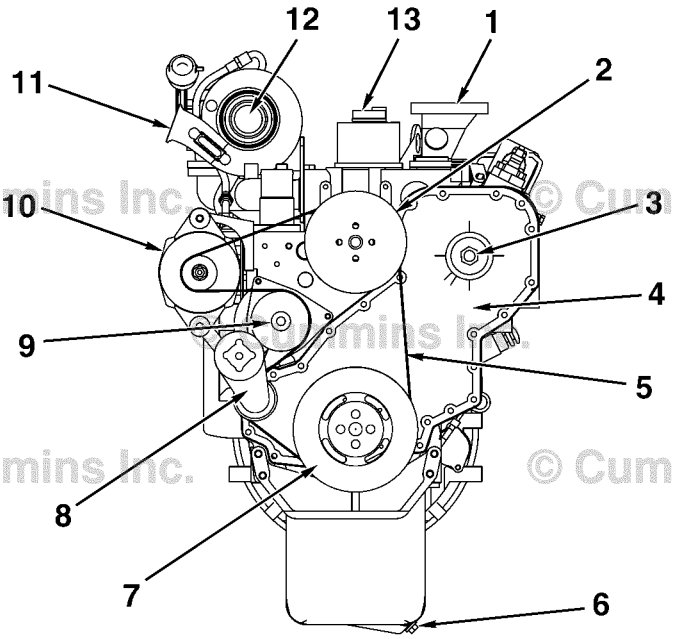
Marine Applications



Top View, C Series, Six-Cylinder Sea Water Aftercooled 450C

1 Engine mount (front)
2 Expansion tank
3 Coolant fill
4 Engine oil fill
5 Valve cover
6 Coolant vent line connections
7 Coolant thermostat location
8 Heat exchanger
9 Exhaust manifold (water cooled)
10 Exhaust outlet elbow
11 Turbocharger (water cooled)
12 Turbocharger coolant vent line
13 Turbocharger oil inlet
14 Inlet air crossover tube
15 Air filter
16 Aftercooler (sea water-type)
17 Air heater
18 Fuel injector
19 Fuel pump.

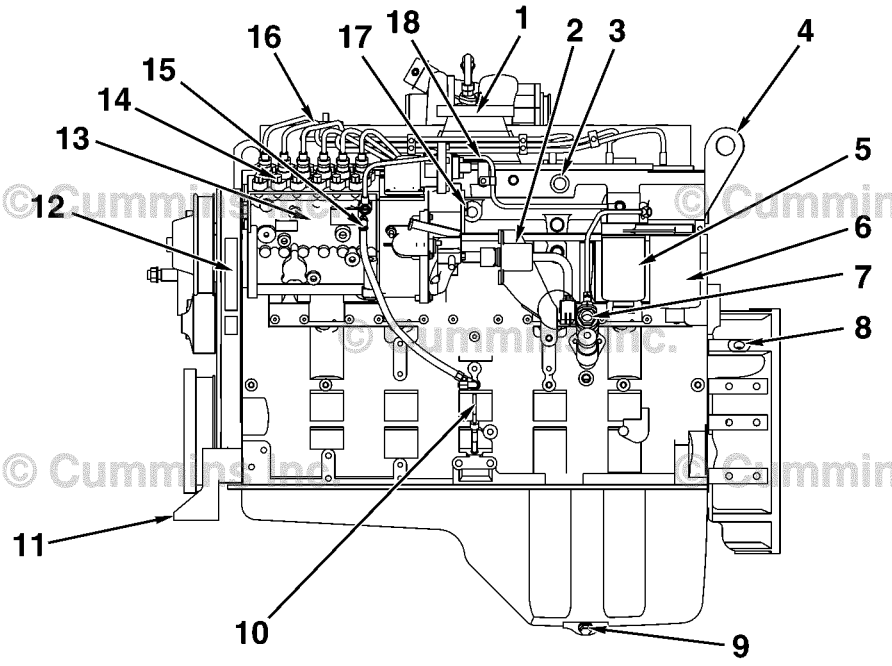
Industrial Applications



Front View - C8.3 - Industrial

1 Engine air inlet
2 Fan pulley
3 Fuel pump drive cover
4 Front gear cover
5 Drive belt
6 Lubricating oil pan drain plug
7 Vibration damper
8 Fan belt tensioner
9 Water pump
10 Alternator
11 Turbocharger air outlet
12 Turbocharger air inlet
13 Engine oil fill.

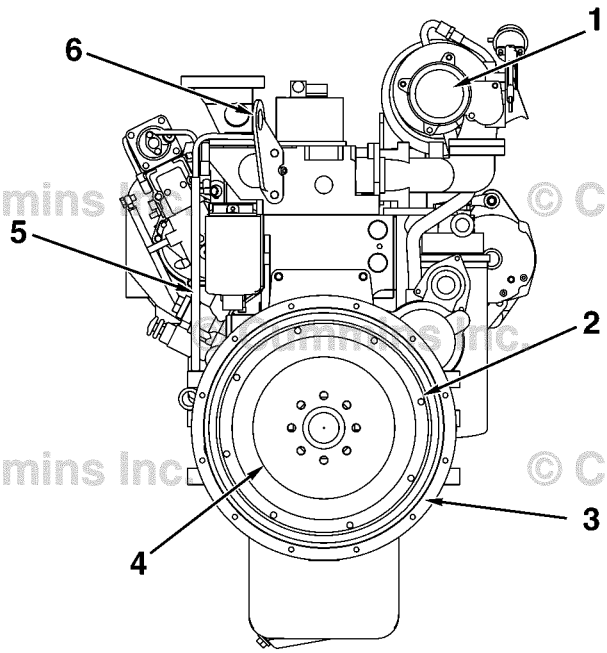
Industrial Applications



Left View - C8.3 - Industrial

1 Engine air inlet
2 Shutoff solenoid
3 M22 x 1.5 inlet (air)
4 Rear lifting bracket
5 Fuel filter
6 Fuel/water separator
7 Fuel transfer pump
8 3/4 x 16-inch UNF tap for magnetic pickup
9 Lubricating oil pan drain plug
10 Lubricating oil dipstick
11 Front engine mounting bracket
12 Engine dataplate
13 Fuel injection pump
14 Delivery valve
15 Fuel drain line
16 High-pressure fuel lines
17 1/2-inch NPTF inlet (air)
18 Intake air heater.

Industrial Applications

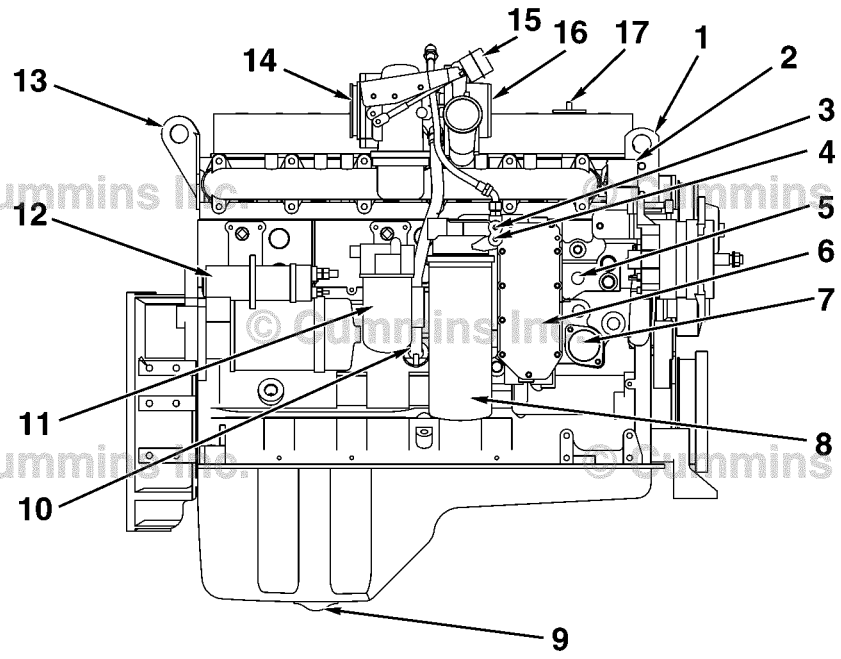


00900321

Rear View - C8.3 - Industrial

1 Turbocharger exhaust outlet
2 Flexplate mounting holes
3 Flywheel housing
4 Flywheel
5 Crankcase breather tube
6 Rear engine lifting bracket.

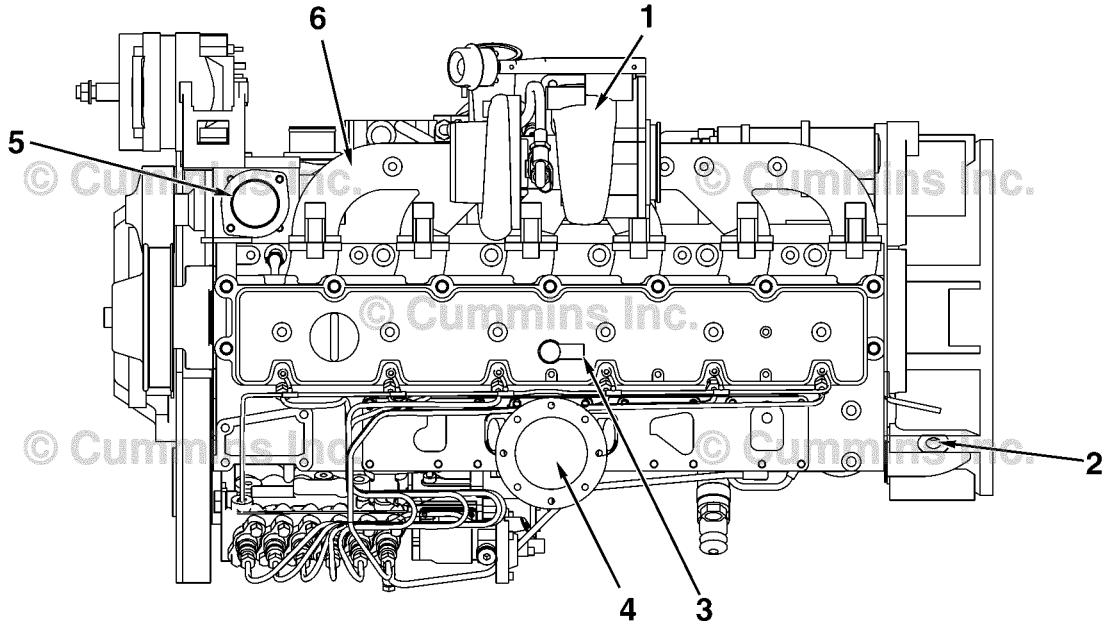
Industrial Applications



Right View - C8.3 - Industrial

1 Front engine lifting bracket
2 Water/coolant outlet connection
3 Lubricating oil pressure (after filter)
4 Lubricating oil pressure (before filter)
5 Coolant heater port
6 Lubricating oil cooler
7 Water/coolant inlet
8 Lubricating oil filter
9 Lubricating oil pan drain plug
10 Turbocharger oil drain
11 Coolant filter
12 Starting motor
13 Rear engine lifting bracket
14 Turbocharger exhaust outlet
15 Turbocharger wastegate actuator
16 Turbocharger air inlet
17 Engine oil fill.

Industrial Applications



Top View - C8.3 - Industrial

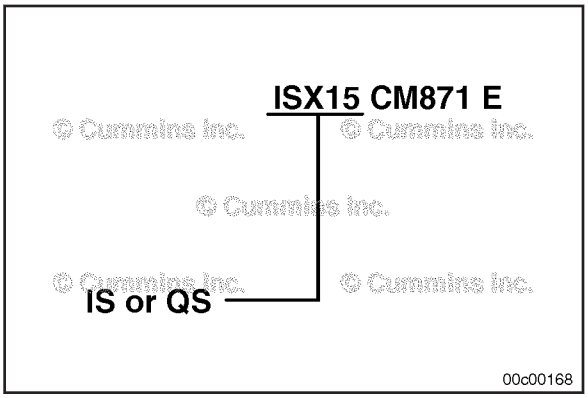
1 Turbocharger
2 3/4 x 16-inch UNF tap for magnetic pickup
3 Crankcase breather
4 Engine air inlet
5 Thermostat
6 Exhaust manifold.

Cummins® Service Engine Model Product Identification

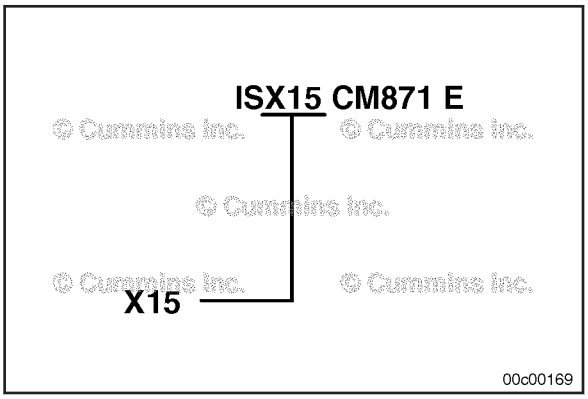
General Information

The Cummins® Service Engine Model Nomenclature procedure describes how engines are identified within Cummins service organization. This method was introduced for models after and including manufacture year 2007.

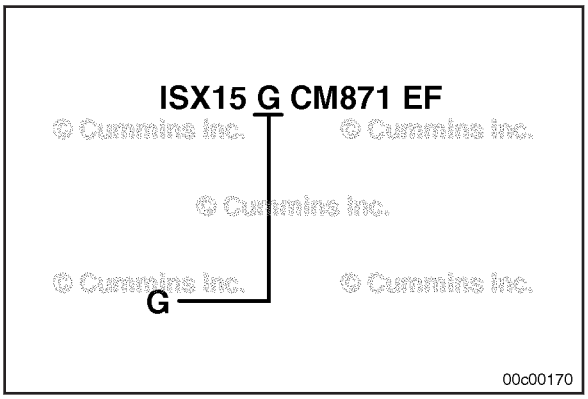
Electronic engines are identified by the first two letters, either an "IS" for On-Highway automotive or "QS" for Off-Highway industrial market applications.

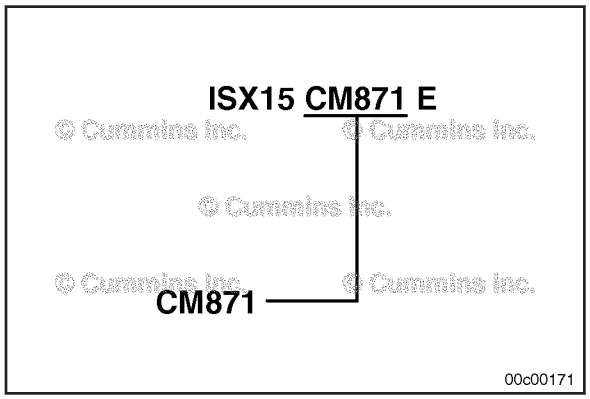


The third letter is the engine platform designation followed by the engine liter size.

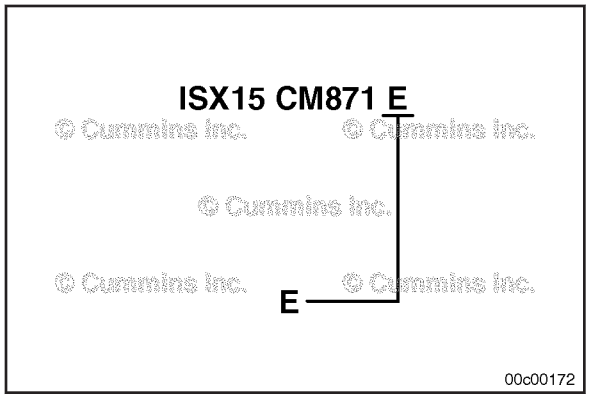


If the engine operates on a fuel type other than diesel, the type will be identified after the liter size.

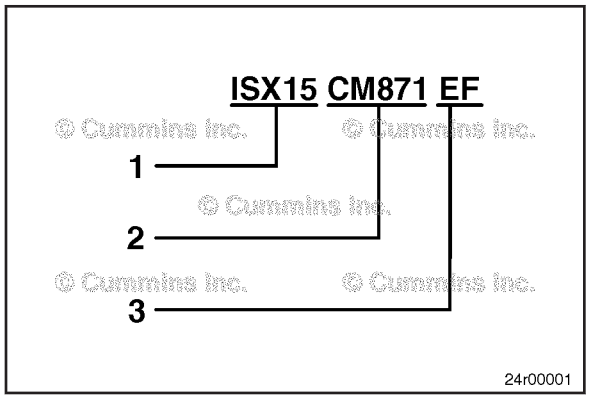




The control system is identified with the letters "CM" followed by the control system model number.



The technology identifier after the control system designates the prevailing technology used with the engine. (See table in this procedure for letter designations.)



Example:

1 On-Highway automotive "X" 15 liter engine

2 Control system number 871

3 Technology supported; Electric EGR and Diesel Particulate Filter

Technology	Name	Suffix
Exhaust Gas Recirculation	Not used	None
	Pneumatic	P
	Electric	E
Diesel Particulate Filter (DPF)	Not used	None
	Full Flow DPF	F
	Partial Flow DPF	F2
Diesel Oxidation Catalyst	Not used	None
	DOC	C
3-Way Oxidation Catalytic Converter	Not used	None
	3-Way Catalyst	J
Selective Catalytic Reduction System	Not used	None
	Air Driven	S
	Airless	A
Nox Sensor	Not used	None
	Nox Sensor	N
Modular Common Rail System	Used only on QSK19, 38, 50 , 60 HHP Engines	MCRS
Integrated Dosing Control Unit	Not Used	None
	Integrated	I

Notes

Section 1 - Operating Instructions

Section Contents

This Page Left Intentionally Blank

Operating Instructions - Overview

General Information

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

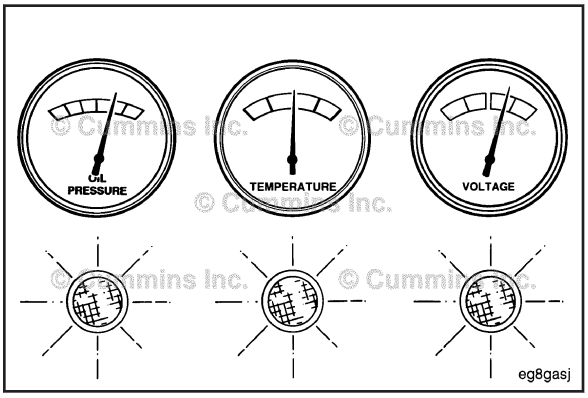
Follow the daily maintenance checks listed in Maintenance Guidelines (Section 2).

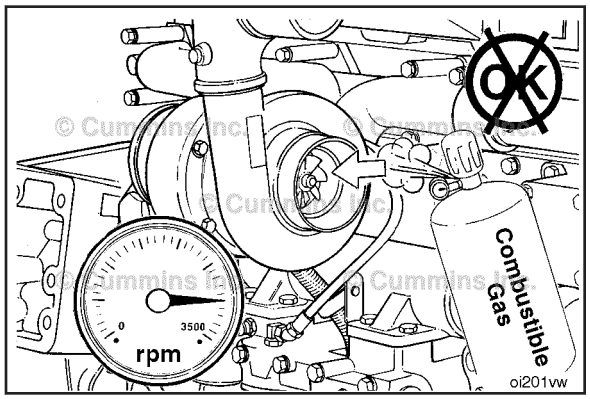
The new Cummins® engine associated with this manual does **not** require a "break-in" procedure. This section of the manual provides all of the necessary information required for proper engine operation.

U.S. legislation requires that stationary compression ignition internal combustion engines designated for emergency use are limited to emergency operations and required maintenance and testing.

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

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





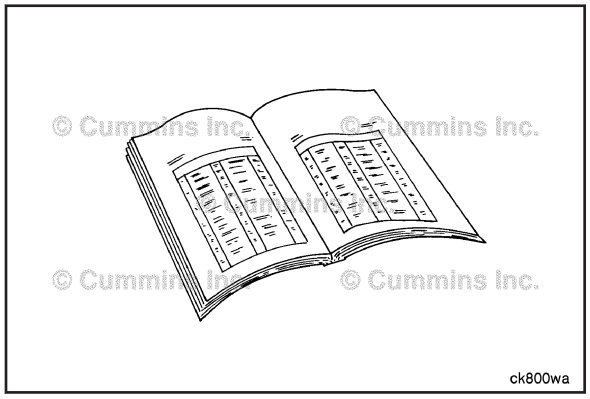
⚠WARNING⚠

Do not operate a diesel engine where there are or can BE COMBUSTIBLE vapors. These vapors can be sucked through the air intake system and cause engine acceleration and over speeding that can result in a fire, an explosion, and extensive property damage. Numerous safety devices are available, such as air intake shutoff devices, to minimize the risk of over speeding where an engine, due to its application, is operating in a combustible environment, such as due to a fuel spill or gas leak. Remember, Cummins Inc. has no way of knowing the use you have for your engine. The equipment owner and operator ARE responsible for safe operation in a hostile environment. Consult A Cummins® Authorized Repair Location for further information.

△CAUTION△

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

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



Normal Starting Procedure

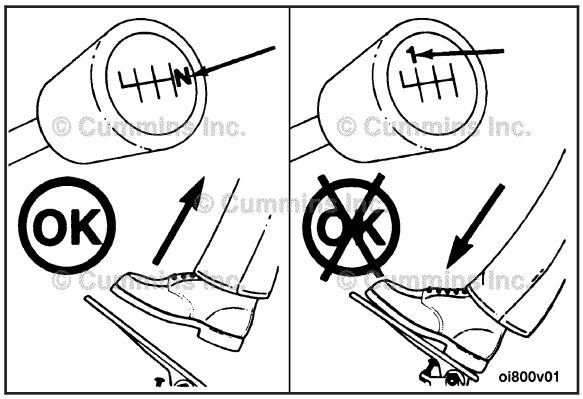
General Information

Industrial Applications

If ambient temperature is below 16°C [60°F], reference the following procedure. Refer to Procedure 101-004 in Section 1.

⚠CAUTION⚠

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

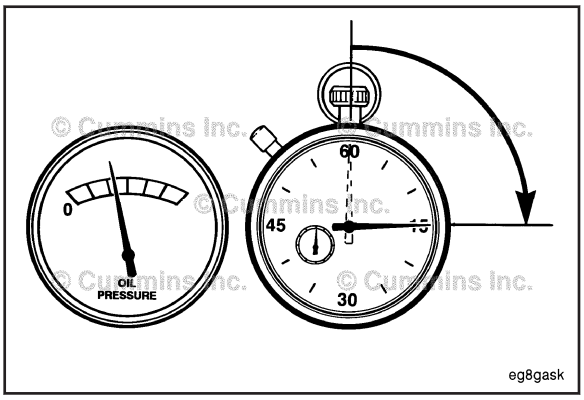


NOTE: Engines equipped with air starting motors require a minimum of 480 kPa [70 psi].

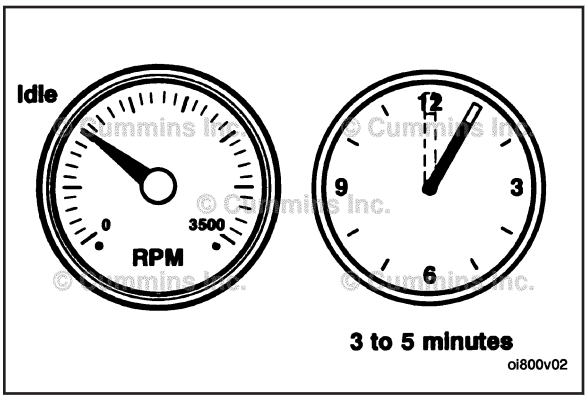
- Disengage the driven unit, or if equipped, put the transmission in neutral.
- With the accelerator pedal or lever in the idle position, turn the key switch to the ON position, and wait for the WAIT-TO-START lamp to go out; then, turn the key to the START position.
- Full throttle is applied after engaging the starter, after 5 seconds release to idle throttle.
- If the engine does **not** start after three attempts, check the fuel supply system. Absence of blue or white exhaust smoke during cranking indicates no fuel is being delivered.

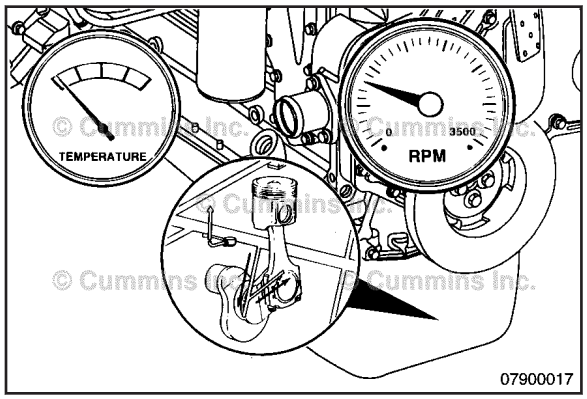
⚠CAUTION⚠

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

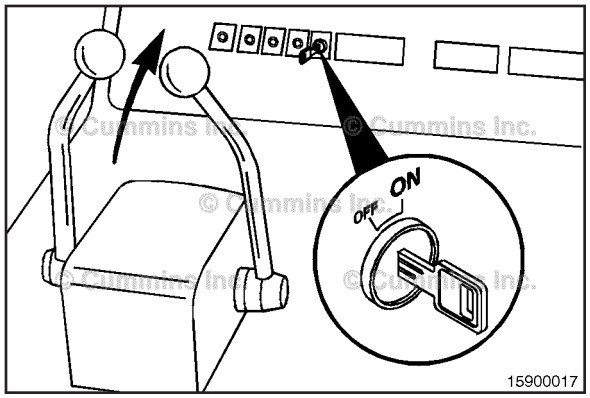


Idle the engine 3 to 5 minutes before operating with a load.





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



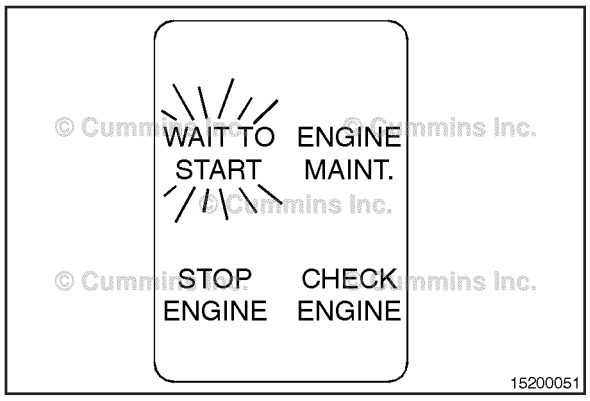
Marine Applications

⚠CAUTION⚠

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

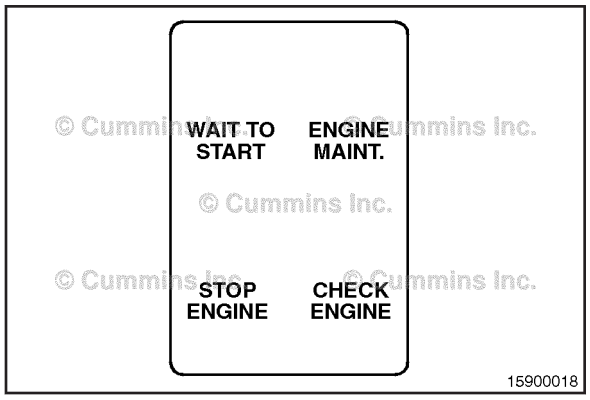
NOTE: There is a separate keyswitch wired to the primary panel. It will be installed in the helm at the boat manufacturer's or installer's desired location. The keyswitch **must** be in the ON or RUN position to crank-start the engine.

Disengage the drive unit.



Turn the key switch to the ON or RUN position. When the key is in this position, the WAIT TO START lamp will be illuminated for a maximum of 20 seconds. The engine should **not** be cranked until the WAIT TO START lamp shuts off.

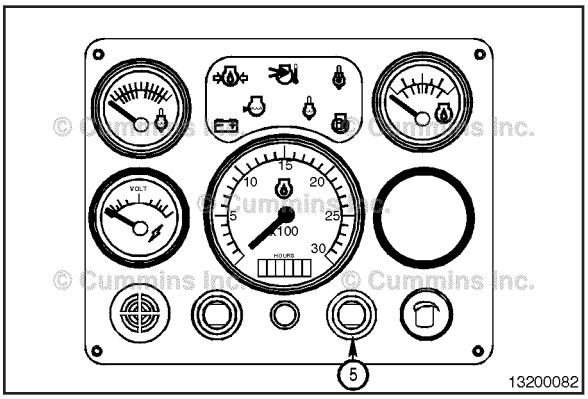
NOTE: The controller is reset each time the ignition is turned off and the cycle will start over.



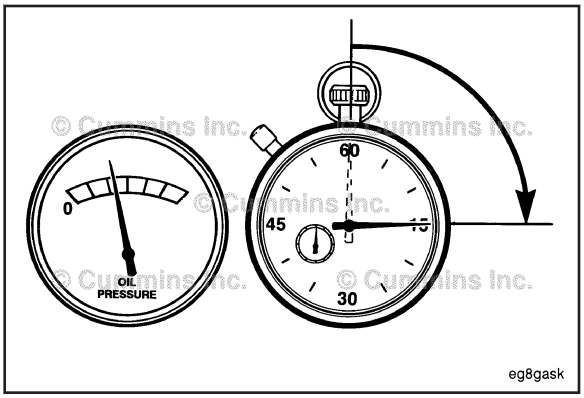
When the WAIT TO START lamp goes out, the preheat cycle is complete.

Start the engine with the throttle in the IDLE position.

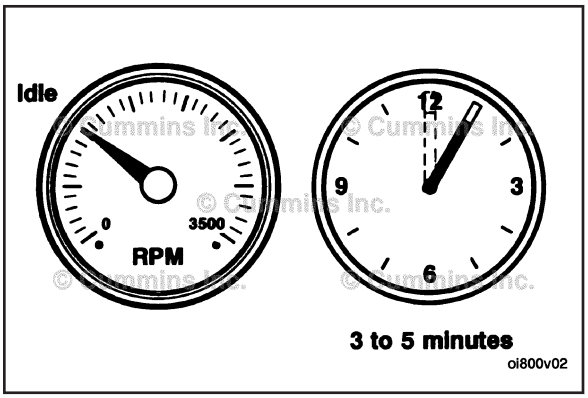
This black push button (5) is used to engage the starter motor.



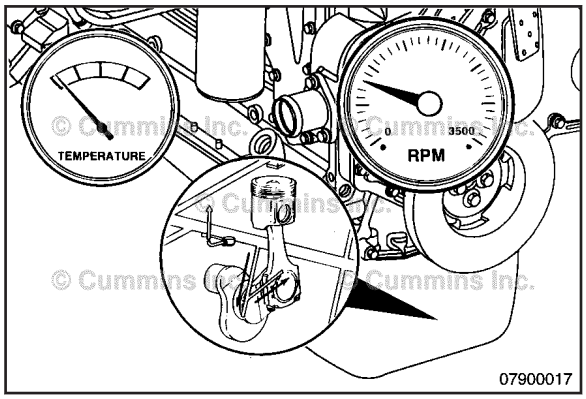
⚠CAUTION⚠
The engine must have adequate oil pressure within 15 seconds after starting. If the WARNING lamp indicating low oil pressure has not gone out or there is no oil pressure indicated on a gauge within 15 seconds, shut off the engine immediately to avoid engine damage. The low oil pressure troubleshooting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

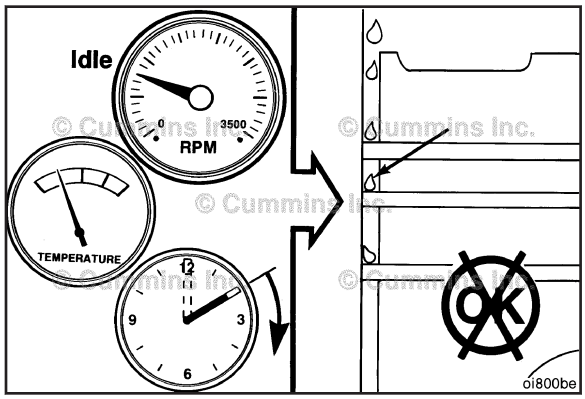


Idle the engine 3 to 5 minutes before operating with a load.



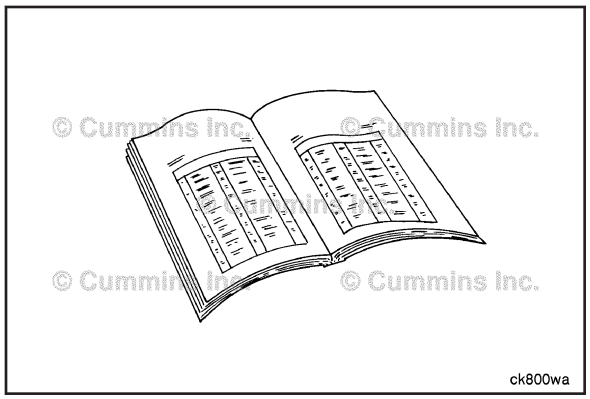
After starting a cold engine, increase the engine speed (rpm) slowly to provide adequate lubrication to the bearings and to allow the oil pressure to stabilize.





⚠CAUTION⚠
Do not operate engine at low idle for long periods with engine coolant temperature below the minimum specification in Maintenance Specifications in this manual. This can result in the following:

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

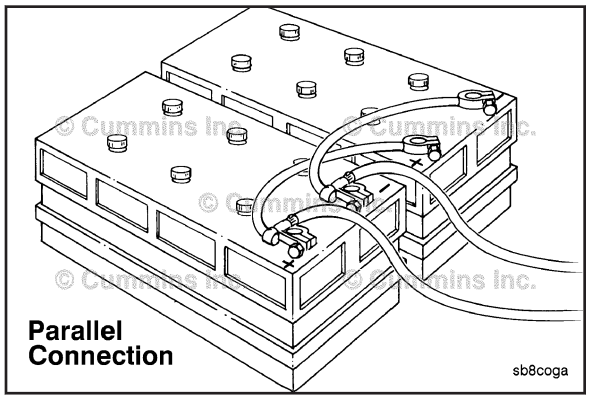


Jump Starting

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

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

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

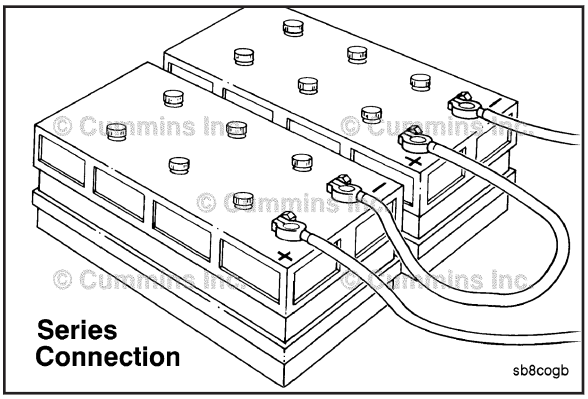


This illustration shows a typical parallel battery connection. This arrangement doubles the cranking amperage.

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

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

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

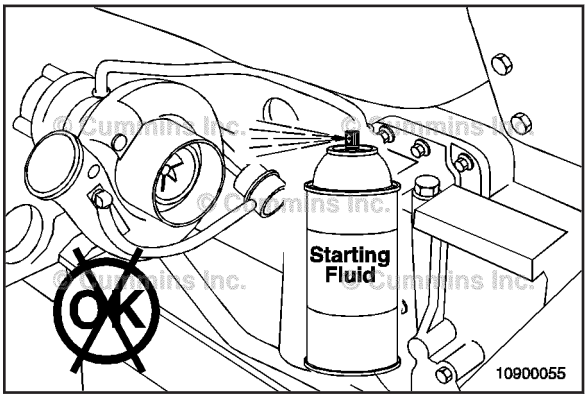


Cold Weather Starting

With Flame Start System

⚠WARNING⚠

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

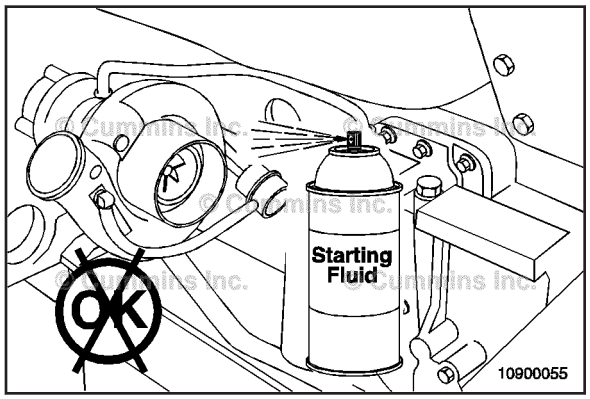


The **only** recommended cold weather starting aids for industrial applications with grid a flame start system, are engine coolant preheaters and oil pan immersion heaters. Contact a Cummins® Authorized Repair Location for more information

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

In cold weather, the WAIT-TO-START lamp will stay on longer.

If ambient temperature is below 16° C [60° F], fully depress the throttle after engaging the stater. Full throttle on the VE pump makes sure there is sufficient start fuel delivery and helps keep the engine operating once started. The in-line pumps with RQV and RQV-K governors require full throttle position and hold the rack in the start fuel position. The throttle **must** be depressed after engaging the starter to allow the shutoff lever to move to the run position before moving the throttle.



Grid Heater

Industrial Applications

⚠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.

The **only** recommended cold weather starting aids for marine or industrial applications with grid a heater or air intake heater, are engine coolant preheaters and oil pan immersion heaters. Contact a Cummins® Authorized Repair Location for more information

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

In cold weather, the WAIT-TO-START lamp will stay on longer.

If ambient temperature is below 16° C [60° F], fully depress the throttle after engaging the stater. Full throttle on the VE pump makes sure there is sufficient start fuel delivery and helps keep the engine operating once started. The in-line pumps with RQV and RQV-K governors require full throttle position and hold the rack in the start fuel position. The throttle **must** be depressed after engaging the starter to allow the shutoff lever to move to the run position before moving the throttle.

Ether Starting Aids

Industrial Applications

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

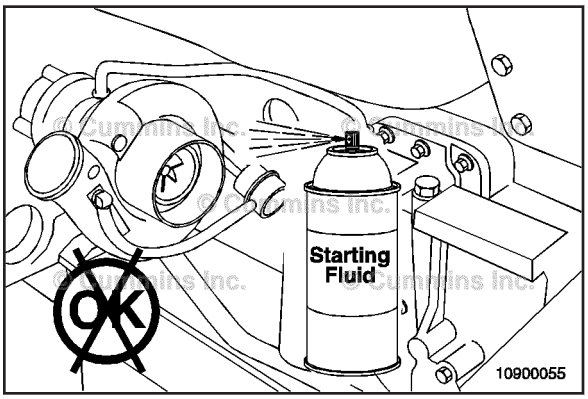
⚠WARNING⚠
Starting fluid is highly flammable and explosive. Keep flames, sparks, and arcing switches away from starting fluid.

⚠WARNING⚠
To reduce the possibility of personal injury, avoid inhalation of starting fluid vapors.

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

If ambient temperature is below 16° C [60° F], fully depress the throttle after engaging the stater. Full throttle on the VE pump makes sure there is sufficient start fuel delivery and helps keep the engine operating once started. The in-line pumps with RQV and RQV-K governors require full throttle position and hold the rack in the start fuel position. The throttle **must** be depressed after engaging the starter to allow the shutoff lever to move to the run position before moving the throttle.

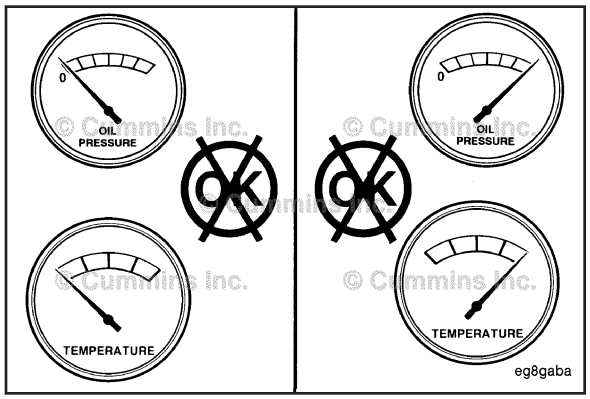
Spray starting fluid into the air cleaner intake while another person cranks the engine.



Starting Procedure After Extended Shutdown or Oil Change

General Information

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

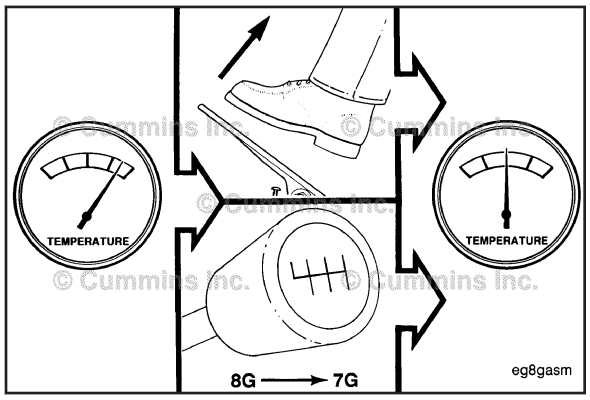


Operating the Engine

Normal

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

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



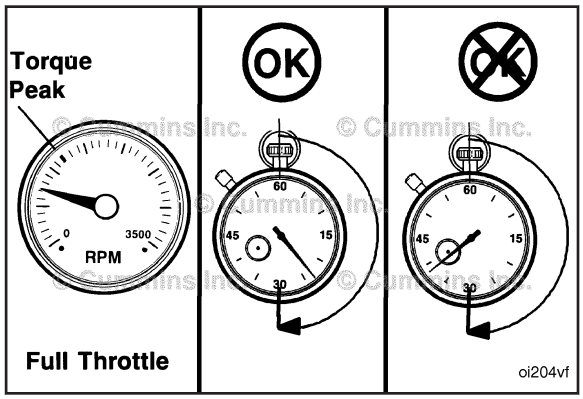
If an overheating condition starts to occur, reduce the power output of the engine by releasing the accelerator pedal or lever or shifting the transmission to a lower gear, or both, until the temperature returns to the normal operating range. If the engine temperature does **not** return to normal, shut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

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

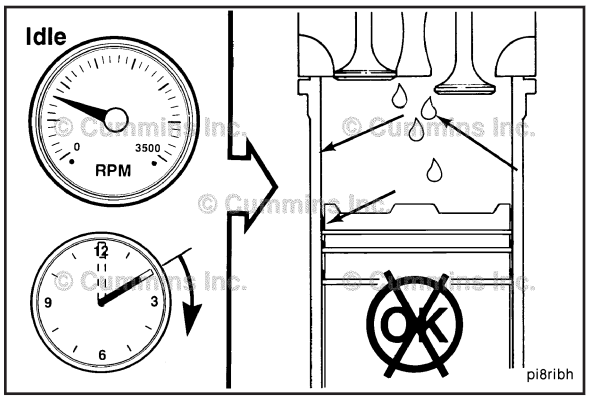


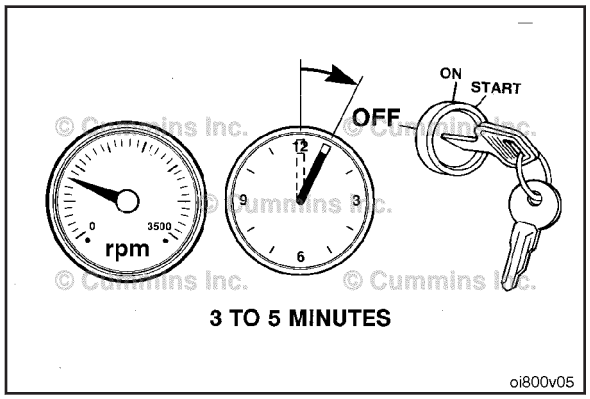
⚠CAUTION⚠
Do not operate the engine at full throttle below peak torque rpm (refer to engine dataplate for peak torque rpm) for more than 30 seconds. Operating the engine at full throttle below peak torque will shorten engine life to overhaul, can cause serious engine damage, and is considered engine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

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

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

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





Engine Shutdown

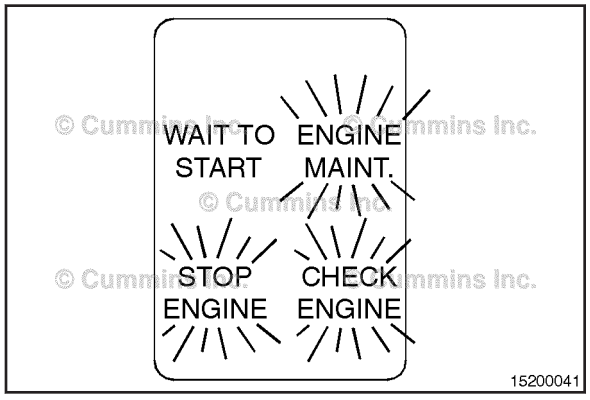
General Information

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

NOTE: For engines equipped with an electronic control module (ECM) ensure the keyswitch is turned off for a minimum of 70 seconds prior to disconnecting the continuous (unswitched) battery power supply. If the unswitched battery power supply is disconnected in less than 70 seconds after the keyswitch is turned off active fault codes and incorrect ECM information can occur.

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

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



Electronic Controlled Fuel System

Fault Lamp Sequencing

General Information

The ENGINE FAULT AND MAINTENANCE lamps are illuminated when the keyswitch is turned to the ON position.

After 2 seconds, the red STOP ENGINE lamp will turn off. After an additional 1/2 of a second, the amber CHECK ENGINE lamp will turn off. After an additional 1/2 of a second, the amber ENGINE MAINT lamp will turn off.

The lamps will remain off until a fault is detected.

NOTE: This is a self-test feature of the lamp wiring and lamps.

NOTE: The names and colors of the lamps can vary with vessel manufacturer if non-Cummins panels are used.

Engine Fault and Maintenance System Familiarization

The following chart summarizes the different lamps and their operation.

Lamp Operation				
Feature	**Operator Message**	**Engine Maintenance**	**Stop Engine**	**Engine Maintenance**
Lamp Display	Power-up lamp test	On then off	On then off	On then off
Diagnostics	Fault code flash-out	Flash once/code	Flash code number	
Engine Protection	System problem		Slow flash	
Maintenance Monitor	Interval expired			3x5 fast flash
Maintenance Monitor	Interval rest			3x5 fast flash
Diagnostics	Nonfatal system error	On steady		
Diagnostics	Fatal system error		On steady	
Diagnostics	Maintenance required			On steady

If the STOP or CHECK ENG lamp comes on when the engine is running, it means a fault code has been recorded. The lamp will remain on as long as the fault exists. The severity of the fault will determine which lamp is illuminated.

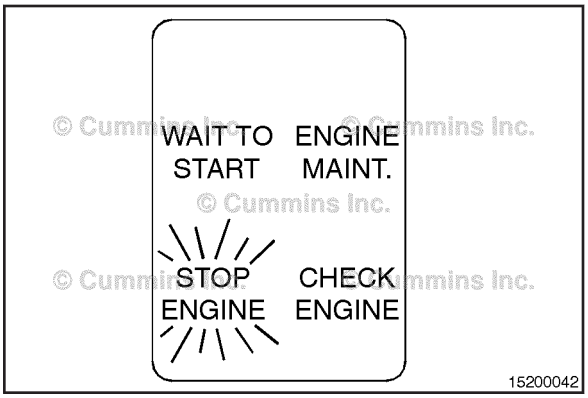
Diagnostic Fault Codes

Stop Engine Lamp

The STOP ENGINE lamp is a red lamp. This lamp indicates that the engine needs to be shut down before permanent damage occurs to the engine.

NOTE: The engine **must** be shut off as soon as it can be shut off safely. The engine **must not** be run until the fault is corrected.

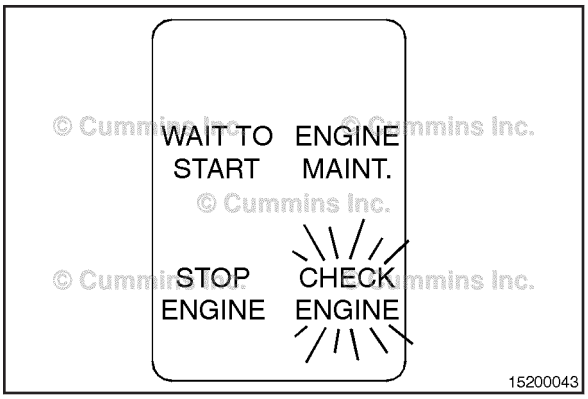
This lamp is also used to flash out the fault code number in the diagnostics mode.



Check Engine Lamp

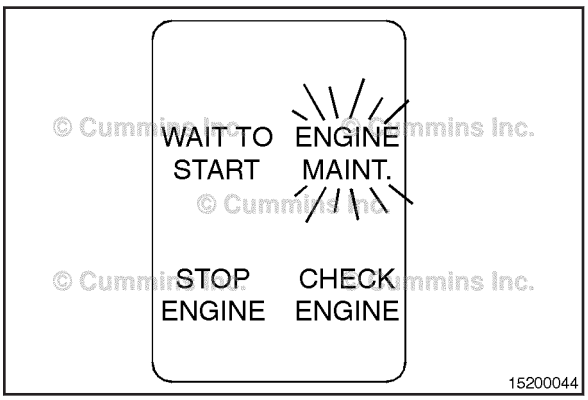
The CHECK ENGINE lamp comes on during a nonfatal system error. The engine can still be run, but the fault **must** be corrected as soon as possible.

NOTE: In the diagnostics mode, the CHECK ENGINE lamp completes the three-digit fault code.



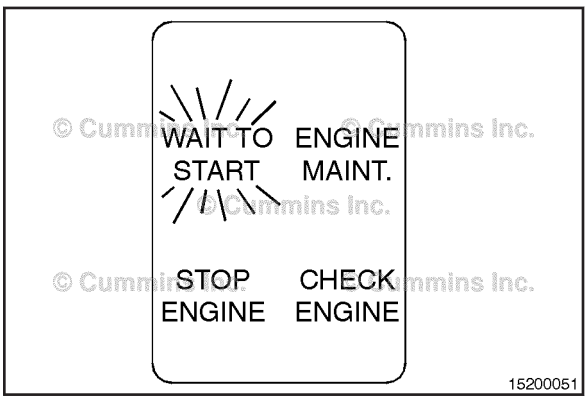
Engine Maintenance Lamp

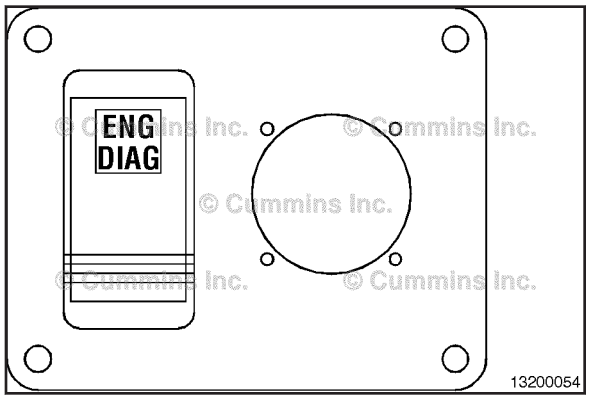
The ENGINE MAINT lamp comes on when engine maintenance is required.



Wait to Start Lamp

The WAIT TO START lamp is **only** used on engines with an intake air heater system such as C Series engines.

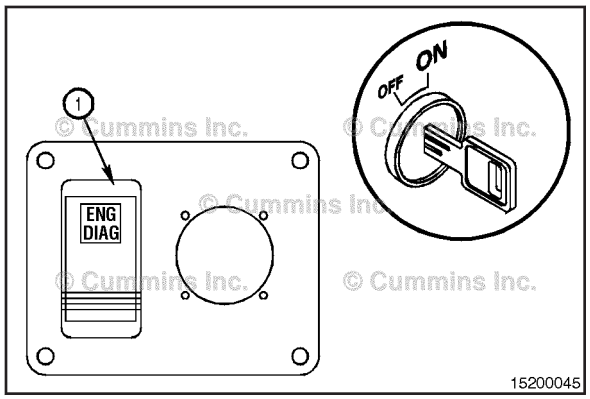




Engine Diagnostics

When a fault or maintenance lamp is lit, the engine diagnostics switch allows the operator to view the fault codes. The receptacle to the right of the switch is for the technician's computer connection, using either INSITE™ or Echek™ service tool.

Active fault codes can be viewed using the stop engine warning lamp as described below.

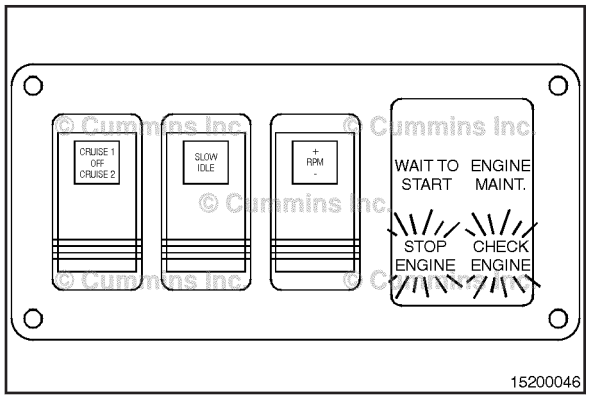


To view the fault codes:

1 The engine **must** be shut off (**not** running).

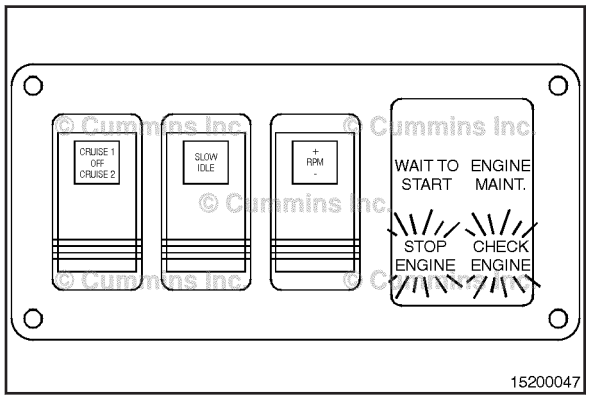
2 The keyswitch **must** be in the ON position.

3 The ENG DIAG switch (1) **must** be in the ON position.



The CHECK ENGINE and STOP ENGINE lamps flash if there are any fault codes to display.

If there are no fault codes to display, the CHECK ENGINE and STOP ENGINE lamps will remain lit.



If there are fault codes to be displayed, the check engine lamp will flash momentarily. Then the stop engine lamp will flash the first, second, and third digits of the fault code.

Example:

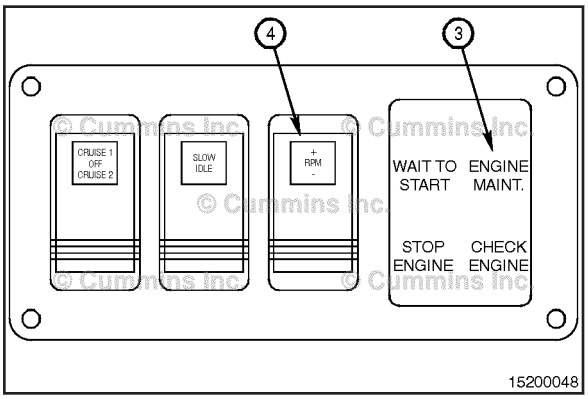
- **Fault Code 432**
- 4 flashes, pause
- 3 flashes, pause
- 2 flashes

NOTE: The check engine lamp will flash between each fault code.

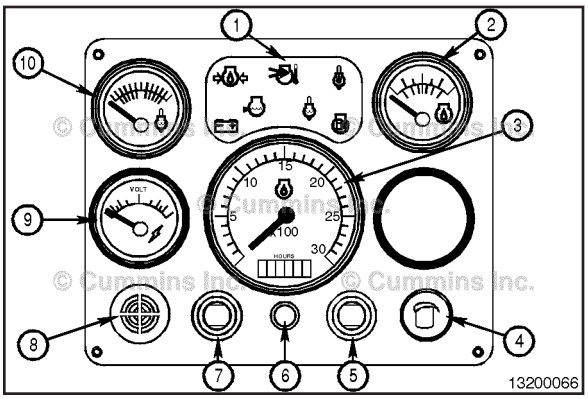
The pattern repeats itself until the fault is cleared or the switch is turned off.

To view the next fault code, press the RPM ± switch (4) in the plus (+) direction.

To view the previous fault code, press the RPM ± switch (4) in the minus (-) direction.

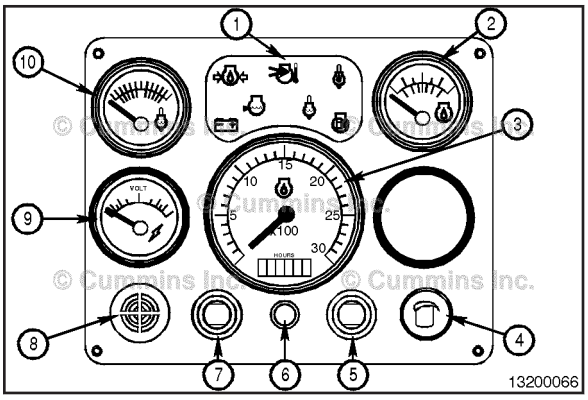


The audible alarm (8) sounds anytime the warning or caution symbols are illuminated.



The alarm silence button (6) will temporarily silence the audible alarm.

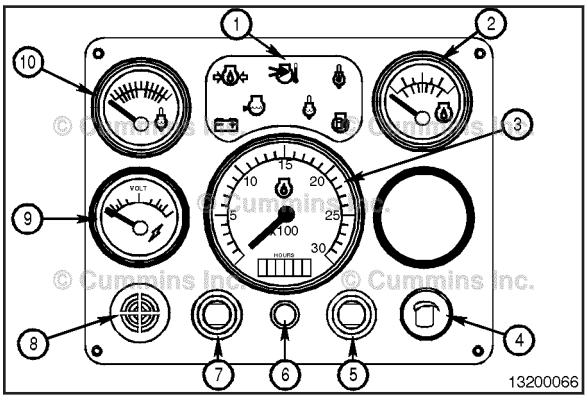
NOTE: The alarm will be silenced for up to 2 minutes. As long as the fault condition exists, the alarm will “chirp” every 2 minutes to remind the operator that a fault exists.

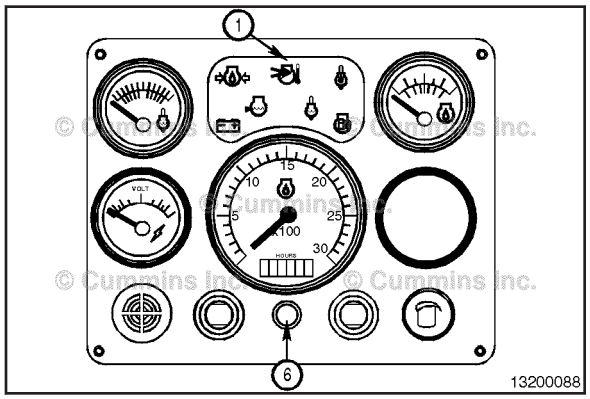


The alarm silence button (6) is also used to test the warning and caution symbol lamps (1) and the gauges.

To test the gauges and symbol lamps, press the alarm silence button (6) while turning on the keyswitch. The alarm will come on for 5 seconds and for 25 seconds all symbols will illuminate and the gauge needles will move from the lowest position to the highest position and back to the lowest position.

NOTE: The voltmeter will **not** display a system test.



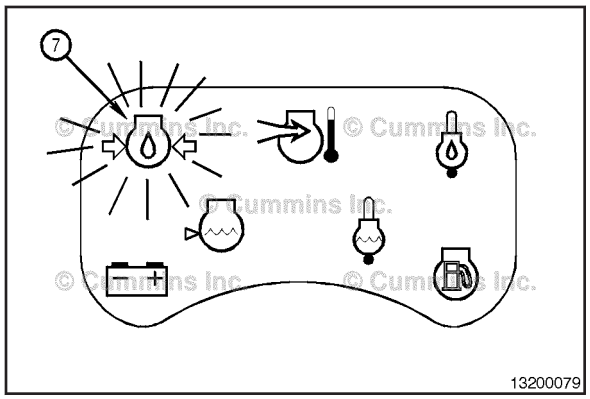


Engine Monitoring System

General Information

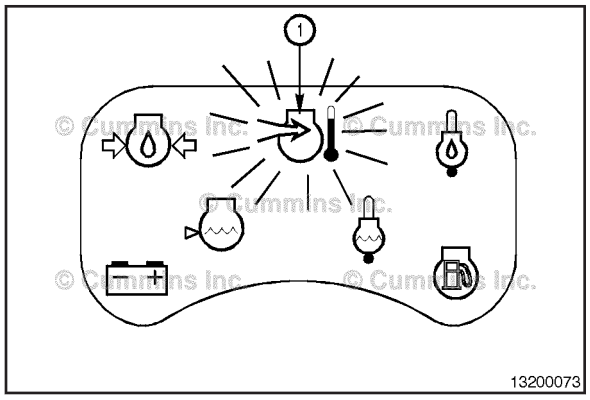
The indicator symbols (1) provide additional information on the type of fault that the ECM has detected. The individual symbols will flash during a fault condition.

NOTE: Pressing the alarm cancel button (6) when the keyswitch is turned on will illuminate the symbols for a self-test.



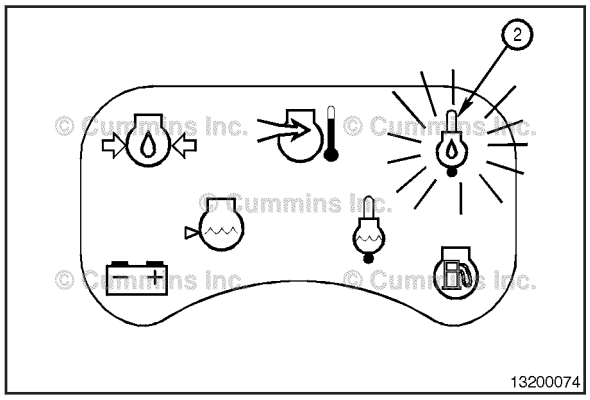
Low Engine Oil Pressure

The low engine oil pressure lamp (7) comes on when the engine oil pressure is below specification. Use the following procedure for lubricating oil specifications.Refer to Procedure 018-017 in Section V.



High Intake Manifold Temperature

The high intake manifold temperature lamp (1) comes on when the intake manifold temperature is above specification.

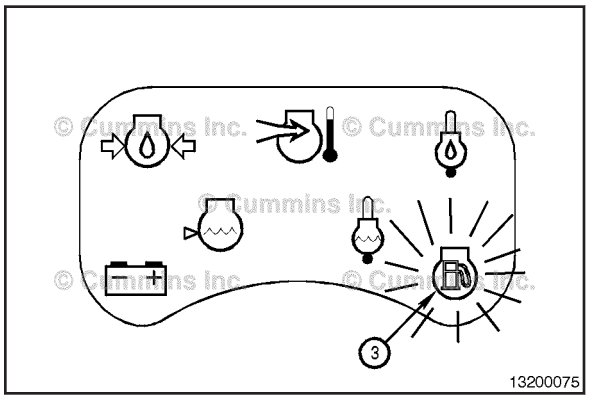


High Engine Oil Temperature

The high engine oil temperature lamp (2) comes on when the engine oil temperature is above specification.

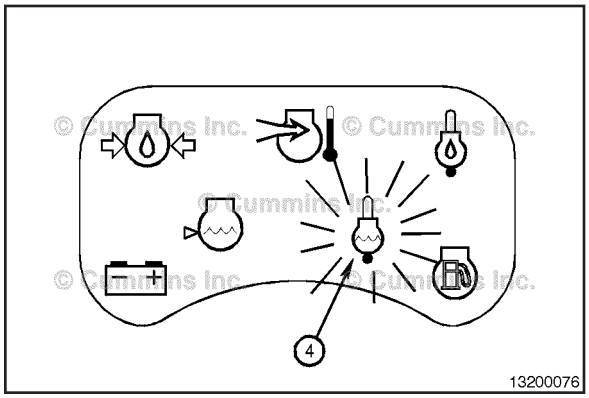
Water in Fuel

The water-in-fuel lamp (3) interfaces with the optional water-in-fuel sensor in the primary fuel filter. It comes on when there is water in the fuel filter. This feature is **not** presently available.



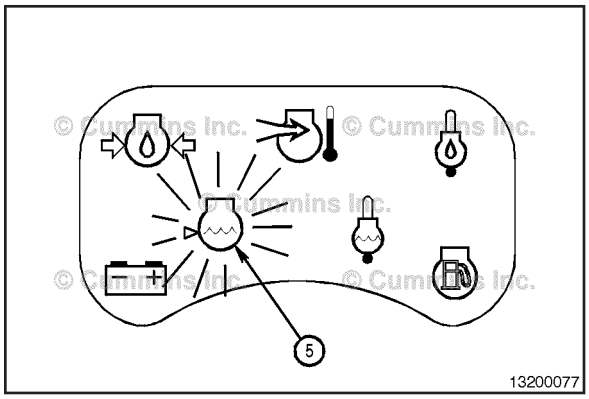
High Coolant Temperature

The high coolant temperature lamp (4) comes on when the engine coolant temperature is above specification.



Low Coolant Level

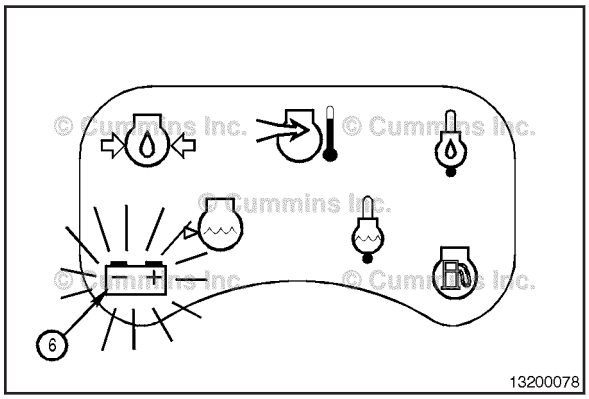
The low coolant level lamp (5) comes on when the coolant level is below specification. Use the following procedure for the coolant specifications.Refer to Procedure 018-018 in Section V.



Low Battery Voltage

NOTE: This voltage lamp **only** applies to marine applications.

The low battery voltage lamp (6) comes on when the battery voltage is below specification.



Electromagnetic Interference (EMI)

General Information

Some applications utilize accessories such as (CB radios, mobile transmitters, etc.) if not installed and used correctly the radio frequency energy generated by these accessories can cause electromagnetic interference (EMI) conditions to exist between the accessory and the Cummins electronically controlled systems. Cummins is **not** liable for any performance problems with either the electronically controlled systems or the accessory due to EMI. EMI is **not** considered by Cummins to be a system failure and therefore is **not** warrantable.

System EMI Susceptibility

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

System EMI Radiation Levels

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

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

1 Locate the transmitting antenna as far away from the electronically controlled systems and as high as possible.

2 Locate the transmitting antenna as far away as possible from all metal obstructions (e.g., exhaust stacks)

3 Consult a representative of the accessory supplier in your area to:

- Accurately calibrate the device for proper frequency, power output, and sensitivity (both base and remote site devices **must** be properly calibrated)
- Obtain antenna reflective energy data measurements to determine the optimum antenna location
- Obtain optimum antenna type and mounting arrangement for your application
- Make sure your accessory equipment model is built for maximum filtering to reject incoming electromagnetic noise.

Section 2 - Maintenance Guidelines

Section Contents

This Page Left Intentionally Blank

Maintenance Guidelines - Overview

General Information

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

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

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

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

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

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

Tool Requirements

General Information

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

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

Tool Part Number	Description
3375045	Torque wrench 136 N•m [100 ft-lb]
locally obtained	Silicon lubricant spray
locally obtained	Brass rod, 4.76 mm [3/16 in] diameter
CC-2602J	Fleetguard DCA4 test kit
CC-2802	Coolant test kit
3824591	Engine barring gear
3375049	Oil filter wrench
3824556	Charge-air cooler (CAC) pressure kit
3376807	Engine coolant and fuel filter wrench
3822524	Belt tension gauge, click type (v-belts and v-ribbed with four or five ribs
3822525	Belt tension gauge, click type (v-ribbed with six to twelve ribs)

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

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

Maintenance Schedule

General Information

Industrial Applications

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

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

Maintenance Procedures at Daily Interval[4] .....Section 3

- Crankcase Breather Tube - Check
- Fuel-Water Separator - Drain
- Lubricating Oil Level - Check
- Fan, Cooling - Check
- Coolant Level - Check
- Air Intake Piping - Check[4]
- Air Tanks and Reservoirs - Drain[4]
- Drive Belts - Check

Maintenance Procedures at 250 Hours, or 3 Months[1, 2, 4] .....Section 5

- Fuel Filter (Spin-On Type) - Change
- Lubricating Oil and Filters - Change[1]
- Charge-Air Cooler - Check[4]
- Charge-Air Piping - Check[4]
- Air Cleaner Restriction - Check[4]
- Air Compressor - Check[4]
- Radiator Pressure Cap - Check

Maintenance Procedures at 500 Hours, or 6 Months[2, 3, 4] .....Section 7

- Coolant Filter - Change
- Supplemental Coolant Additive (SCA) and Antifreeze Concentration - Check[2, 3]
- Air Compressor Discharge Lines - Check[4]

Maintenance Procedures at 1000 Hours, or 1 Year[4] .....Section 9

- Overhead Set - Adjust
- Cooling Fan Belt Tensioner - Check
- Air Cleaner Assembly (Engine-Mounted) - Change[4]

Maintenance Procedures at 2000 Hours, or 2 Years[2, 3, 4, 5] .....Section 10

- Vibration Damper, Rubber - Inspect for Reuse
- Vibration Damper, Viscous - Inspect for Reuse
- Cooling System - Flush[2, 3, 5]
- Air Compressor Discharge Lines - Check[4]

1 The lubricating oil and lubricating oil filter interval can be adjusted based on fuel consumption, gross vehicle weight, and idle time. Refer to Oil Drain Intervals in this section.

2 Test the SCA concentration level every 6 months unless concentration is over three units; then check at every oil drain interval until concentration is below three units.

3 Antifreeze check interval is every oil change or 500 hours or 6 months, whichever occurs first. The operator **must** use a heavy-duty year-round antifreeze that meets the chemical composition of ASTM D6210. The antifreeze change interval is 2 years. Antifreeze is essential for freeze, overheat, and corrosion protection.

4 Follow the manufacturer's recommended maintenance procedures for the starter, alternator, generator, batteries, electrical components, engine brakes, exhaust brake, charge-air cooler, air compressor, refrigerant compressor, and fan clutch.

5 This cooling system requirement to Flush at this scheduled maintenance includes Drain, Flush, and Fill.

Marine Applications

Maintenance Procedures at Daily Interval[1] .....Section 3

- Fuel-Water Separator - Drain
- Lubricating Oil Level - Check
- Coolant Level - Check
- Sea Water Strainer - Clean
- Marine Gear - Check[1]
- Drive Belts - Check

Maintenance Procedures at 75 Hours or 3 Months[3] .....Section 4

- Zinc Anode - Check[3]
- Cooling System Hoses - Check
- Sea Water Hoses - Check
- Air Cleaner Restriction - Check
- Batteries - Check
- Battery Cables and Connections - Check
- Component Connector and Pin Inspection - Check

Maintenance Procedures at 300 Hours or 1 Year[1, 2] .....Section 6

- Fuel Filter (Spin-On Type) - Change
- Fuel-Water Separator Element - Replace
- Lubricating Oil and Filters - Change[2]
- Coolant Filter - Change
- Engine Coolant Heater - Check
- Marine Gear Oil Cooler - Flush[1]
- Supplemental Coolant Additive (SCA) and Antifreeze Concentration - Check[2]
- Heat Exchanger - Flush
- Sea Water Pump - Replace
- Aftercooler Assembly (Sea Water) - Flush
- Air Cleaner Assembly (Engine-Mounted) - Check
- Air Intake Piping - Check
- Marine Gear Oil - Check[1]
- Radiator Pressure Cap - Check
- Engine Wiring Harness - Check

Maintenance Procedures at 600 Hours or 2 Years .....Section 8

- Vibration Damper, Rubber - Inspect for Reuse
- Vibration Damper, Viscous - Inspect for Reuse
- Overhead Set - Adjust
- Cooling System - Flush[4]
- Cooling Fan Belt Tensioner- Check

1 Consult the marine gear manufacturer operator's manual for specifications and recommendations.

2 Refer to Refer to Procedure 018-024 in Section V.

3 Depending upon the quality of electrical bonding and water conditions, increased maintenance is sometimes necessary.

4 This cooling system requirement to Flush at this scheduled maintenance includes Drain, Flush, and Fill.

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/scrape/skipper

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
- Generator set/air compressor/fire equipment

If Yes -

- Select the correct oil drain interval from Table 2.

If No -

- Select the correct oil drain interval from Table 3.

Table 1, Oil Drain Intervals

Vehicle/Equipment	Kilometers	Miles	Hours	Months
Truck crane/yard spotter	10,000	6,000	250	3
Paver/crane/backhoe	N/A	N/A	250	3
Dozer/scraper/skidder	N/A	N/A	250	3

Table 2, Oil Drain Intervals

Vehicle/Equipment	Kilometers	Miles	Hours	Months
Tractor/combine/ irrigation equipment	N/A	N/A	250	3
Generator set/air compressor/fire pump	N/A	N/A	250	3

Table 3, Oil Drain Intervals

Vehicle/Equipment	Kilometers	Miles	Hours	Months
All others	10,000	6,000	250	3

Maintenance Record Form

Maintenance Data

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

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

A	B	C	D	E	F

Section 3 - Maintenance Procedures at Daily Interval

Section Contents

This Page Left Intentionally Blank

Daily Maintenance Procedures - Overview

General Information

Preventative maintenance begins with day-to-day awareness of the system. Before starting the system, check the appropriate fluid levels. Look for:

- Leaks
- Loose or damaged parts
- Worn or damaged belts
- Worn or damage low and high voltage harnesses
- Any change in system appearance.
- Odor of fuel
- Odor of electronic devices

System Operation Report

The system **must** be maintained in top mechanical and electronic 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.

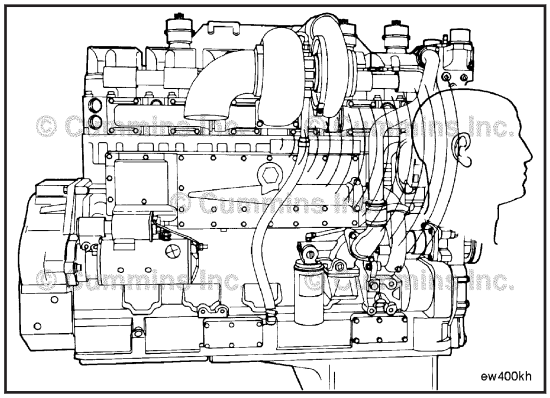
Comparison and intelligent interpretation of the daily report, along with a practical follow-up action, will eliminate most failures and emergency repairs.

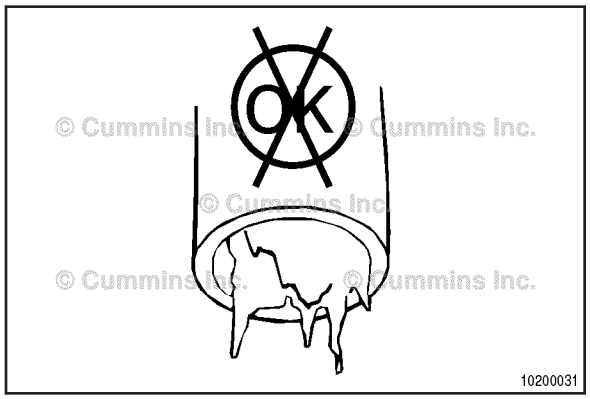
Report to the maintenance department any of the following conditions that may apply:

- 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 system 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
- Worn or damaged low or high voltage harnesses

Unusual System Noise

During daily maintenance checks, listen for any unusual system noise(s) that can indicate that service is required.



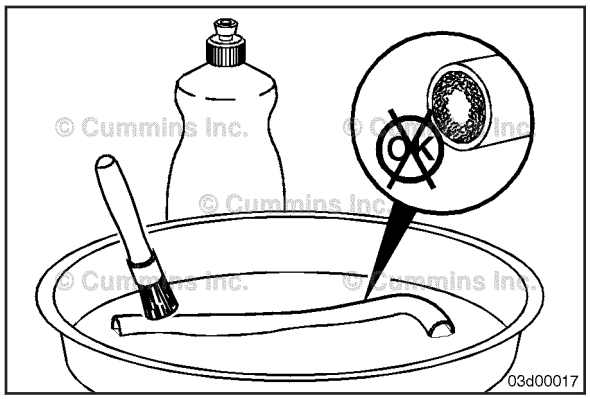


Crankcase Breather Tube

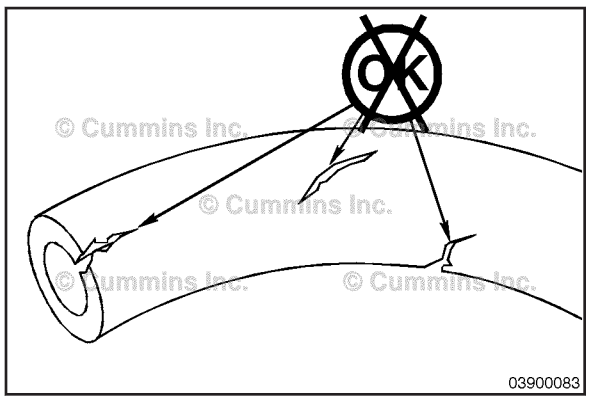
Maintenance Check

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

Inspect the tube more frequently in icy conditions.



If sludge, debris, or ice is found clean the tube with detergent and warm water or a solvent. Dry the tube with compressed air.



Visually inspect the tube for cracks or damage. If damage is found, replace the crankcase breather tube. Contact your Cummins Authorized Repair Location.

Fuel-Water Separator

Drain

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

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

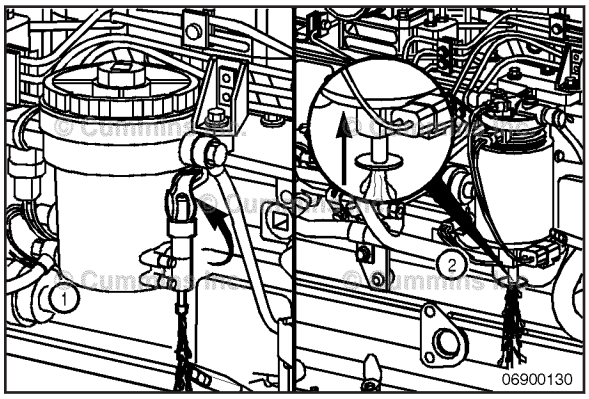
Drain the water and sediment from the separator daily.

Canister Type

Shut off the engine.

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

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



Spin-on Type

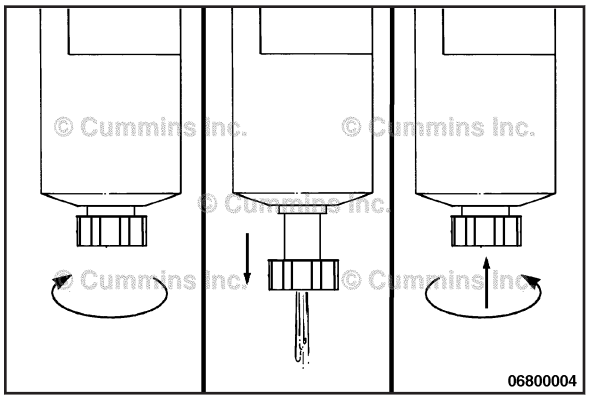
Shut off the engine.

Use your hand to open the drain valve. Turn the valve **counterclockwise** approximately 3½ turns until the valve drops down 25.4mm [1 in] and draining occurs.

Drain the filter sump until clear fuel is visible.

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

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



Lubricating Oil Level

Maintenance Check

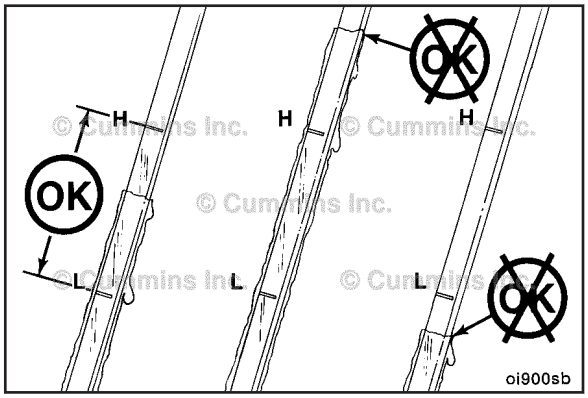
⚠CAUTION⚠
Never operate the engine with oil level below the L (low) mark or above the H (high) mark. Poor engine performance or engine damage can occur.

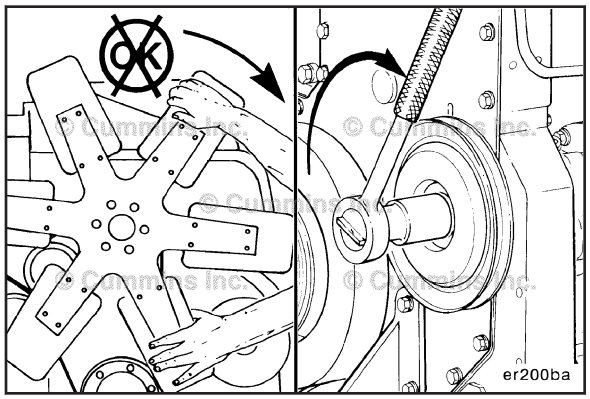
The engine **must** be level when checking the oil level to make sure the measurement is correct.

Shut off the engine for an accurate reading.

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

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

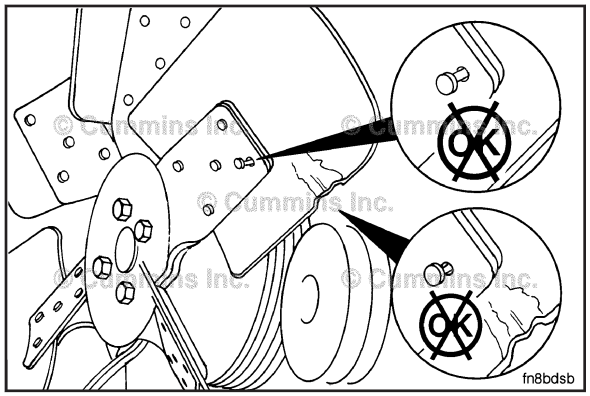




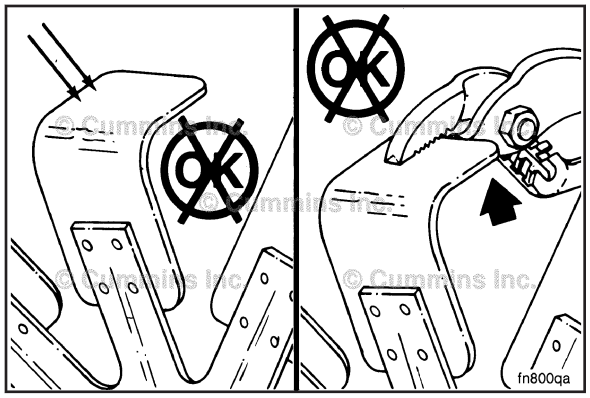
Fan, Cooling

Inspect for Reuse

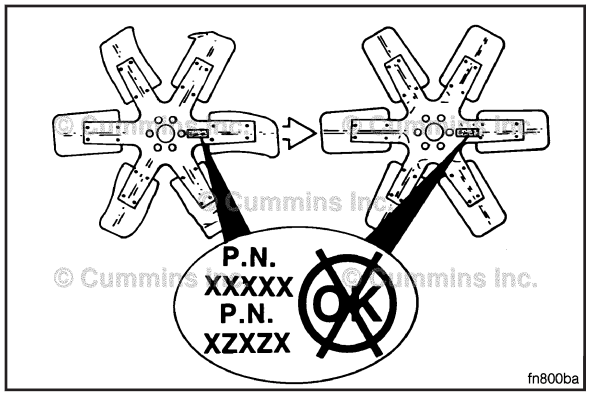
⚠WARNING⚠
Do not rotate the engine by pulling or prying on the fan. The fan blade(s) can be damaged and cause the fan to fail and cause personal injury or property damage. Use the accessory drive shaft or the crankshaft barring tool to rotate the crankshaft.



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



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



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

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

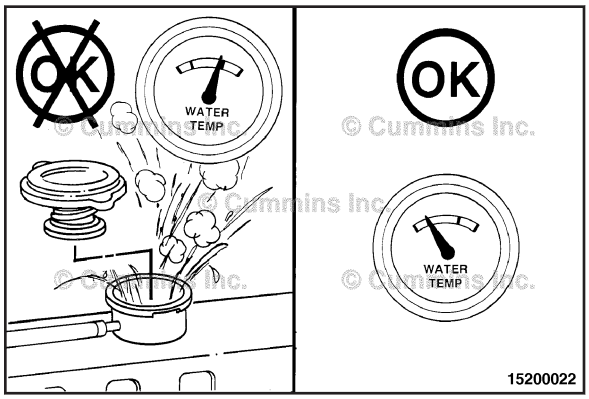
Coolant Level

Maintenance Check

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

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

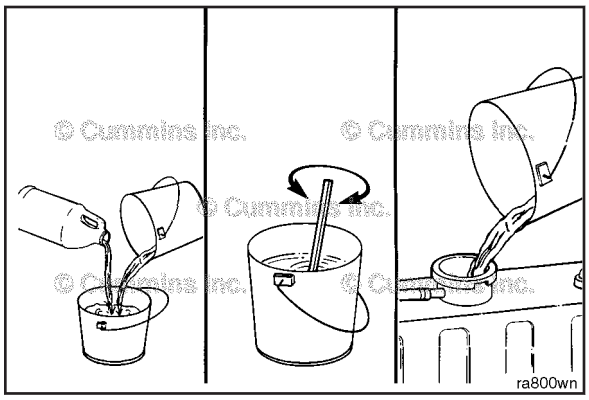
The coolant level **must** be checked daily.



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

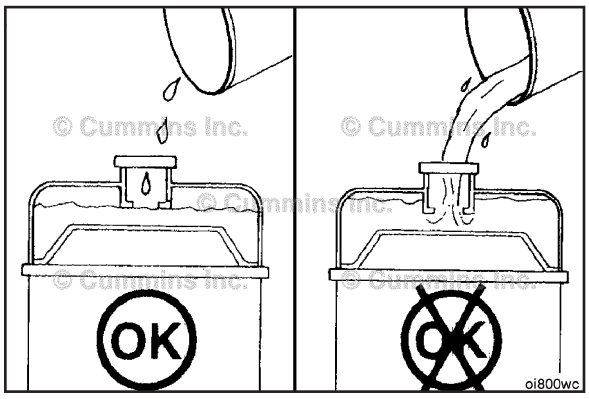
Coolant added to the engine **must** be mixed with the correct proportions of antifreeze, supplemental coolant additive, and water to avoid engine damage.

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



Fill the cooling system with coolant. Refer to the markings on the radiator or expansion tank for coolant levels or refer to the OEM manual.

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

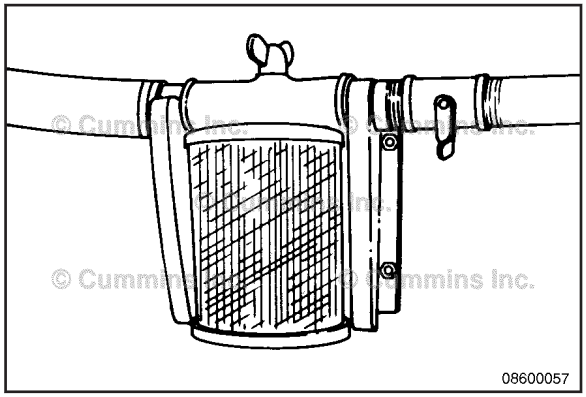


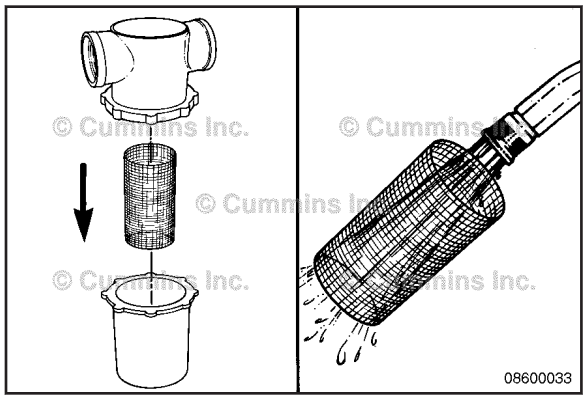
Sea Water Strainer

General Information

Marine Applications

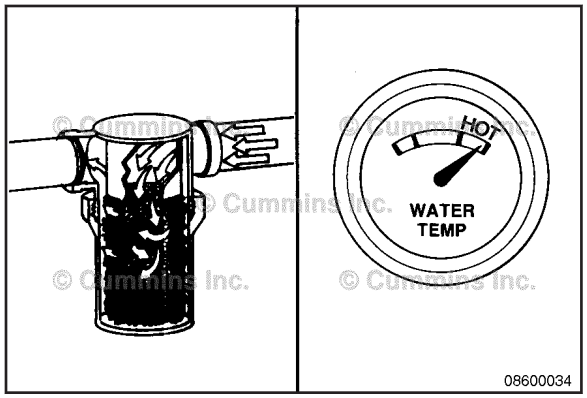
NOTE: Most sea water systems for heat exchanger cooled engines use a sea water strainer. The strainer removes debris from the sea water before it enters the sea water pump.





NOTE: Sea water strainer arrangements may differ.

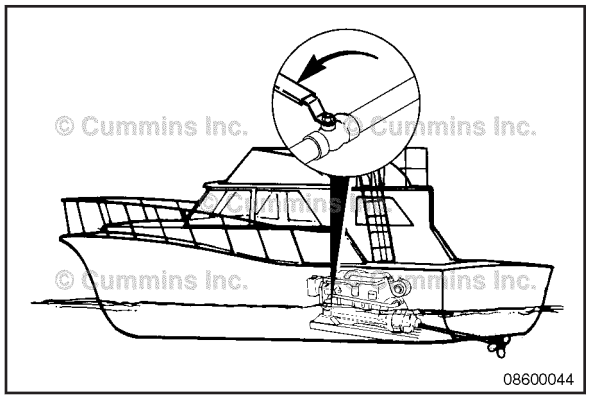
Inspect the sea water strainer daily for any foreign objects that could restrict water flow.



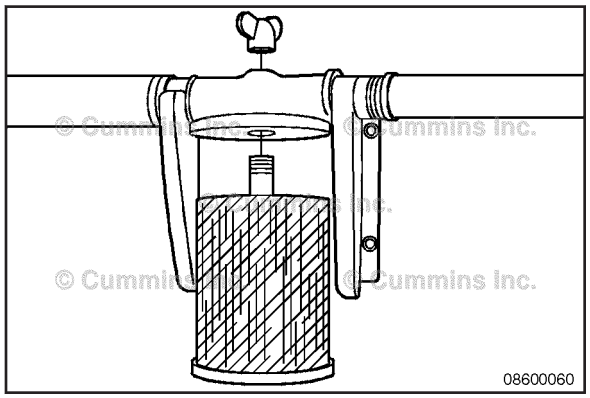
⚠CAUTION⚠

A restricted or clogged sea water strainer can result in hotter than normal, or overheated, engine coolant and marine gear oil temperatures.

For more detailed information, refer to Sea Water Strainer Cleaning in this section.



NOTE: If the sea water strainer is below the water level, close the sea water inlet valves before servicing the sea water strainer.

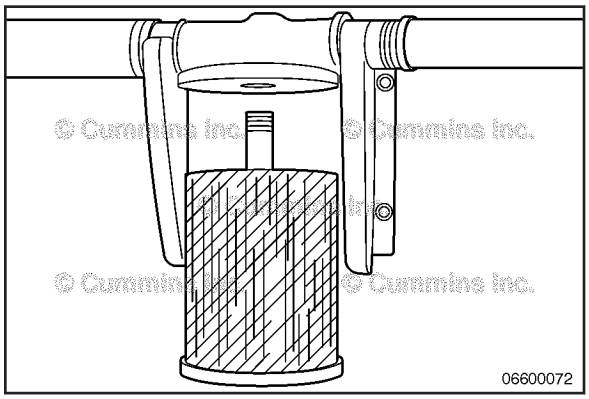


Disassemble

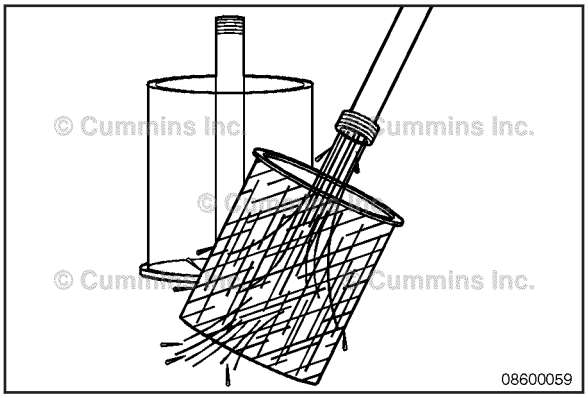
Marine Applications

Loosen and remove the sea water strainer wing nut(s) as required.

Remove the sea water strainer assembly. Be careful **not** to damage o-ring. Retain and inspect for damage.



Remove the sea water strainer basket.

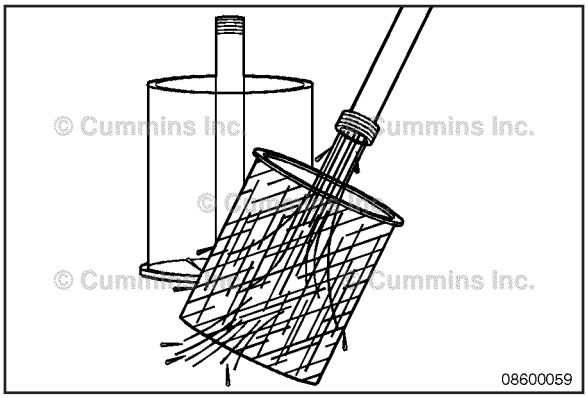


Clean

Marine Applications

Empty all debris from the sea water strainer basket.

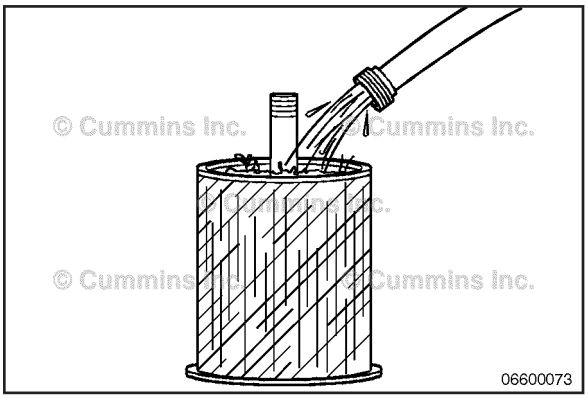
Clean the sea water strainer.

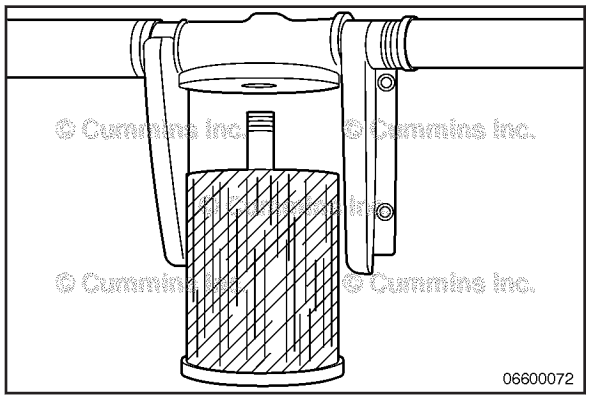


Prime

Marine Applications

Prime the sea water strainer with clean water.



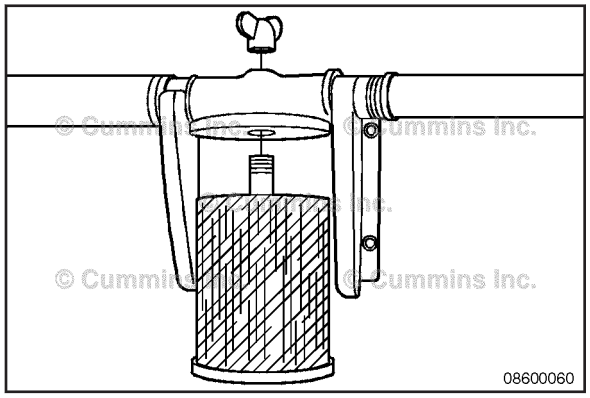


Assemble

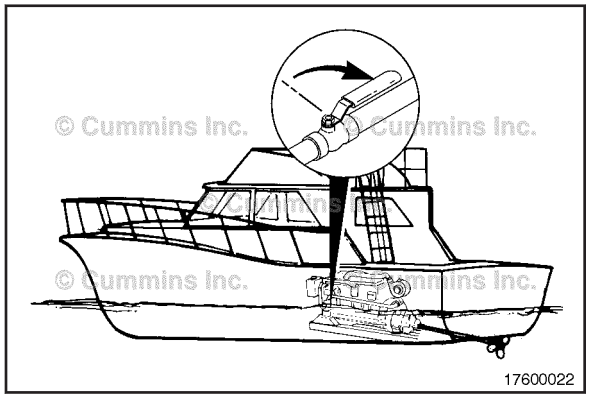
Marine Applications

Install the sea water strainer.

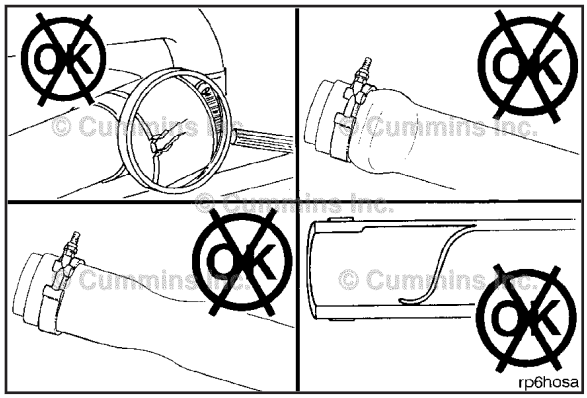
Inspect o-ring seal for tears or damage. Replace if necessary. Be sure o-ring is seated properly.



Install and tighten the wing nut(s).



Open the sea water inlet valves.



Air Intake Piping

Maintenance Check

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

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

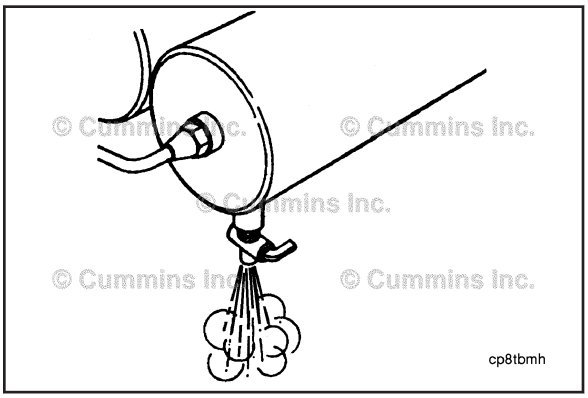
Torque Value: 8 N•m [71 in-lb]

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

Air 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.



Marine Gear

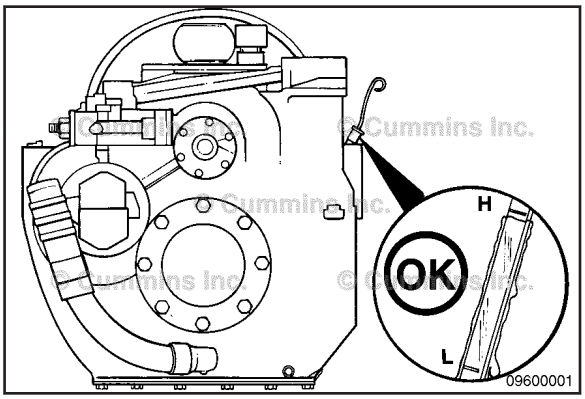
Maintenance Check

Marine Applications

Check the marine gear oil level daily.

Refer to the OEM's recommendations for the gear oil requirements.

NOTE: Different models of marine gears will have the marine gear oil dipstick and fill cap in different locations. The location shown is typical.



Drive Belts

Maintenance Check

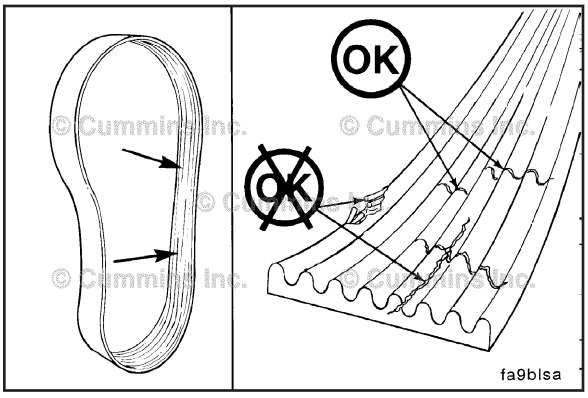
Poly-Vee Belt

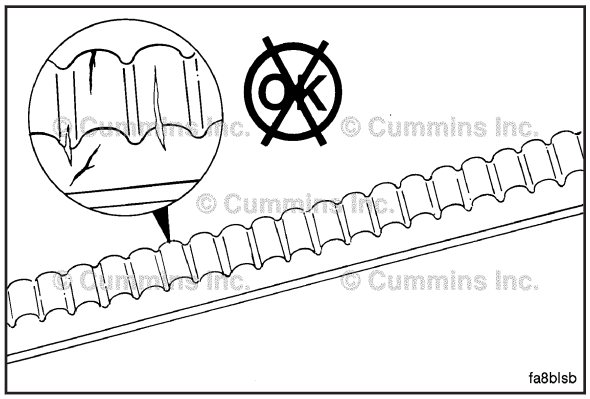
⚠CAUTION⚠
Make sure that the engine is switched off and any starting mechanisms are isolated before any inspections are made. Daily belt inspections can be carried out through an appropriate aperture. Do not remove any guards.

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

Belt damage can be caused by:

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





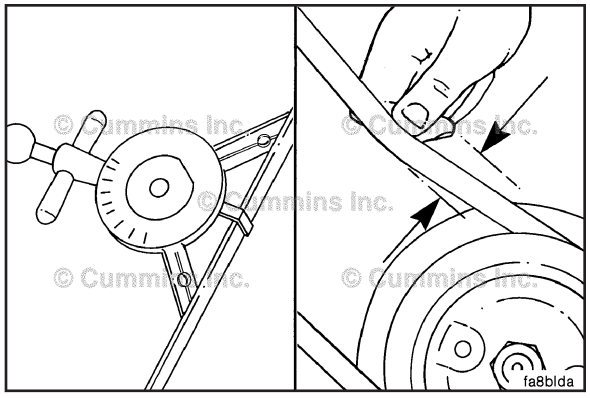
Cogged Belt

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

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

Belt damage can be caused by:

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

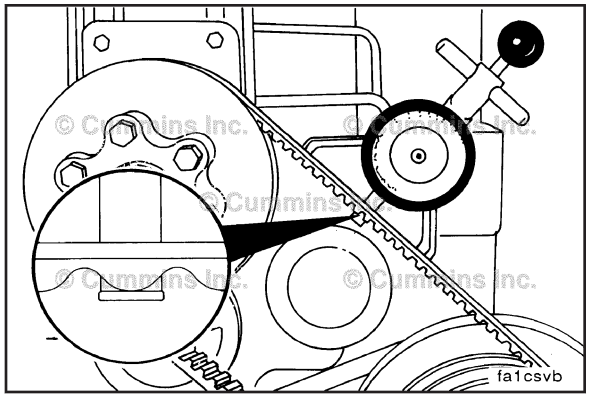


Measure the belt tension in the center span of the pulleys.

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

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

Refer to Section A for adjustment procedures.



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

Section 4 - Maintenance Procedures at 75 Hours, or 3 Months

Section Contents

This Page Left Intentionally Blank

Maintenance Procedures - Overview

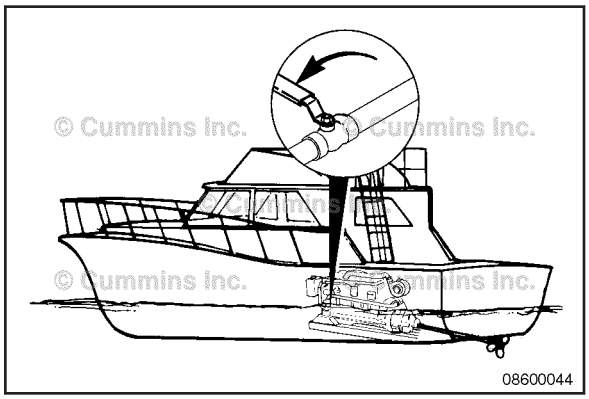
General Information

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.

Zinc Anode

Remove

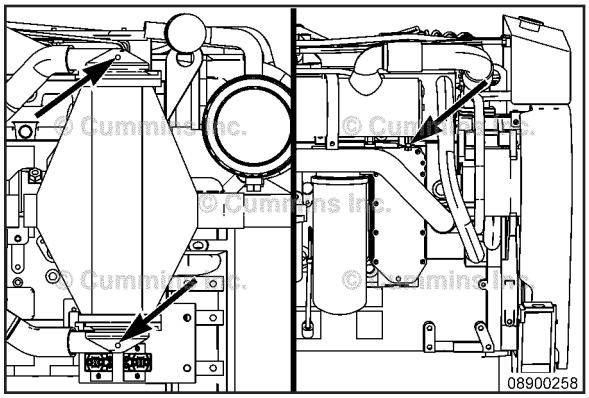
Shut off the sea water inlet valve on the vessel hull.



⚠CAUTION⚠
In some cases, it will be necessary to hold the welded fitting on the heat exchanger with an additional wrench to prevent damage to the heat exchanger.

Remove the zinc plug(s).

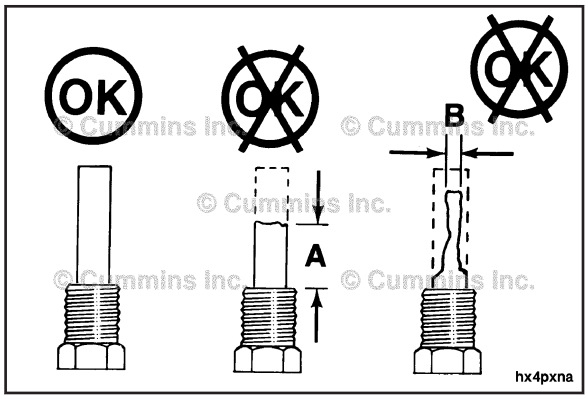
NOTE: The illustration shown is generic. For engine-specific locations, see to Section E.

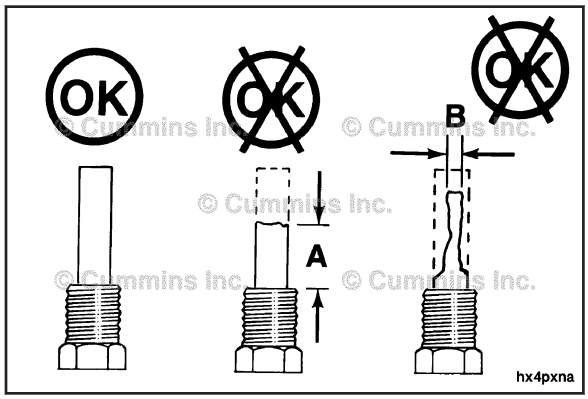


Inspect for Reuse

Measure the length of the zinc plug(s) removed from the heat exchanger. Replace any zinc plug if it is 50 percent or more eroded.

NOTE: The frequency of change depends on the chemical reaction of the sea water circulated through the heat exchanger.

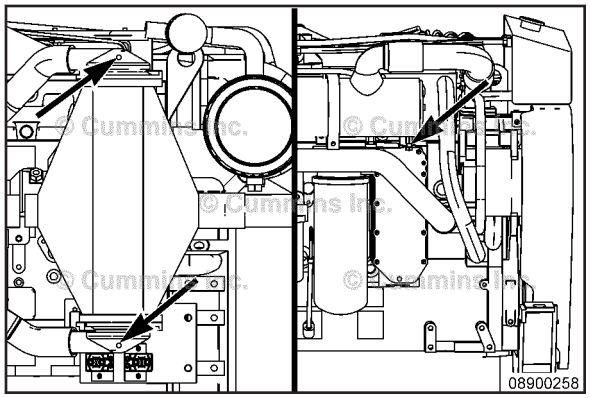




Zinc Plug Erosion Limits

	mm		in
A	19.0	MIN	0.750
New	51.0	MAX	2.000
B	6.4	MIN	0.250
New	16.0	MAX	0.630

NOTE: If any zinc plug does **not** meet specification, replace it with a new zinc plug.



Install

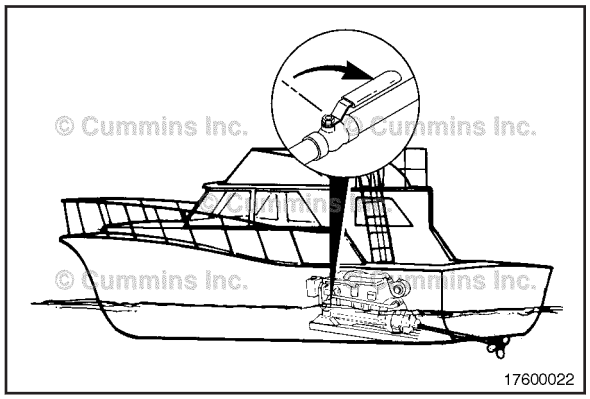
Install and tighten the zinc plug(s).

NOTE: Do **not** use Teflon™ tape or pipe sealant on the threads of the sacrificial zinc plugs. Use of any type of sealant will insulate the zinc anode and prevent a good ground.

Torque Value:
1/4-inch Plug 12 N•m [106 in-lb]

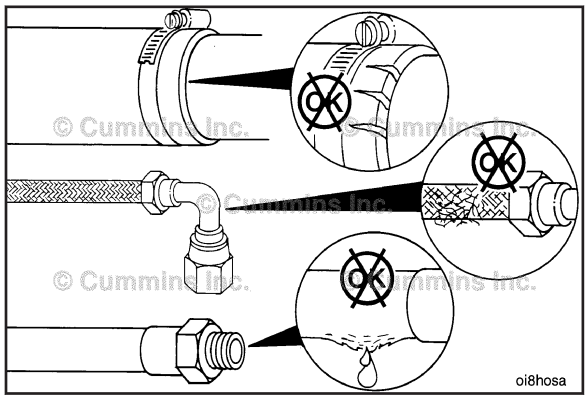
Torque Value:
3/8-inch Plug 22 N•m [195 in-lb]

Torque Value:
1/2-inch Plug 30 N•m [22 ft-lb]



Open the sea water valve on the vessel hull.

Operate the engine and check for leaks.



Cooling System Hoses

Maintenance Check

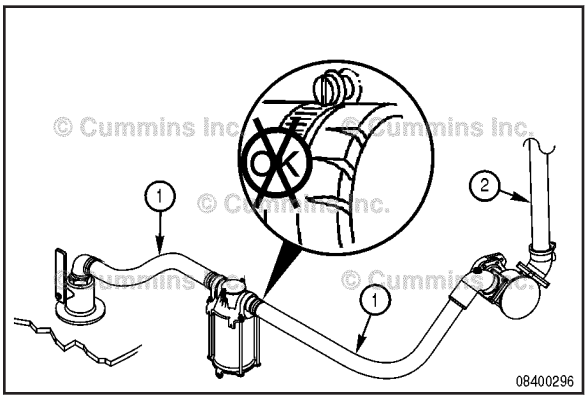
Marine and Industrial Applications

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

Sea Water Hoses

Inspect

Start engine, and inspect all hoses and connections for deterioration or leaks. Replace damaged hoses and clamps, if necessary.



Air Cleaner Restriction

Maintenance Check

Mechanical Indicator

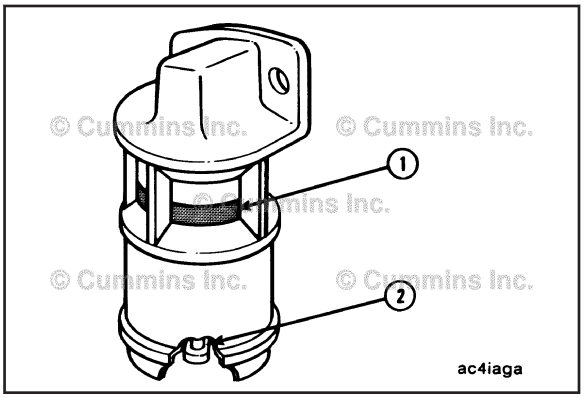
⚠CAUTION⚠

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.

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

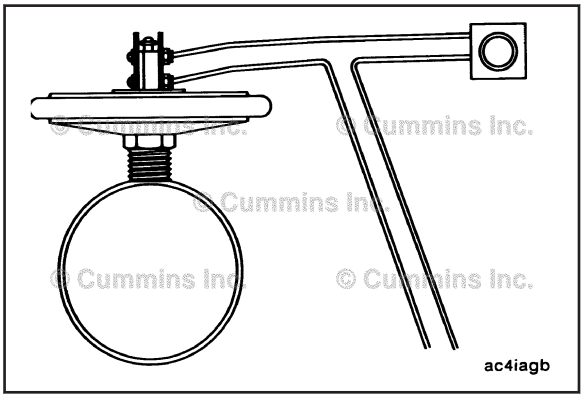
A mechanical restriction indicator is available to indicate excessive air restriction through a dry-type air cleaner. This instrument can be mounted in the air cleaner outlet or on the instrument panel. The red flag (1) in the window gradually rises as the cartridge loads with dirt. After changing or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

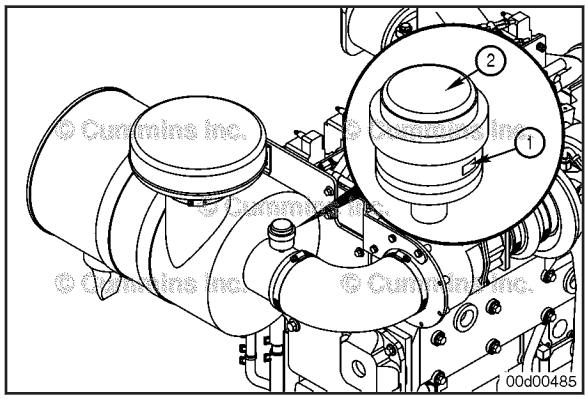
Restriction or vacuum indicators need to be installed as close as possible to the turbocharger air inlet in order to obtain a true indication of restrictions.



Vacuum Indicator

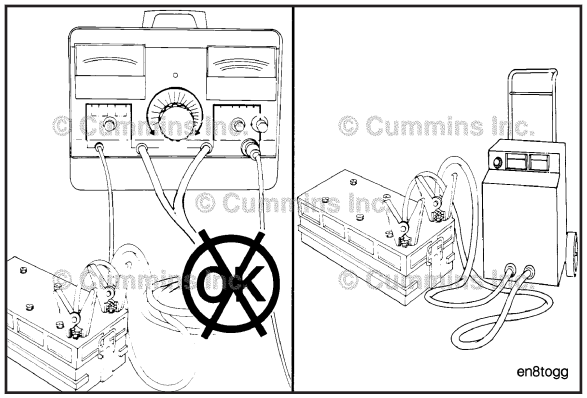
Vacuum switches actuate a warning light on the instrument panel when the air restriction becomes excessive.





Industrial Gas Mechanical Indicator

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

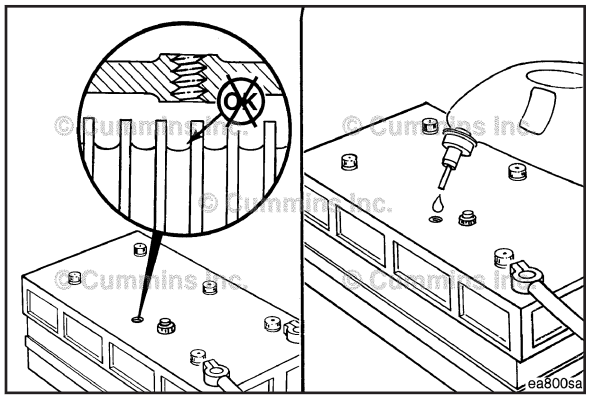


Batteries

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.

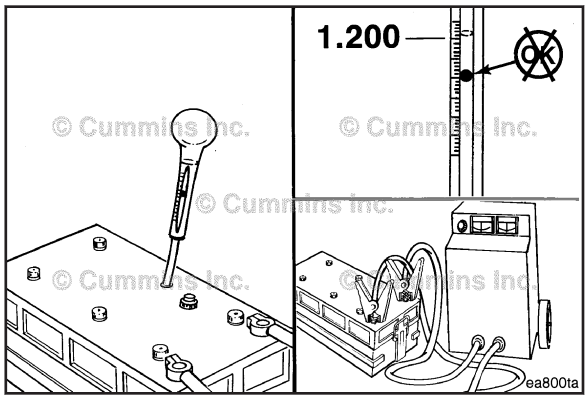
Refer to the accompanying table to determine the battery state of charge based on the specific-gravity readings.

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.

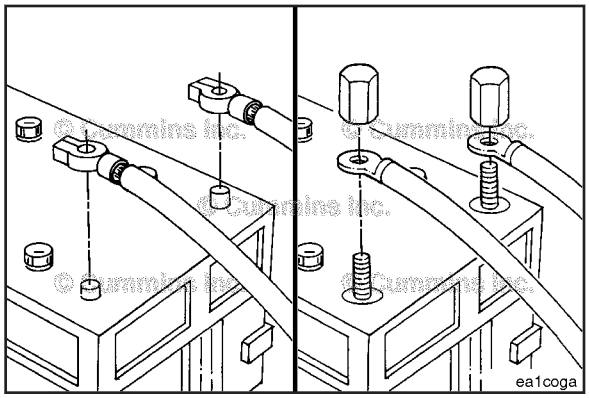


Battery Cables and Connections

Initial Check

There are two possible heavy-duty battery connections:

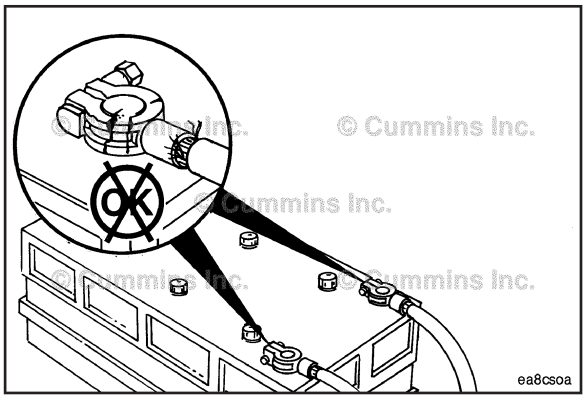
- Battery terminal and clamp (1)
- Threaded battery terminal and nut (2).



⚠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.

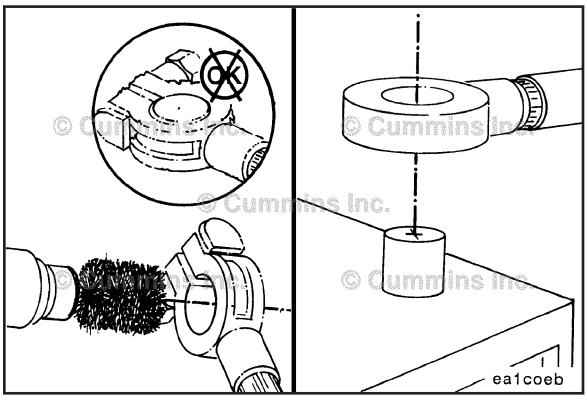
Remove and inspect the battery cables and connections for cracks or corrosion.

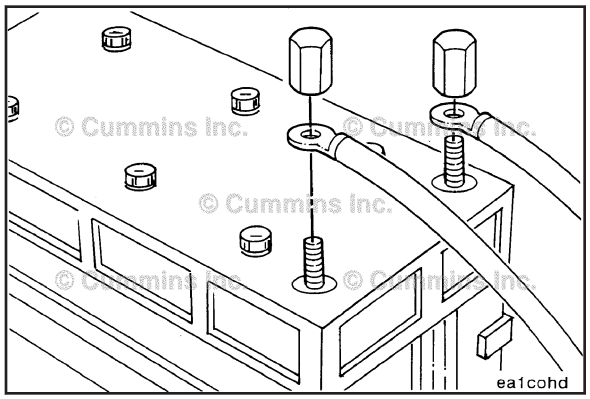
Replace broken terminals, connectors, or cables.



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.

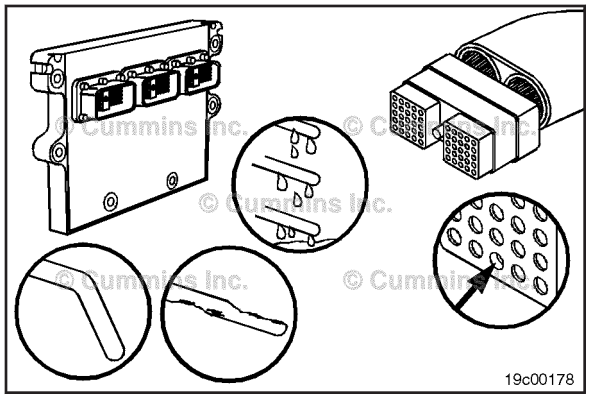
Install the cables and tighten the battery connections.

Coat the terminals with grease to prevent corrosion.

Component Connector and Pin Inspection

General Information

The following inspection procedures should be used for any component, connector, or harness connector to ensure there is no pin damage.



Inspect for Reuse

When disconnecting connectors during troubleshooting, **always** check for loose connectors (gently pull the wires at the back of the connector) and inspect the pins to make sure they are **not** the cause of a bad connection. The things to look for are bent, corroded, and pushed back pins.

Moisture in Connector

Moisture in a connector can also cause system performance issues. Many times it is difficult to see moisture in a connector. If moisture is suspected, the connector **must** be dried by applying contact cleaner, Part No. 3824510, to the connector. A heat gun can also be used on a low heat setting so that it will **not** damage the connector or wires.

NOTE: Do **not** blow compressed air in the electronic control unit ports or connector. Compressed air can contain moisture due to condensation.

Bent or Expanded Pins

Inspect the male terminals of the connector. If any of the terminals are bent, so that they will **not** easily mate with the other side of the connector, or if the male terminals are expanded, that is, bulged out or squashed so as to make them too large to mate with the other side of the connector, then the pin **must** be replaced. Refer to the repair section for the specific connector in question.

Corroded Pins

Inspect both the male and female terminals for corrosion, which can cause a poor electrical connection within the connector. If any corrosion is evident on the pins, then the corroded pins **must** be replaced. Refer to the repair section for the specific connector in question.

Pushed Back Pins

Inspect both the male and female terminals for pins that can **not** be making contact because they are pushed back in the connector. To repair, push the pin into the connector body from the back of the connector. Make sure the terminal locks into place. If the terminal will **not** lock into place, then replace it. Refer to the repair section for the specific connector in question.

Notes

Section 5 - Maintenance Procedures at 250 Hours or 3 Months

Section Contents

This Page Left Intentionally Blank

Maintenance Procedures - Overview

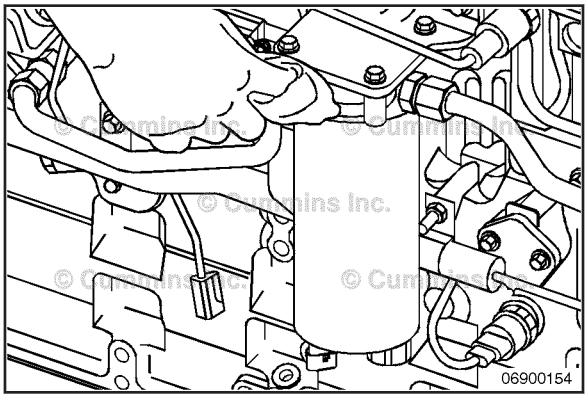
General Information

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)

Clean

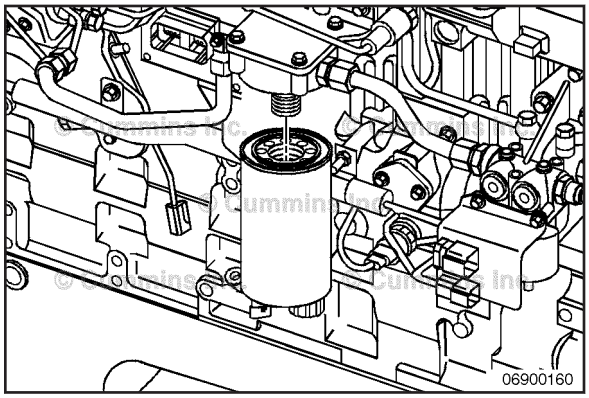
Clean the area around the fuel filter head.



Remove

75- to 80-mm and 90- to 95-mm Wrenches

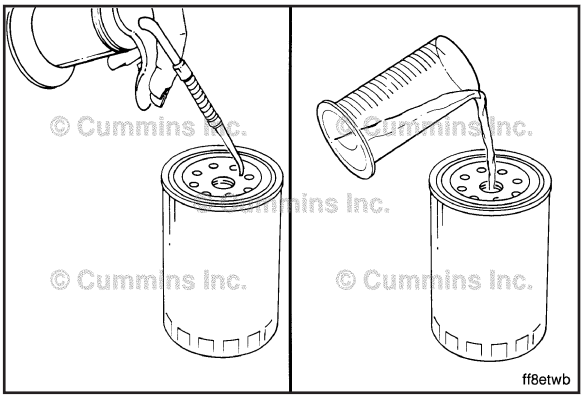
Remove the fuel filter. Clean the gasket surface of the fuel filter head.

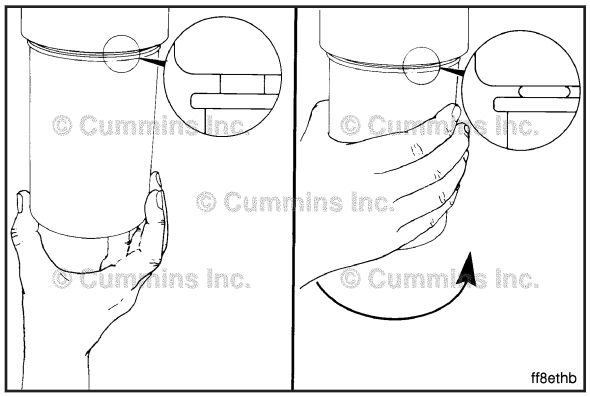


Install

Replace the o-ring.

Fill the new fuel filter(s) with clean fuel, and lubricate the o-ring seal with clean lubricating engine oil.

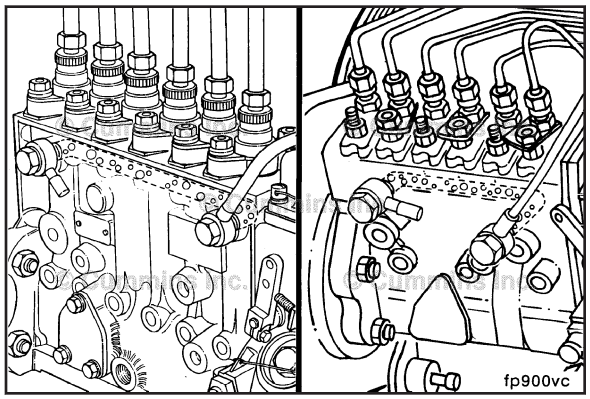




CAUTION

To reduce the possibility of fuel leaks, make sure the fuel filter is installed tightly but not too tightly. Mechanical overtightening will damage the fuel filter.

Install the fuel filter as specified by the filter manufacturer.

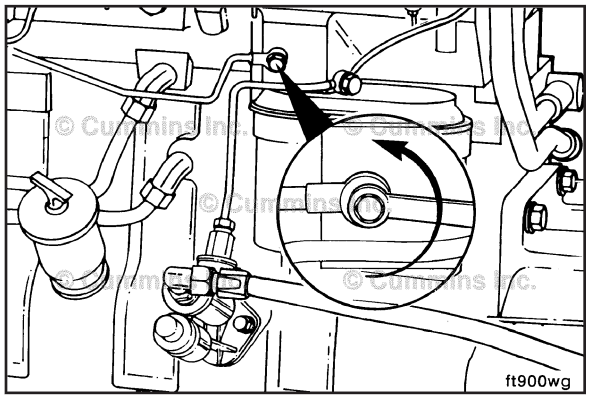


Prime

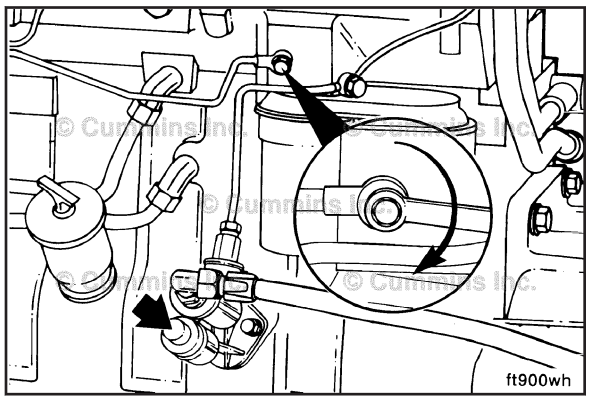
Controlled venting is provided at the injection pump through the fuel drain manifold. Small amounts of air introduced by changing the fuel filters or fuel injection pump supply line will be vented automatically if the fuel filter is changed in accordance with the instructions.

Manual bleeding is required if:

- The fuel filter is **not** filled prior to installation
- Fuel injection pump is replaced
- High-pressure fuel line connections are loosened or fuel lines replaced
- Initial engine start up or start up after an extended period of no engine operation occurs
- Vehicle fuel tank has been run until empty.



Open the bleed screw.



Operate the plunger on the fuel transfer pump until the fuel flowing from the fitting is free of air.

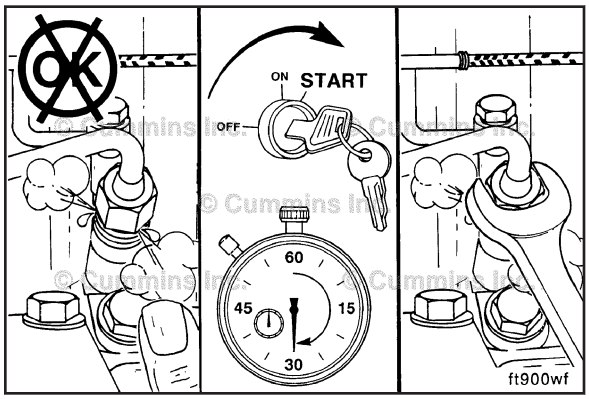
Tighten the bleed screw.

Torque Value: 9 N•m [80 in-lb]

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

17-mm (PES.A, PES.MW) and 19-mm (PES.P) Wrenches

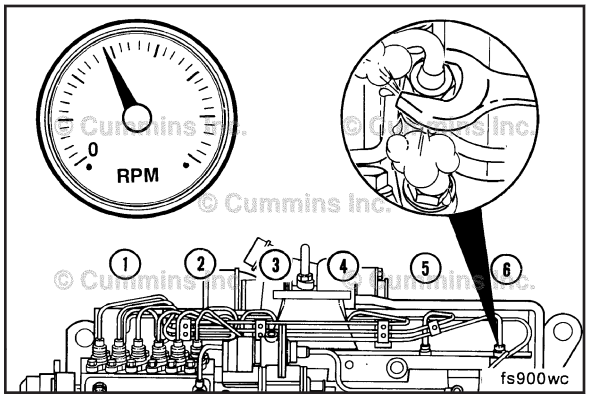
Loosen the fittings at the injectors, and crank the engine to allow entrapped air to vent from the lines. Tighten the fittings.



⚠WARNING⚠
It is necessary to put the engine in the run position. Because the engine could start, be sure to follow all the safety precautions. Use the normal engine starting procedure.

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

NOTE: Do **not** engage the starter for more than 30 seconds each time when it is used to vent the system: Wait 2 minutes between engagements.

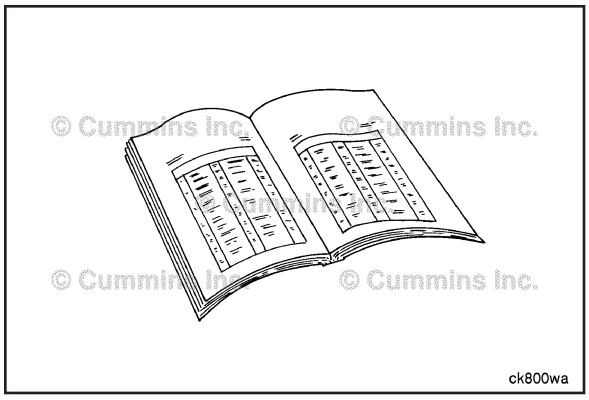


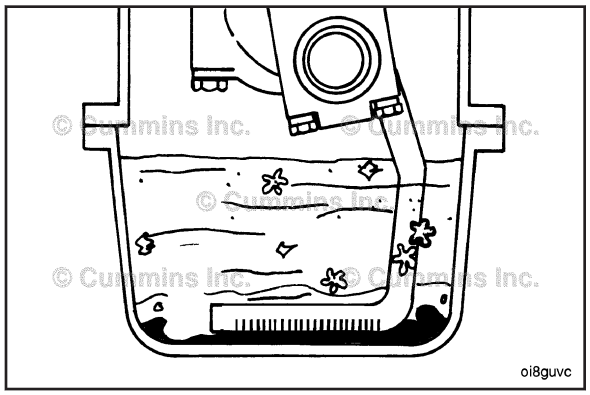
Lubricating Oil and Filters

Drain

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

PROTECT THE ENVIRONMENT: Handling and disposal of used lubricating engine oil is subject to federal, state, and local laws and regulations. Use authorized waste disposal facilities, including civic amenity sites and garages providing authorized facilities for receipt of used lubricating oil. If in doubt, contact your state and local environmental authorities or the Environmental Protection Agency for guidance as to proper handling and disposal of used lubricating engine oil.

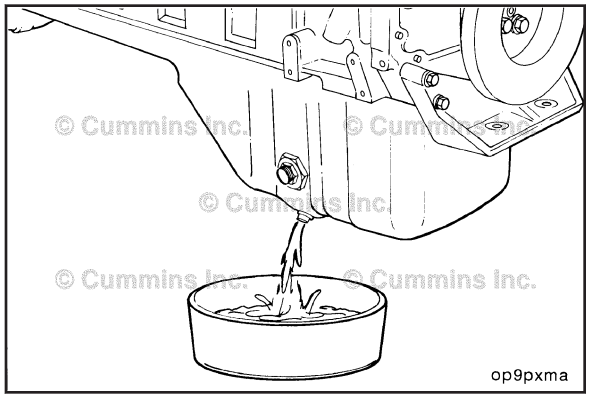




NOTE: If the engine is in service, under no circumstances can the lubricating oil drain interval extend beyond the intervals given in the charts.

Change the lubricating oil and filters to remove the contaminants suspended in the lubricating oil.

NOTE: Drain the lubricating oil **only** when it is hot and the contaminants are in suspension.

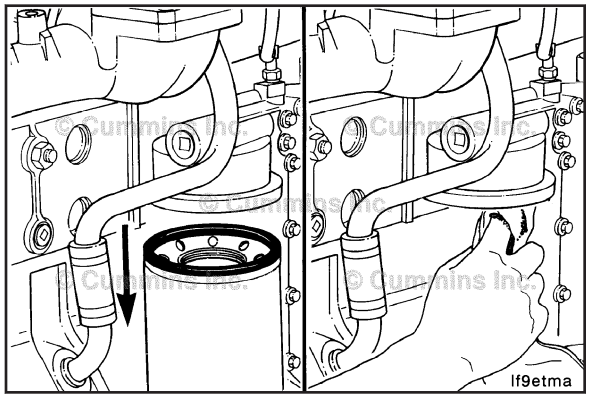


⚠WARNING⚠
To reduce the possibility of personal injury, avoid direct contact of hot oil with your skin.

Use a container that can hold at least 25 liters [26 qt] of lubricating oil.

Operate the engine until the water temperature reaches 60°C [140°F]. Shut off the engine . Remove the lubricating oil drain plug.

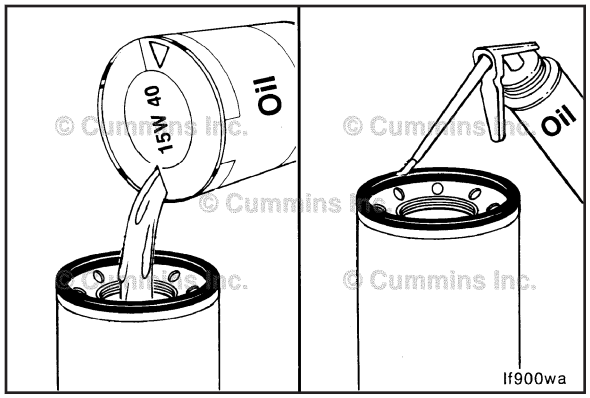
NOTE: Some applications such as marine, industrial, or generator drives have limited accessibility to oil drains. Alternate methods are available for removing oil such as pump out systems. Check with local dealer or distributor for information.



Remove

Clean the area around the lubricating oil filter head. Remove the filter. Clean the gasket surface of the filter head.

The o-ring can stick on the filter head. Make sure it is removed.



Install

Fill the filters with clean lubricating oil before installation.

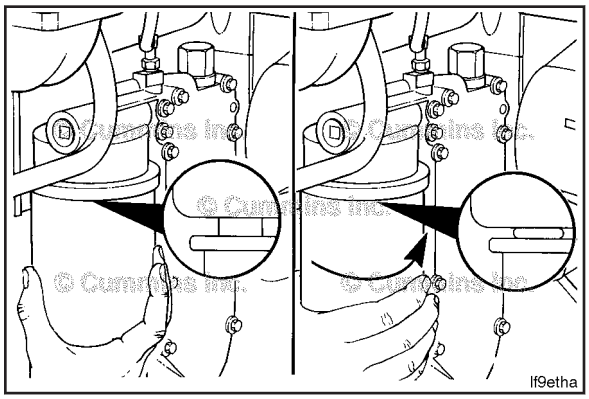
NOTE: The LF3000 lubricating oil filter has two gaskets. Lubricate both gaskets.

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

⚠CAUTION⚠
Mechanical overtightening can distort the threads or damage the lubricating oil filter element seal.

⚠CAUTION⚠
If the filter canister is damaged in any way, do not use it. Dents or scrapes can lead to a rupture or premature failure of the filter.

Install the lubricating oil filter as specified by the filter manufacturer.

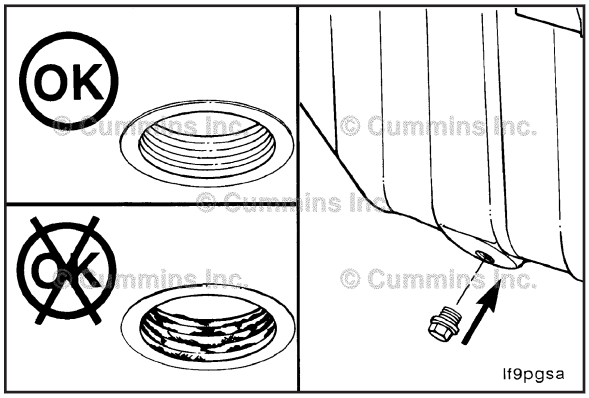


Check and clean the lubricating oil drain plug threads and sealing surface.

Install the lubricating oil pan drain plug.

Torque Value:
For steel stamp oil pans 80 N•m [59 ft-lb]

Torque Value:
For aluminum oil pans 60 N•m [44 ft-lb]

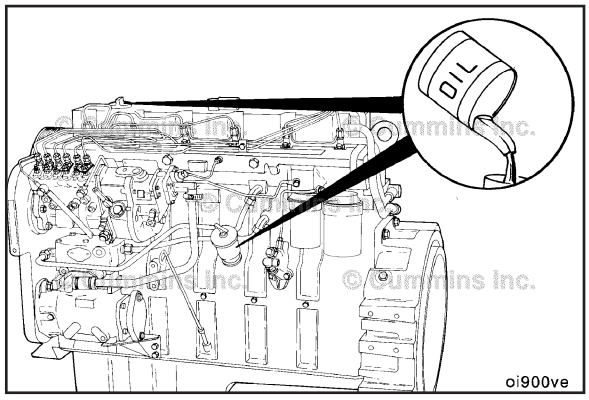


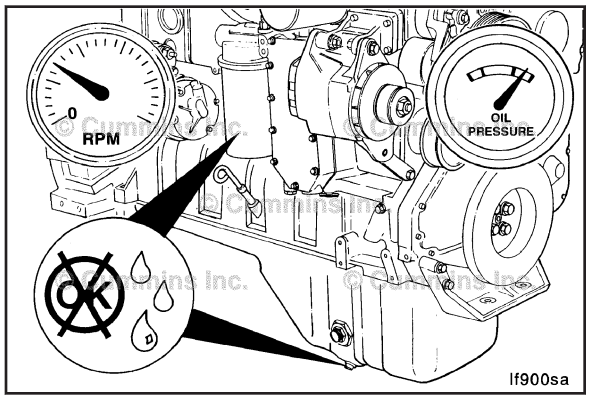
Fill

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

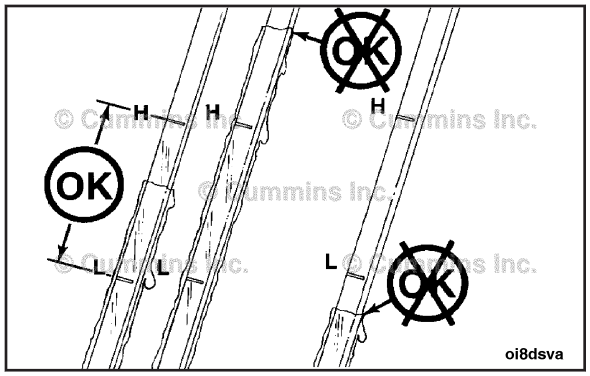
Fill the engine with clean lubricating oil to the proper level.

Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3.



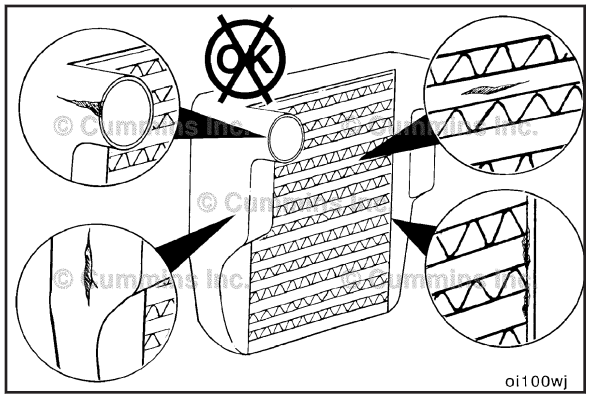


Operate the engine at low idle to inspect for leaks at the lubricating oil filter and the drain plug.



Stop the engine. Wait approximately 15 minutes to let the lubricating oil drain from the upper parts of the engine. Check the level again.

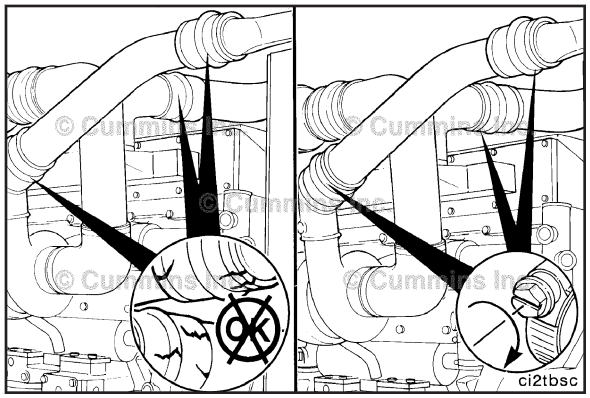
Add oil as necessary to bring the oil level to the H (high) mark on the dipstick.



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.

Air Cleaner Restriction

Maintenance Check

Mechanical Indicator

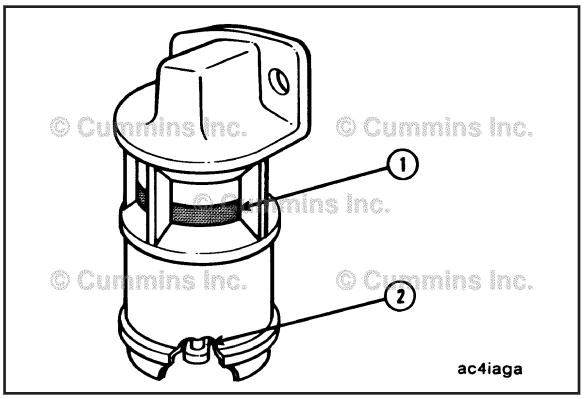
⚠CAUTION⚠

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.

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

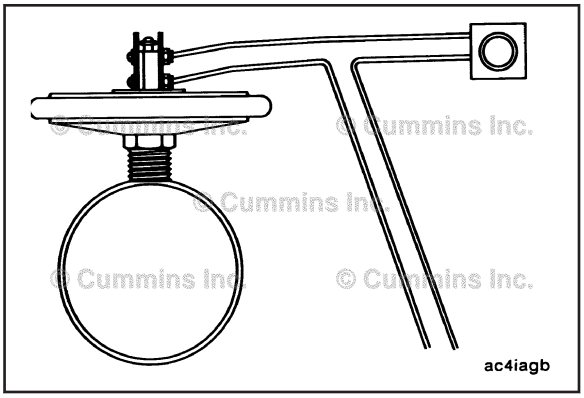
A mechanical restriction indicator is available to indicate excessive air restriction through a dry-type air cleaner. This instrument can be mounted in the air cleaner outlet or on the instrument panel. The red flag (1) in the window gradually rises as the cartridge loads with dirt. After changing or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



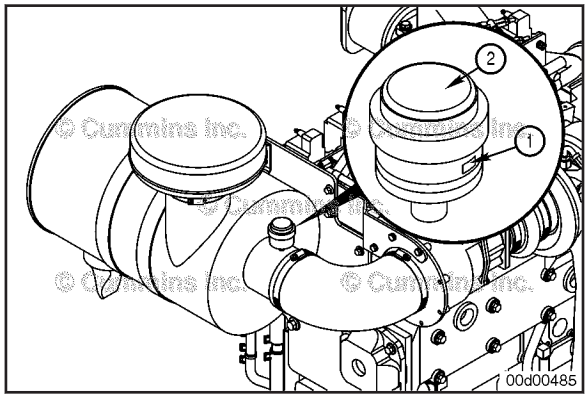
Vacuum Indicator

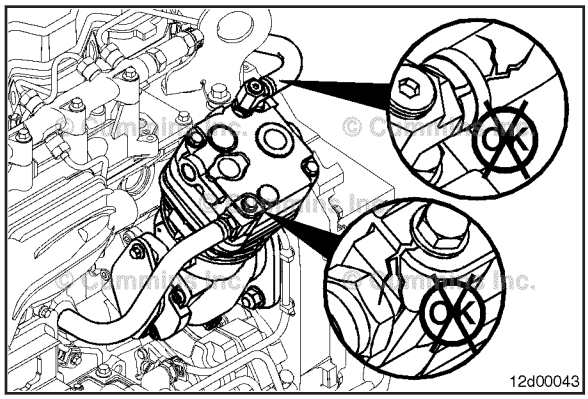
Vacuum switches actuate a warning light on the instrument panel when the air restriction becomes excessive.



Industrial Gas Mechanical Indicator

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





Air Compressor

Maintenance Check

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

Inspect compressor housing for cracks and damage.

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

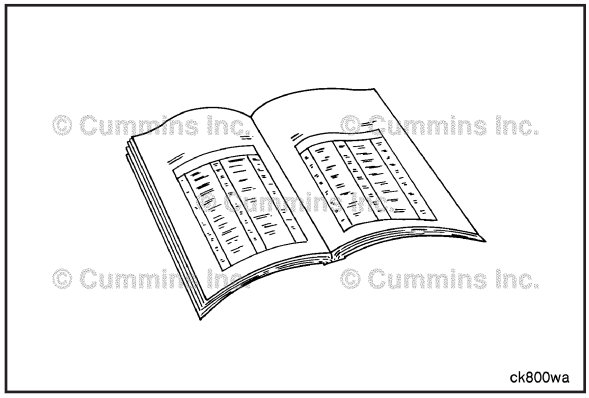
Inspect air plumbing for splits or cracks.

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

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

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

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



Preparatory Steps

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

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

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

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

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

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

Remove the coolant lines from the air compressor.

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

Use steam to clean the air compressor.

Dry with compressed air.

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

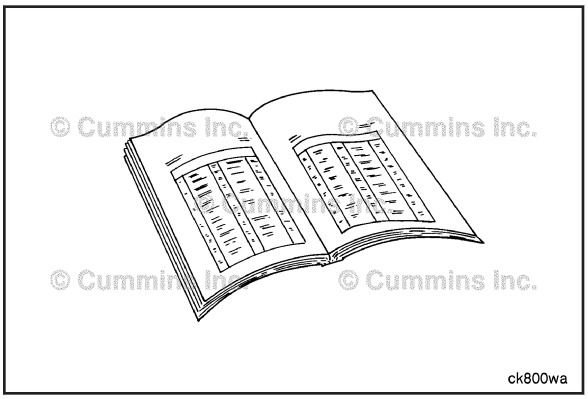
Finishing Steps

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

Operate the engine and check for leaks.

Operate the engine to activate the air compressor.

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



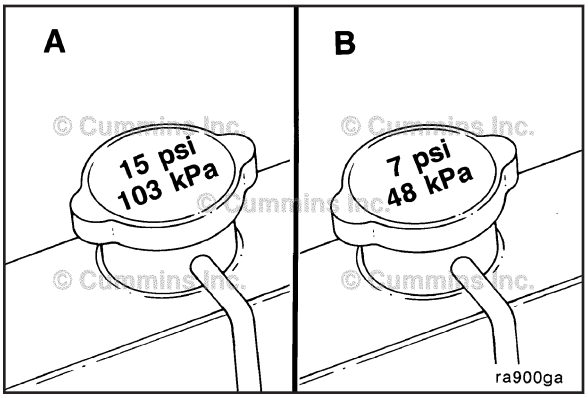
Radiator Pressure Cap

Pressure Test

The system is designed to use a pressure cap to prevent boiling of the coolant.

Different caps are specified for the two recommended systems:

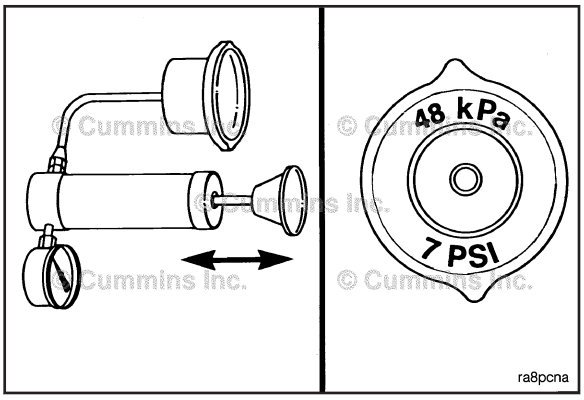
System	Cap
A - 104°C [220°F]	103 kPa [15 psi]
B - 99°C [210°F]	48 kPa [7 psi]



Pressure-test the cooling system pressure cap.

The pressure cap **must** seal within 14 kPa [2 psi] of the value stated on the cap, or it **must** be replaced.

An incorrect or malfunctioning cap can result in the loss of coolant and the engine running hot.



Notes

Section 6 - Maintenance Procedures at 300 Hours or 1 Year

Section Contents

This Page Left Intentionally Blank

Maintenance Procedures - Overview

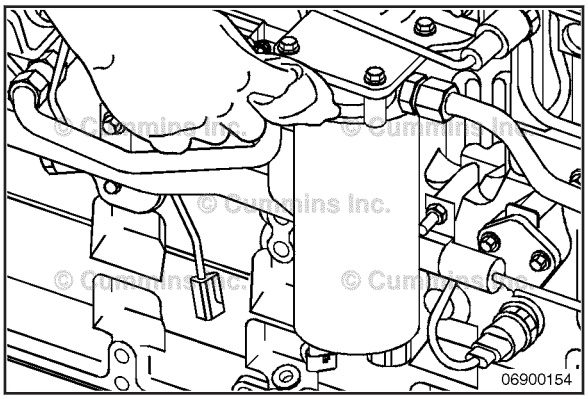
General Information

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)

Clean

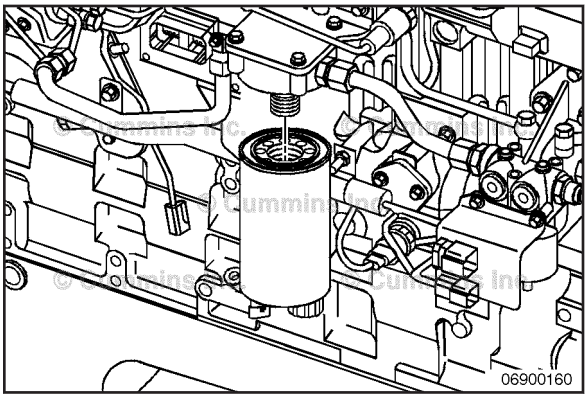
Clean the area around the fuel filter head.



Remove

75- to 80-mm and 90- to 95-mm Wrenches

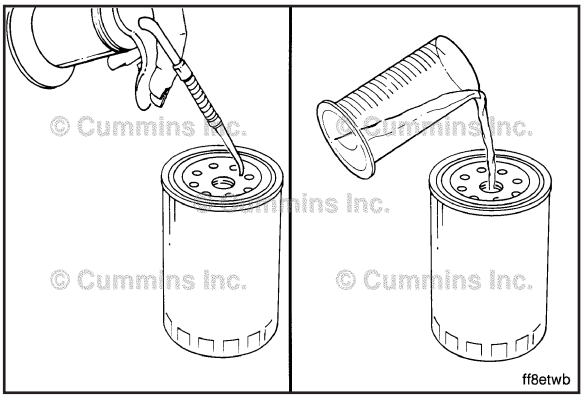
Remove the fuel filter. Clean the gasket surface of the fuel filter head.

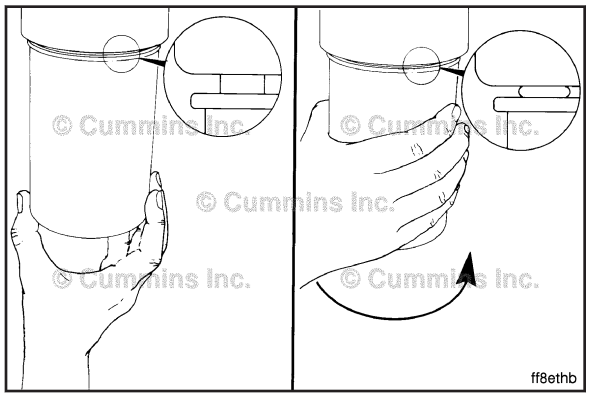


Install

Replace the o-ring.

Fill the new fuel filter(s) with clean fuel, and lubricate the o-ring seal with clean lubricating engine oil.

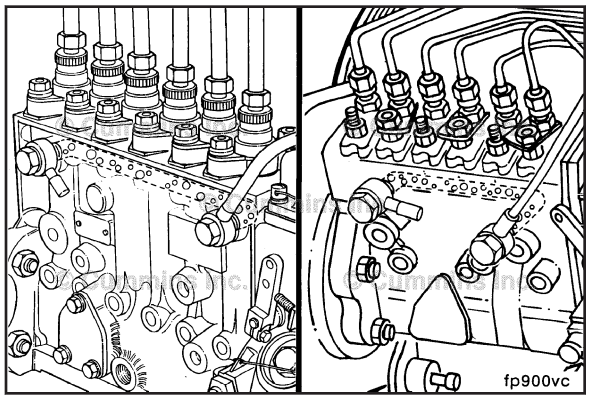




CAUTION

To reduce the possibility of fuel leaks, make sure the fuel filter is installed tightly but not too tightly. Mechanical overtightening will damage the fuel filter.

Install the fuel filter as specified by the filter manufacturer.

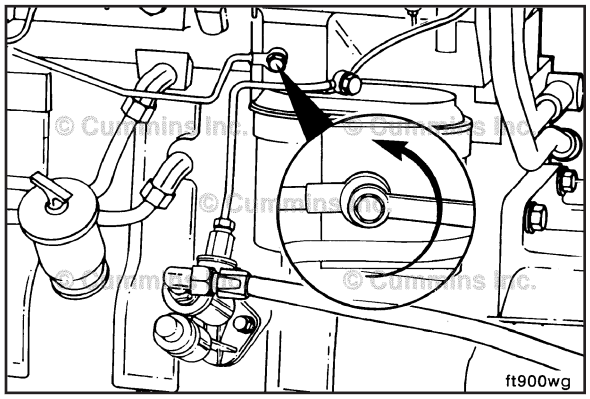


Prime

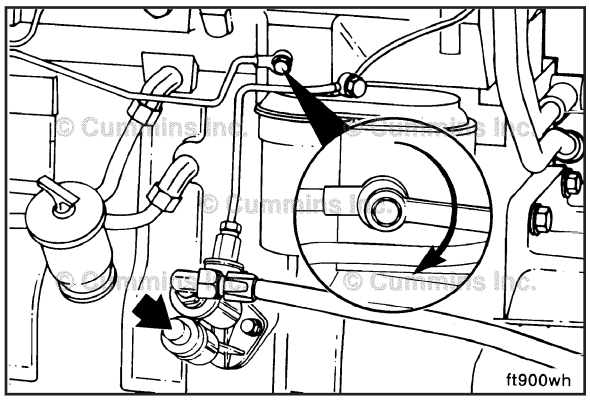
Controlled venting is provided at the injection pump through the fuel drain manifold. Small amounts of air introduced by changing the fuel filters or fuel injection pump supply line will be vented automatically if the fuel filter is changed in accordance with the instructions.

Manual bleeding is required if:

- The fuel filter is **not** filled prior to installation
- Fuel injection pump is replaced
- High-pressure fuel line connections are loosened or fuel lines replaced
- Initial engine start up or start up after an extended period of no engine operation occurs
- Vehicle fuel tank has been run until empty.



Open the bleed screw.



Operate the plunger on the fuel transfer pump until the fuel flowing from the fitting is free of air.

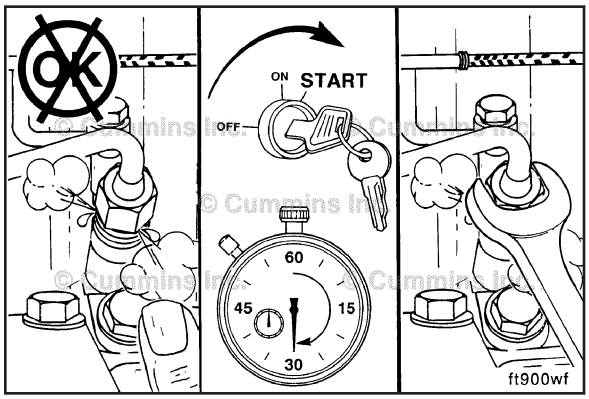
Tighten the bleed screw.

Torque Value: 9 N•m [80 in-lb]

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

17-mm (PES.A, PES.MW) and 19-mm (PES.P) Wrenches

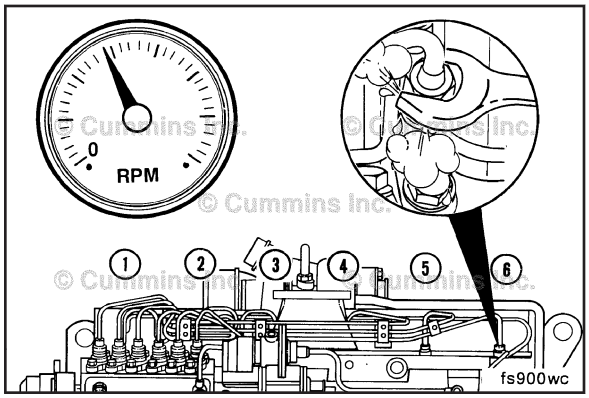
Loosen the fittings at the injectors, and crank the engine to allow entrapped air to vent from the lines. Tighten the fittings.



⚠WARNING⚠
It is necessary to put the engine in the run position. Because the engine could start, be sure to follow all the safety precautions. Use the normal engine starting procedure.

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

NOTE: Do **not** engage the starter for more than 30 seconds each time when it is used to vent the system: Wait 2 minutes between engagements.



Fuel-Water Separator

Drain

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

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

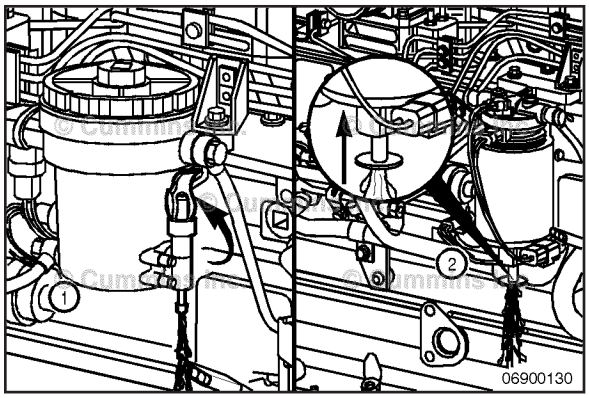
Drain the water and sediment from the separator daily.

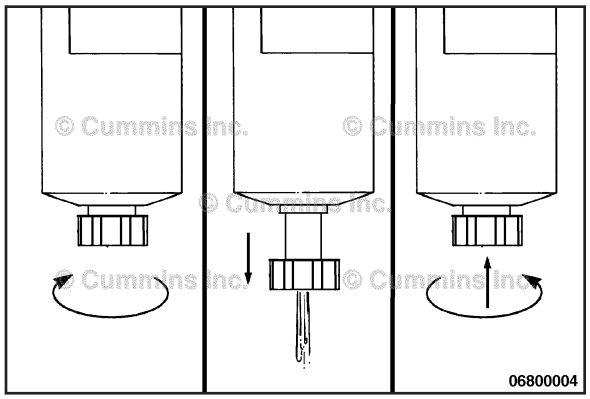
Canister Type

Shut off the engine.

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

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





Spin-on Type

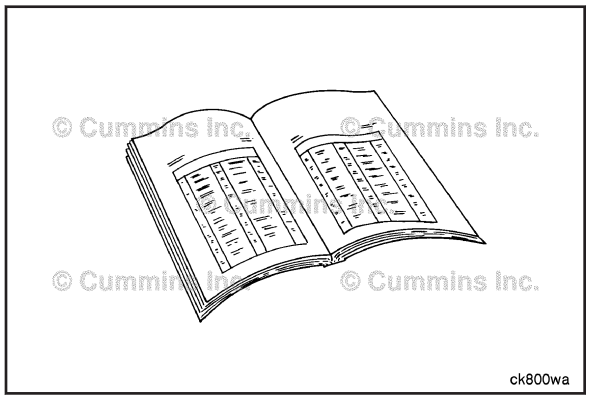
Shut off the engine.

Use your hand to open the drain valve. Turn the valve **counterclockwise** approximately 3½ turns until the valve drops down 25.4mm [1 in] and draining occurs.

Drain the filter sump until clear fuel is visible.

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

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

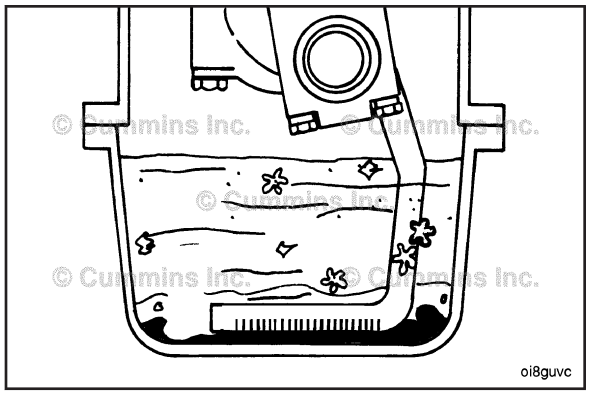


Lubricating Oil and Filters

Drain

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

PROTECT THE ENVIRONMENT: Handling and disposal of used lubricating engine oil is subject to federal, state, and local laws and regulations. Use authorized waste disposal facilities, including civic amenity sites and garages providing authorized facilities for receipt of used lubricating oil. If in doubt, contact your state and local environmental authorities or the Environmental Protection Agency for guidance as to proper handling and disposal of used lubricating engine oil.



NOTE: If the engine is in service, under no circumstances can the lubricating oil drain interval extend beyond the intervals given in the charts.

Change the lubricating oil and filters to remove the contaminants suspended in the lubricating oil.

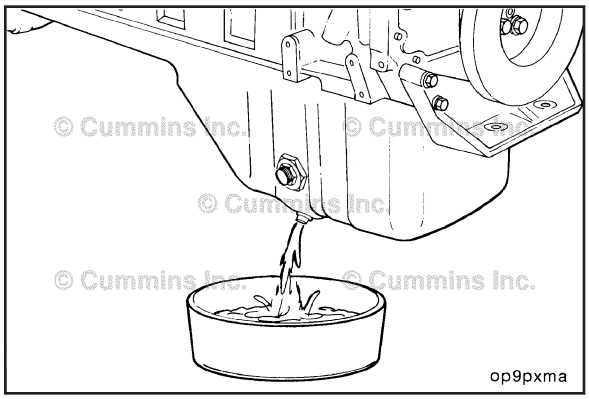
NOTE: Drain the lubricating oil **only** when it is hot and the contaminants are in suspension.

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

Use a container that can hold at least 25 liters [26 qt] of lubricating oil.

Operate the engine until the water temperature reaches 60°C [140°F]. Shut off the engine . Remove the lubricating oil drain plug.

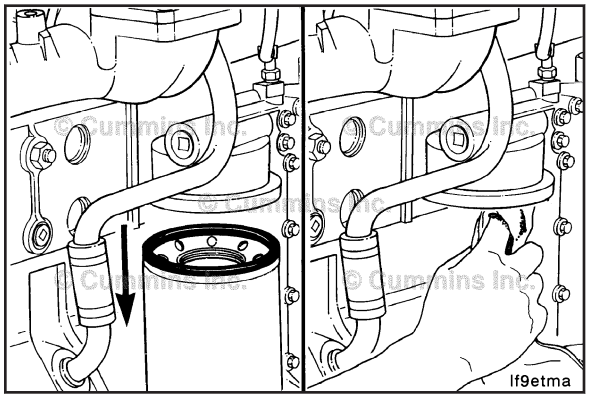
NOTE: Some applications such as marine, industrial, or generator drives have limited accessibility to oil drains. Alternate methods are available for removing oil such as pump out systems. Check with local dealer or distributor for information.



Remove

Clean the area around the lubricating oil filter head. Remove the filter. Clean the gasket surface of the filter head.

The o-ring can stick on the filter head. Make sure it is removed.

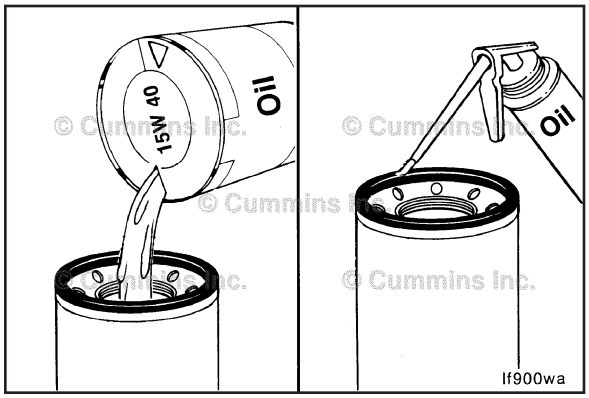


Install

Fill the filters with clean lubricating oil before installation.

NOTE: The LF3000 lubricating oil filter has two gaskets. Lubricate both gaskets.

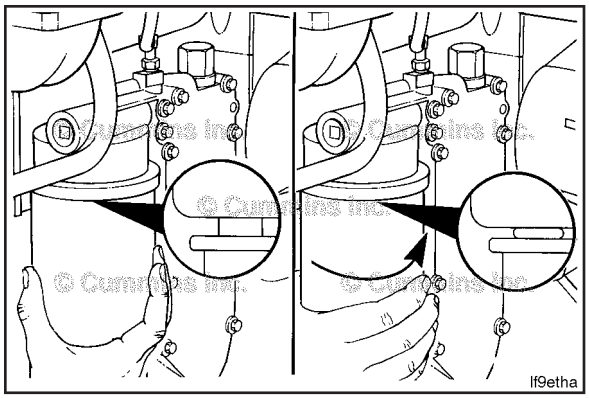
Apply a light film of oil to the gasket sealing surface before installing the filters.

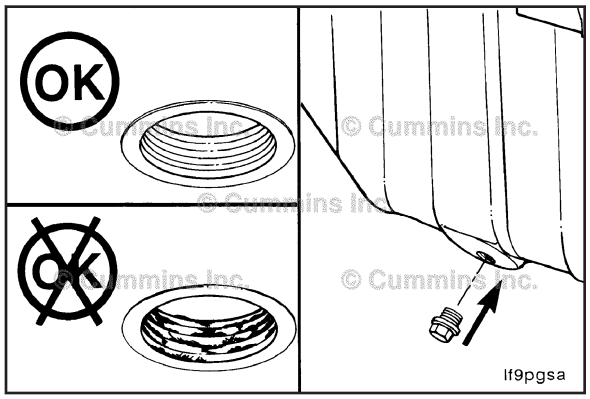


⚠CAUTION⚠
Mechanical overtightening can distort the threads or damage the lubricating oil filter element seal.

⚠CAUTION⚠
If the filter canister is damaged in any way, do not use it. Dents or scrapes can lead to a rupture or premature failure of the filter.

Install the lubricating oil filter as specified by the filter manufacturer.





Check and clean the lubricating oil drain plug threads and sealing surface.

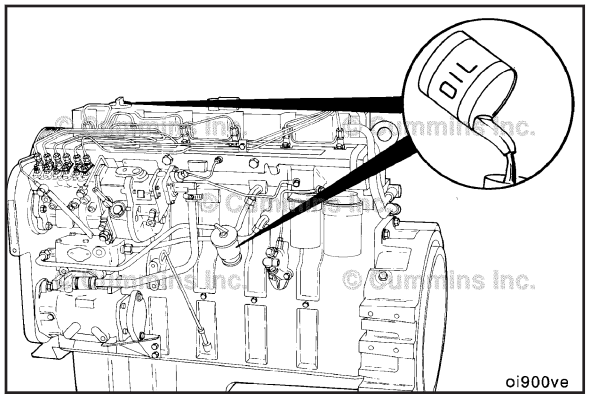
Install the lubricating oil pan drain plug.

Torque Value:
For steel stamp oil pans 80 N•m [59 ft-lb]

Torque Value:
For aluminum oil pans 60 N•m [44 ft-lb]

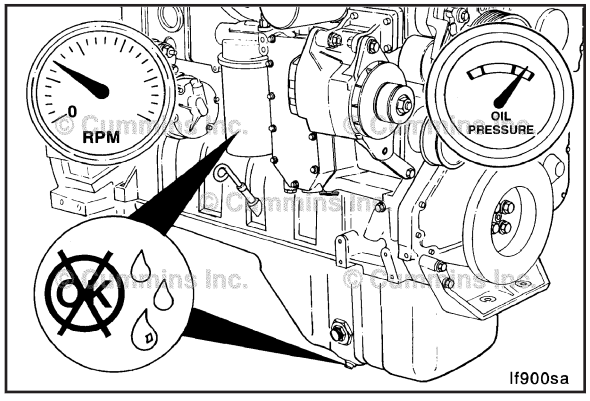
Fill

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



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

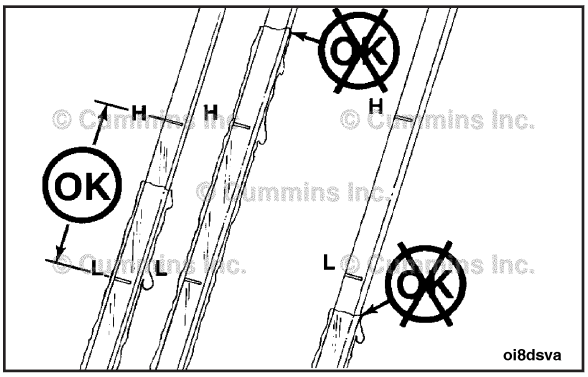
Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3.



Operate the engine at low idle to inspect for leaks at the lubricating oil filter and the drain plug.

Stop the engine. Wait approximately 15 minutes to let the lubricating 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.

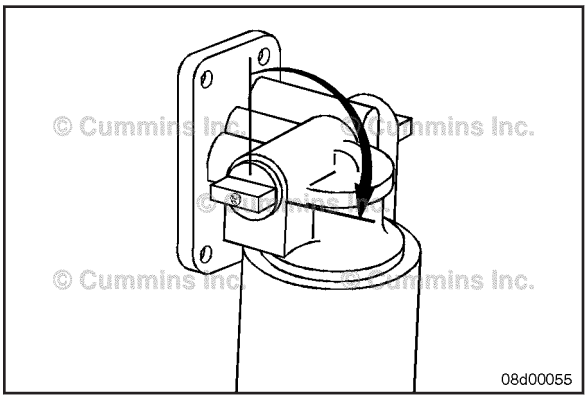


Coolant Filter

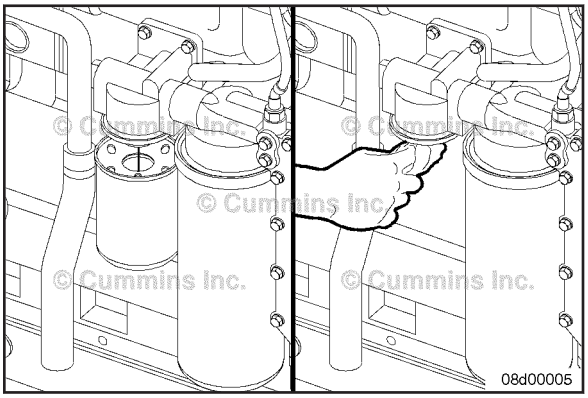
Remove

⚠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

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

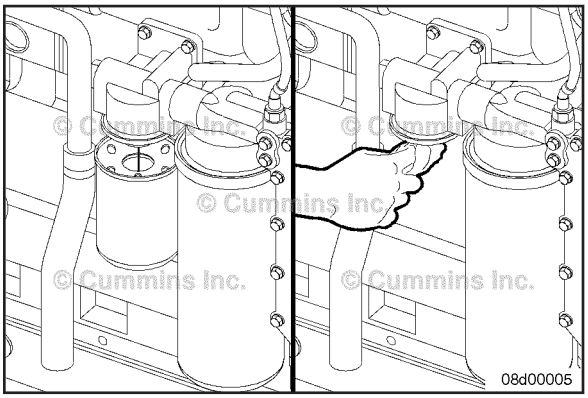


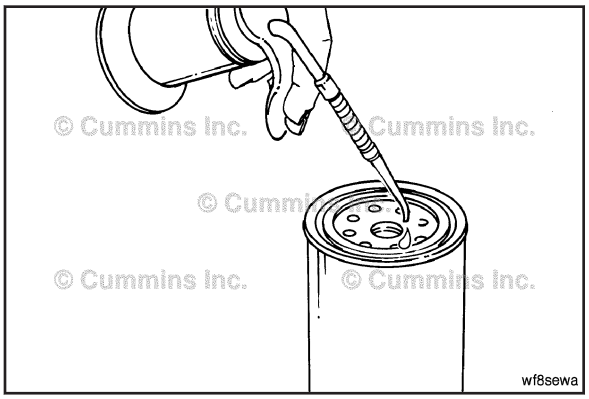
Remove and discard the coolant filter.



Clean

Clean the gasket surface.





Install

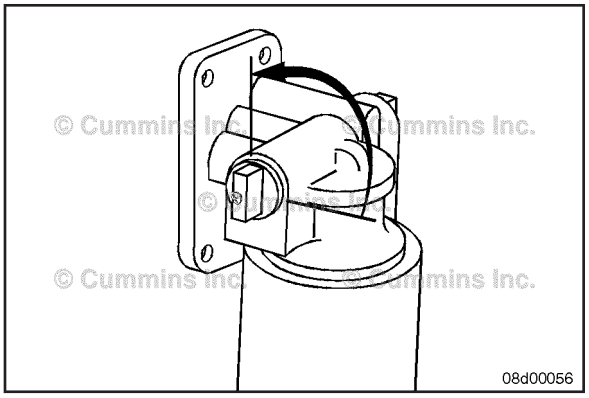
CAUTION
Do not allow oil to get into the filter. Oil will damage the DCA.

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.

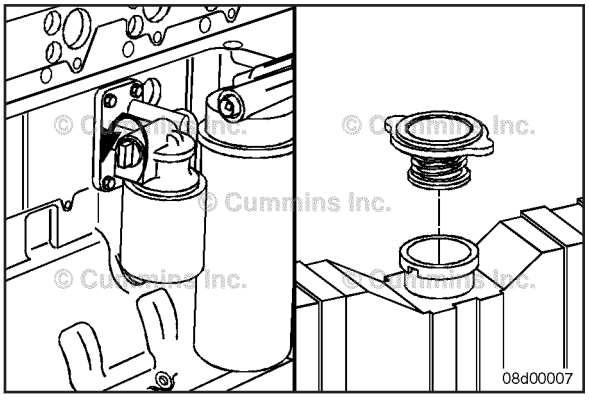
Install the coolant filter on the filter head. Tighten the filter until the gasket contacts the filter head surface.

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

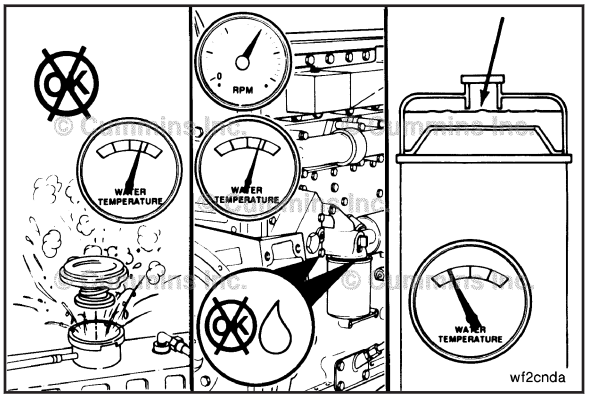


CAUTION
The valve must be in the ON position to prevent engine damage.

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.



Operate the engine and check for coolant leaks.

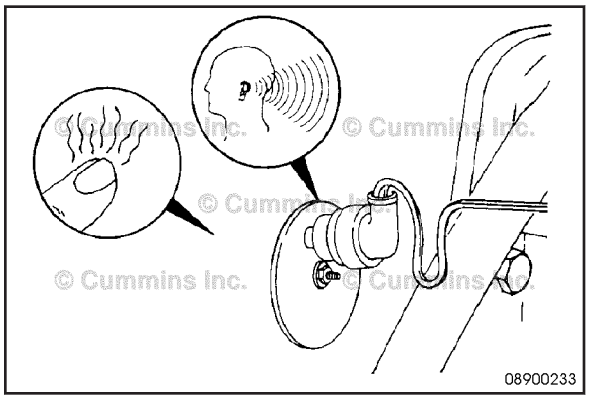
After the air has been purged from the system, check the coolant level again.

Engine Coolant Heater

Maintenance Check

If your engine is equipped with an optional coolant heater, it should be checked periodically, especially when cold weather nears.

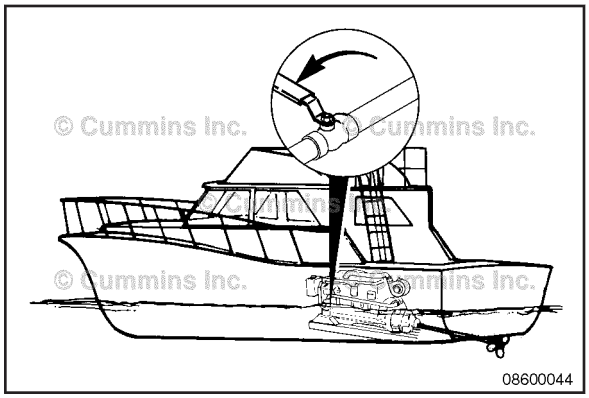
When operating, the engine block heater will make an audible sound and the engine block will be warm to the touch in the water jacket areas. The coolant heater works on shore power.



Marine Gear Oil Cooler

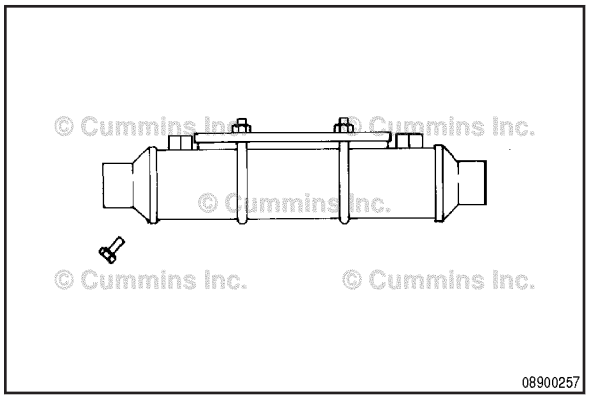
Flush

Shut off the sea water inlet valve on the vessel hull, if so equipped.



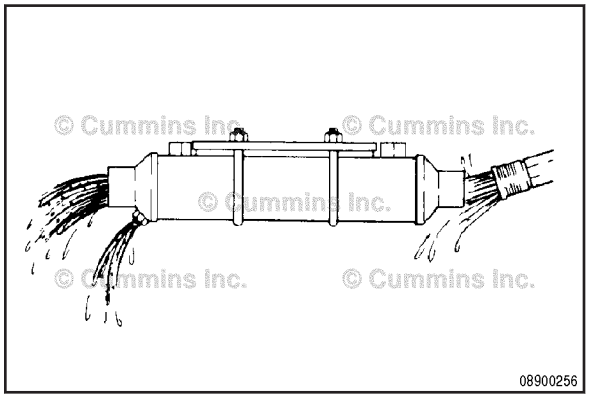
Remove the marine gear oil cooler drain plug and drain the sea water from the gear oil cooler.

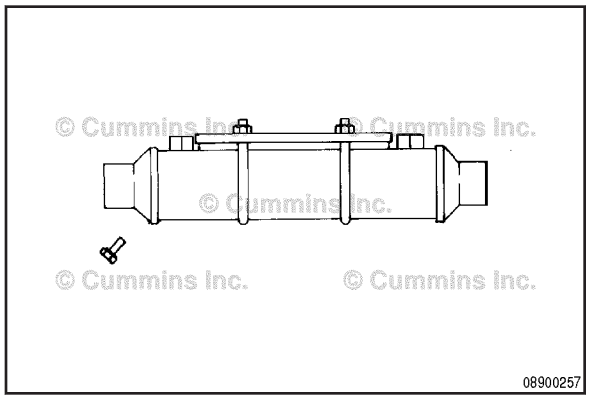
Disconnect the sea water inlet and outlet connections.



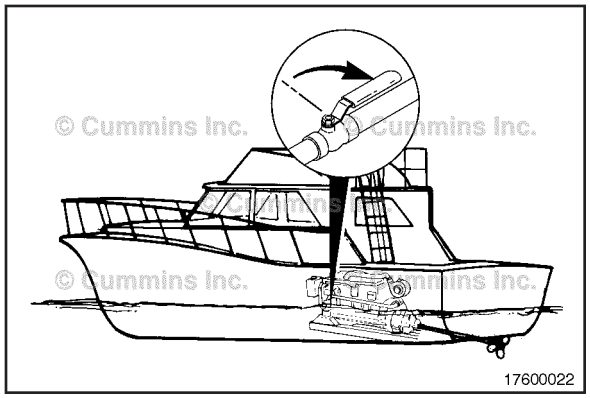
Use clean water to flush all the debris from the cooler.

Make sure the debris flushed from the cooler does **not** enter the water supply hoses.

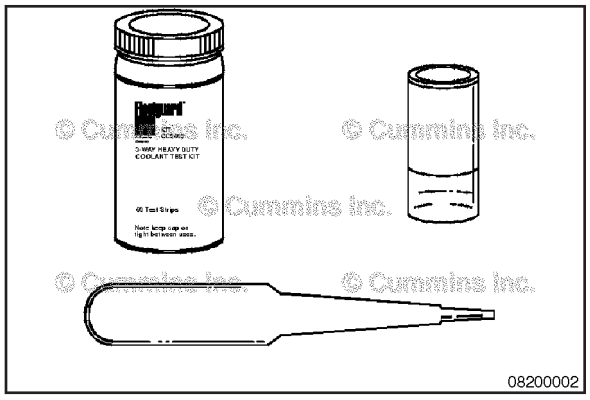




Install the drain plug and sea water hose connections.



Open the sea water valve on the vessel hull, if closed.



Supplemental Coolant Additive (SCA) and Antifreeze Concentration

Maintenance Check

Supplemental Coolant Additive (SCA)

⚠CAUTION⚠

Failing to maintain the required SCA concentration level can cause engine damage.

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.

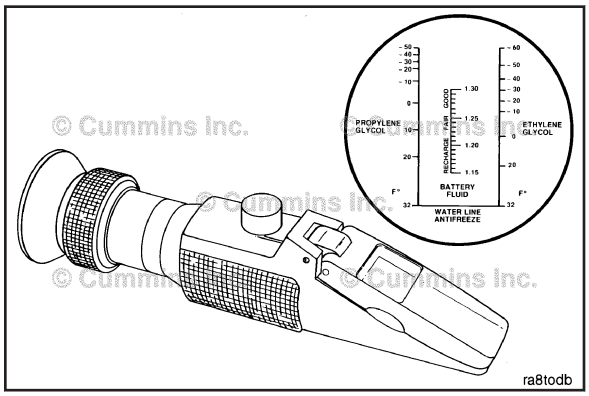
Use Fleetguard® coolant test kit, Part No. CC2602, to check the SCA concentration level. Instructions are included with the test kit. Use the Coolant Recommendations and Specifications in Maintenance Specifications (Section V) for the correct SCA and antifreeze level.

Antifreeze

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

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

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



Antifreeze is essential in every climate.

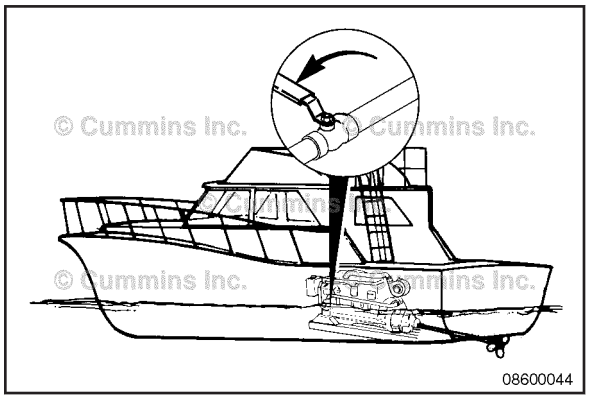
Antifreeze broadens the operating temperature range by lowering the coolant freezing point and by raising its boiling point.

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

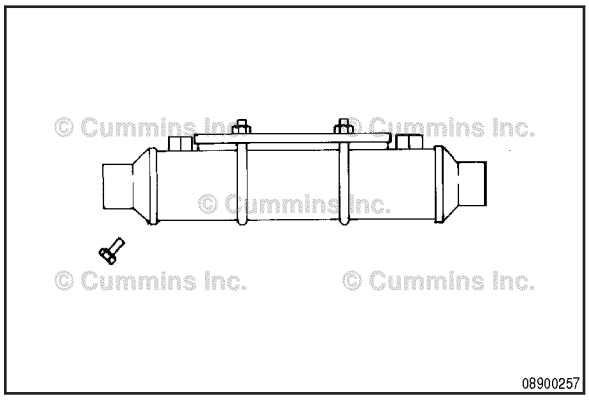
Heat Exchanger

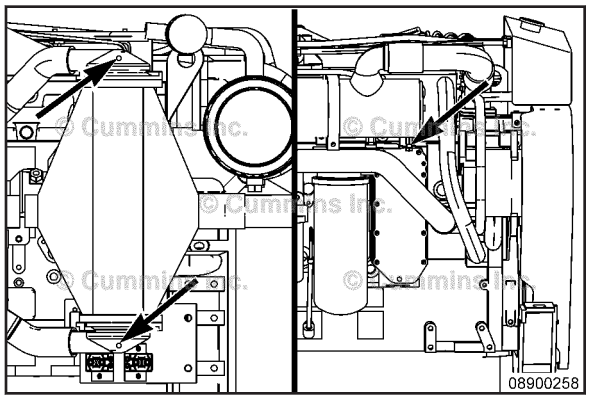
Flush

Shut off the sea water valve on the vessel hull.

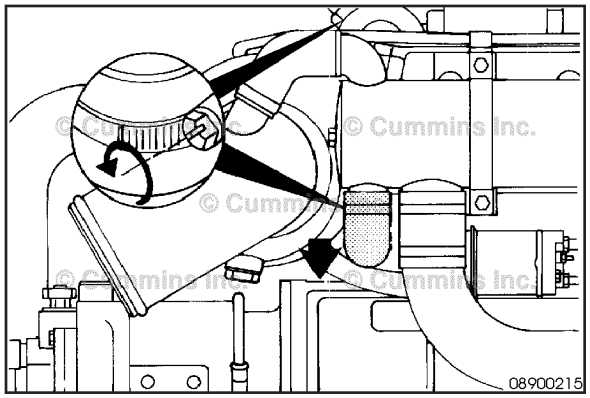


To flush the marine gear oil cooler, refer to Procedure 008-041 (Marine Gear Oil Cooler) in Section 5.





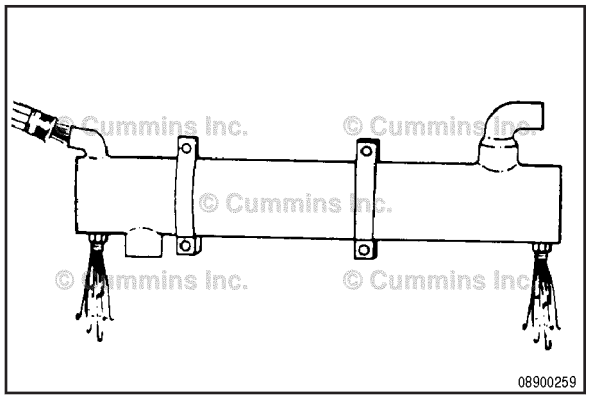
Remove the zinc plugs from the aftercooler and heat exchanger.



Typical hose connections are shown.

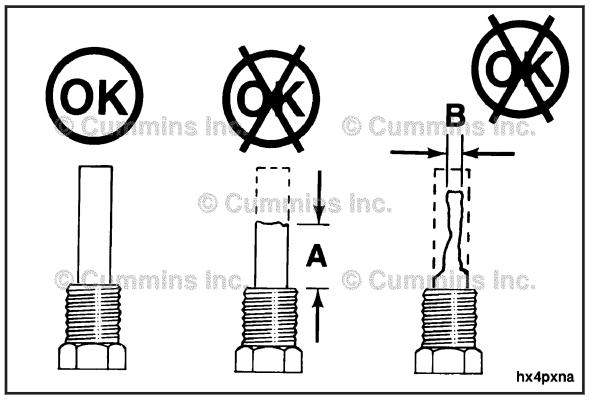
Refer to 100-002 (Engine Diagrams) in Section E.

Disconnect the sea water inlet and outlet connection from the heat exchanger.



Use clean low-pressure water to backflush the heat exchanger.

Connect the hose to the heat exchanger sea water outlet to allow the water to backflush the system. This will remove and flush away any loose debris. Make sure the end cavities are cleared of all debris.

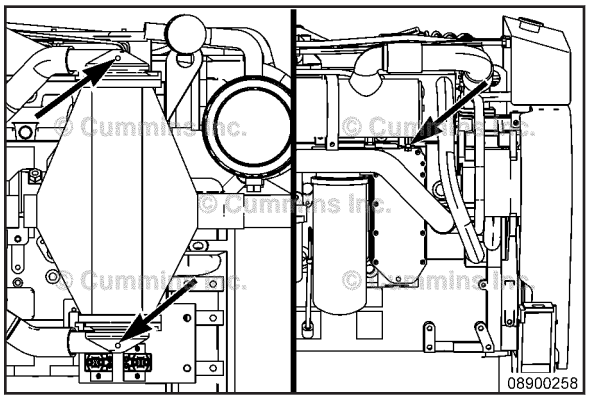


Inspect each plug. If either plug has eroded over 50 percent, it **must** be replaced.

Erosion Limits	New
A = Approximately 19 mm [0.75 in]	51 mm [2 in]
B = Approximately 6.4 mm [0.25 in]	16 mm [0.63 in]

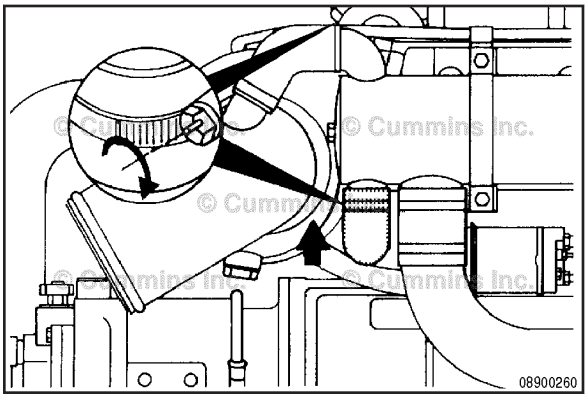
NOTE: Do **not** use thread sealant on the zinc plugs. They **must** be grounded to the component to function properly.

Install the zinc plugs in the aftercooler and heat exchanger. Refer to Procedure 008-059 (Zinc Anode).



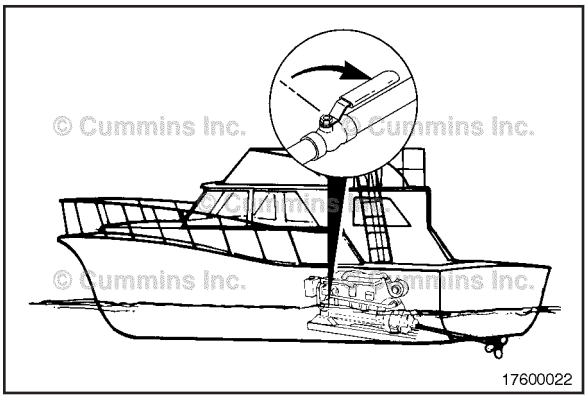
Install the sea water inlet and outlet connections.

Torque Value: 5 N•m [44 in-lb]



Open the sea water valve on the vessel hull.

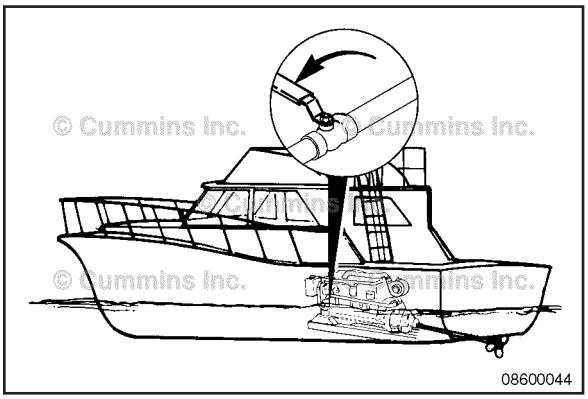
Operate the engine and check for leaks.

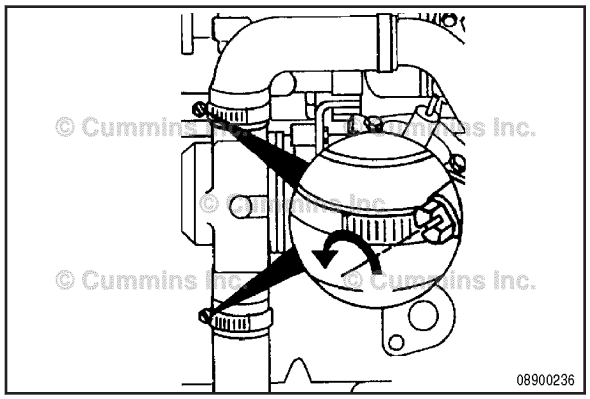


Sea Water Pump

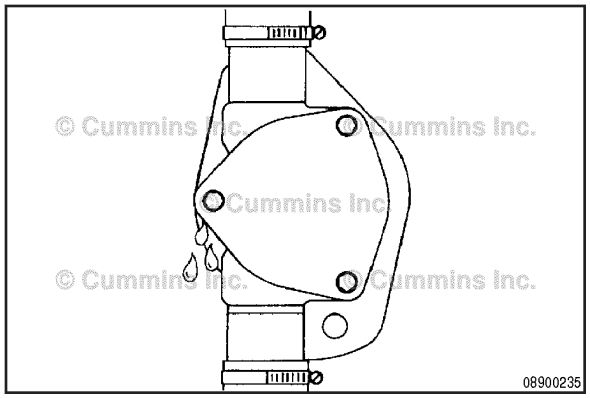
Preparatory Steps

Shut off the sea water inlet valve on the vessel hull.





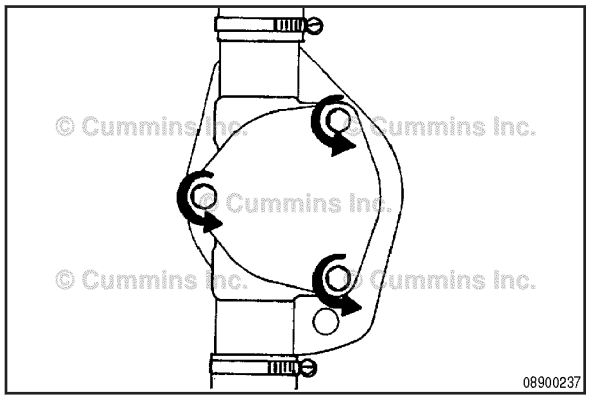
Remove the inlet and outlet hose and drain the water from the pump.



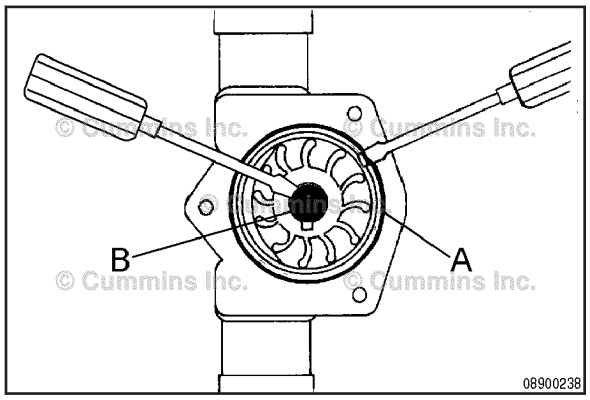
Remove

⚠CAUTION⚠
If the impeller has failed and pieces are missing, all pieces must be retrieved. The engine heat exchanger, gear oil cooler, and sea water aftercooler (if equipped) must be flushed. Refer to the procedures for flushing these components in other headings of this section. Failure to do so can result in overheating and damage to engine can occur.

Impeller debris can also drop into the inlet piping. Make sure all debris is removed before installing a new impeller; otherwise, additional impeller failures or engine overheating will occur.



Remove the capscrews. Lift off the cover.



Use a small screwdriver to remove the o-ring (A).

Use a small screwdriver to remove the inner cap (B).

Clean the o-ring groove.

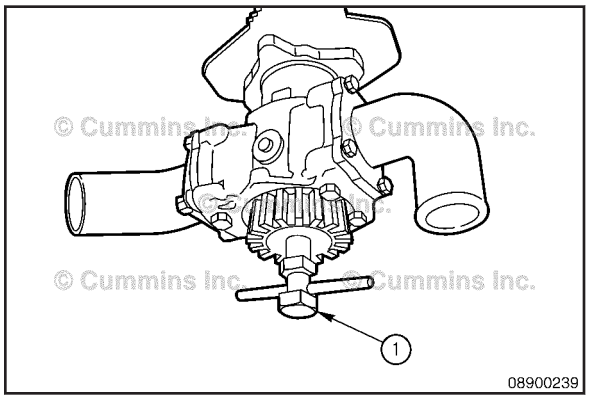
⚠CAUTION⚠

Do not pry against the pump housing to remove the impeller as this can cause damage to the liner.

Be sure to note the direction of impeller fins for proper re-installation. Mark the outer surface.

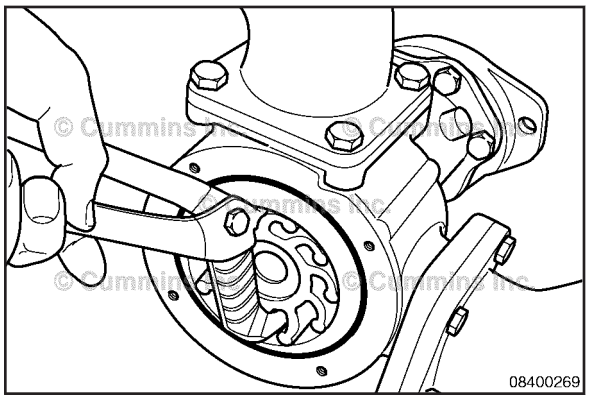
An impeller removal tool is available from Sherwood Pumps, Part Number 23631.

If the impeller is equipped with a threaded insert, use the special tool or a ¾-NFT bolt (1) to insert in the impeller to pull the impeller out.



Be sure to note the direction of impeller fins for proper re-installation. Mark the outer surface.

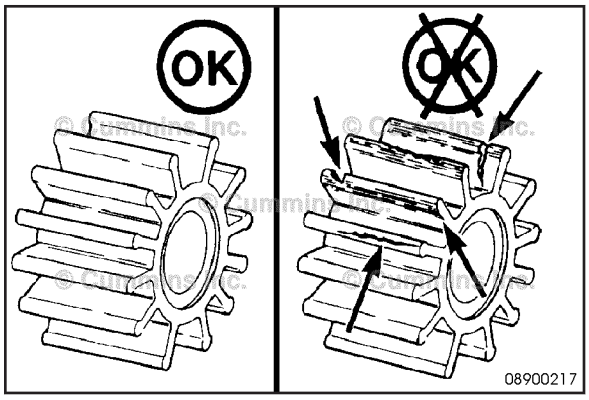
If the impeller does **not** have a threaded bore, grasp the hub of the impeller with pliers and remove the impeller from the impeller bore.



Clean and Inspect for Reuse

Inspect for damage such as rips, tears, chunks of material missing, or wear on the edges of the blades.

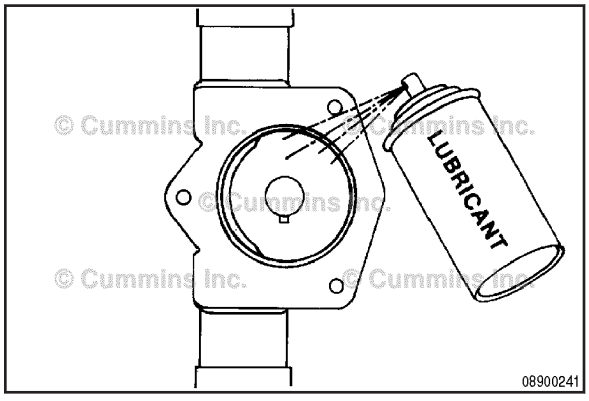
Replace as necessary.

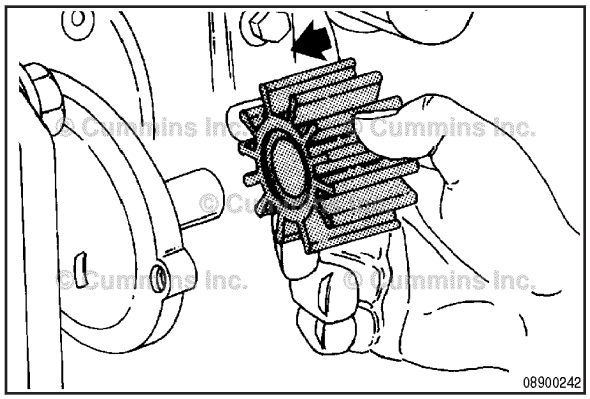


Clean the internal pump surfaces.

Lubricate the housing with silicone or glycerine non-petroleum-based lubricant. Petroleum-based lubricant will damage the rubber impeller.

If non-petroleum-based lubricant is **not** readily available, use soapy water to ease installation.

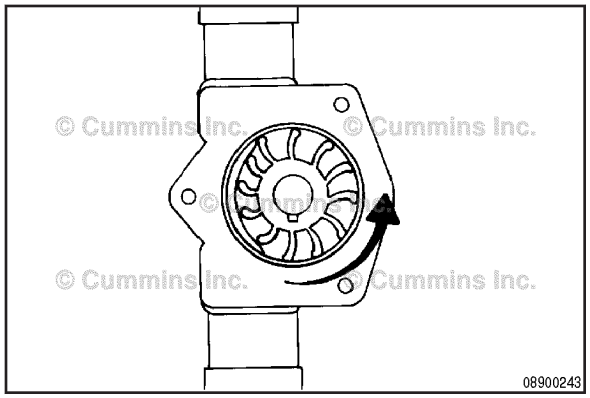




Install

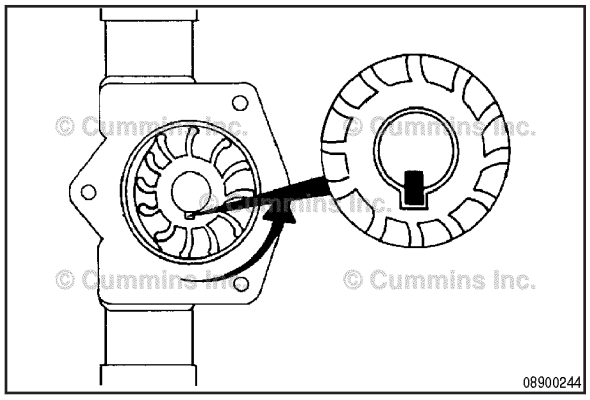
If the impeller is in good shape and will be reused, install it in the same direction from which it was removed. Refer to the mark you made during removal.

If the impeller was **not** marked and the original rotation or direction can **not** be determined, replace the impeller with a new one.

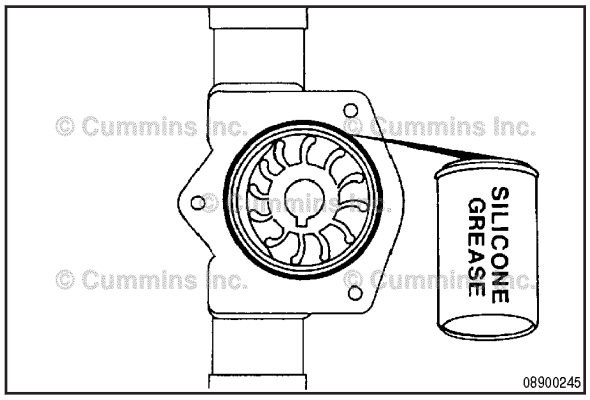


An oil filter strap wrench or even plastic wire straps can be used as an installation aid to hold the vanes.

Guide the impeller into the housing, twisting it **counterclockwise** as it is advanced so that the vanes will be deflected in the proper direction.

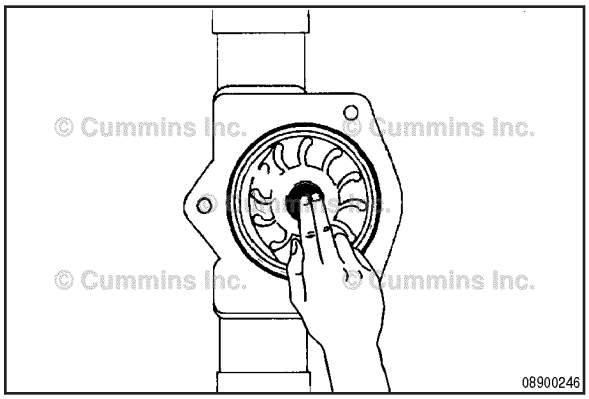


Continue to turn the impeller while pushing it into the housing. It will slide all the way in when the keyway lines up with the key.



Insert the new o-ring into the impeller housing. Use a little silicone grease to hold it in place.

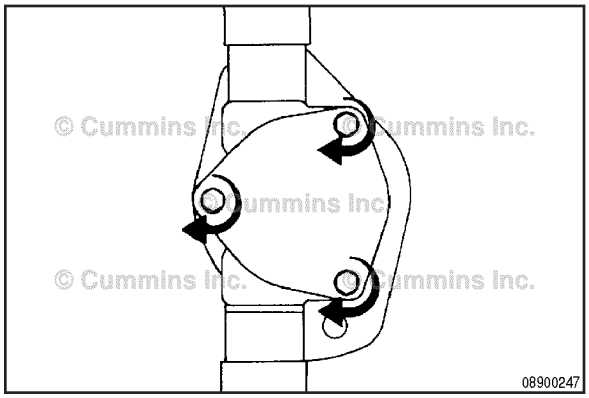
Install the rubber impeller cap into the center hub of the impeller.



Install a new gasket, cover plate, and capscrews.

Tighten the capscrews.

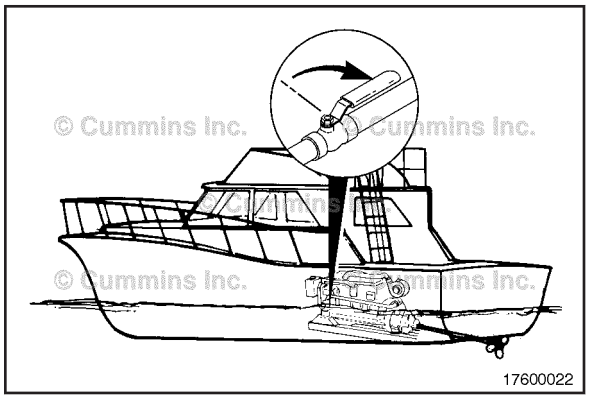
Torque Value: 24 N•m [212 in-lb]



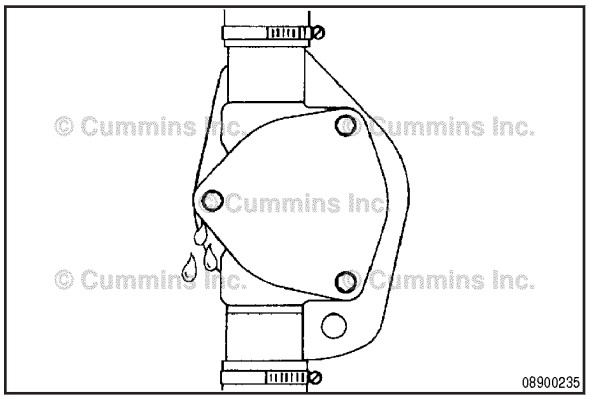
Finishing Steps

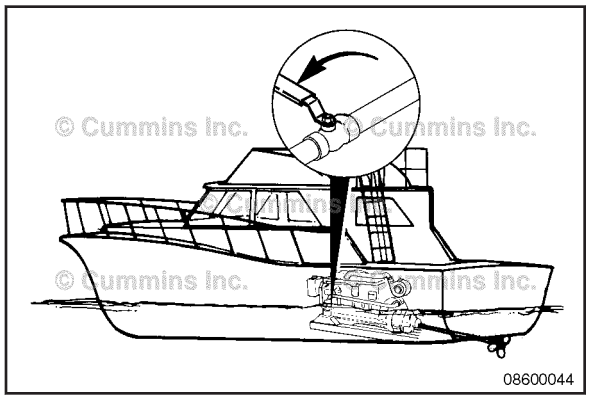
Install the inlet and outlet hose to the pump.

Open the sea water inlet valve and check for leaks.



If you have a wet exhaust system, start the engine and check for water flow from the exhaust. Also, check the sea water pump and plumbing for leaks.





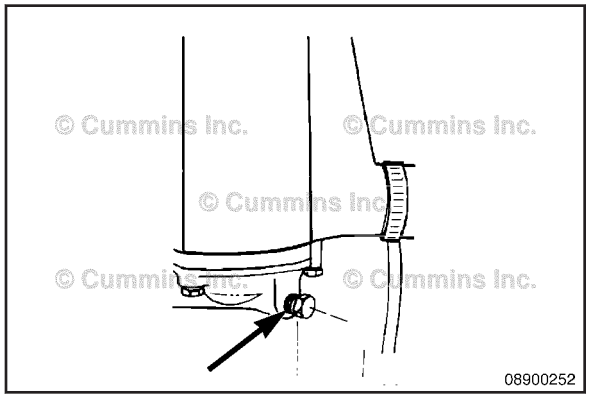
Aftercooler Assembly (Sea Water)

Flush

⚠CAUTION⚠
In any flushing operation, it is critical that the air filter element or turbocharger inlet not be exposed to moisture. Equipment damage can result.

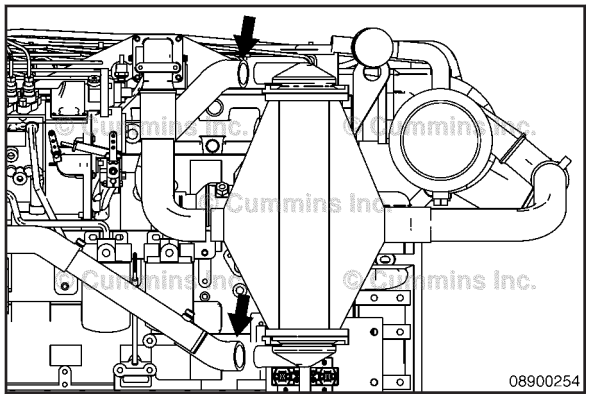
The sea water aftercooler is used to cool the intake air to the engine. Because sea water runs through the core tubes, it **must** be flushed with fresh water at least once each year.

Shut off the sea water supply valve on the vessel hull.

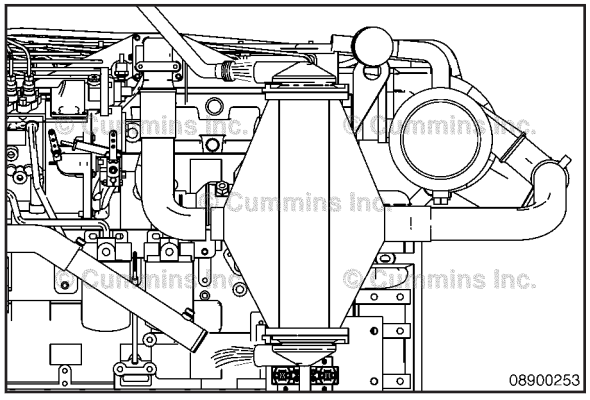


Remove both zinc plugs from the aftercooler to drain the aftercooler. If the zinc plug should break off in the aftercooler during removal, all pieces **must** be removed.

To make certain all pieces are removed, it will possibly be necessary to disassemble some components.



Remove the sea water inlet and outlet hose from the aftercooler.

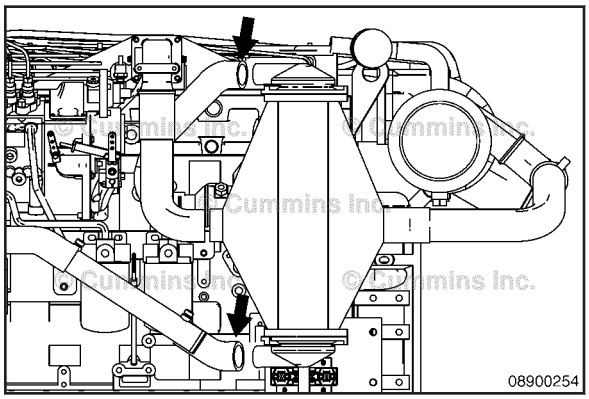


Use clean low-pressure water such as a garden hose connected to city water.

Connect the hose to the sea water outlet to allow the water to backflush the system. This will remove and flush away any loose debris.

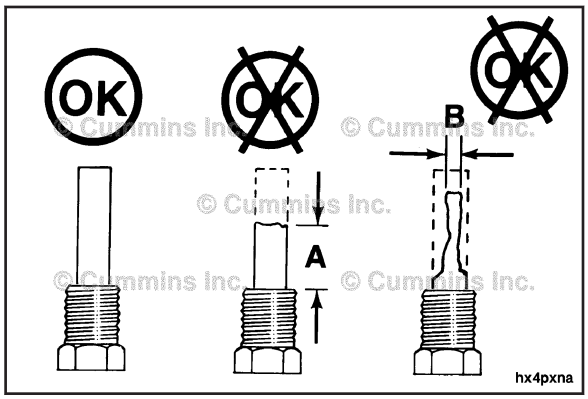
Install the sea water inlet and outlet hoses on the aftercooler.

Torque Value:
Constant Torque5 N•m [44 in-lb]
Type of Clamps



Inspect the zinc plug. If it has eroded over 50 percent, replace it.

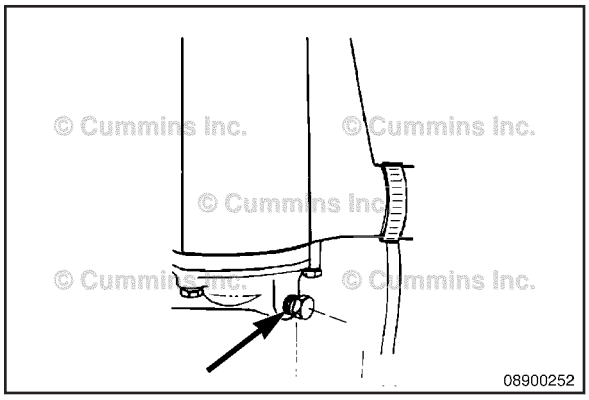
Erosion Limits	New
A = Approximately 19 mm [0.75 in]	51 mm [2 in]
B = Approximately 6.4 mm [0.25 in]	16 mm [0.63 in]



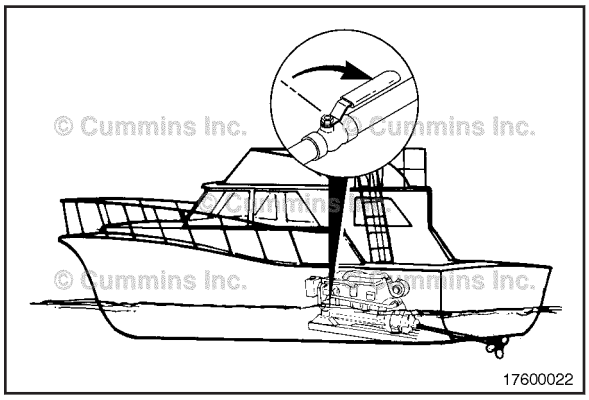
NOTE: Do **not** use thread sealant in the plugs. They **must** be grounded to component to function properly.

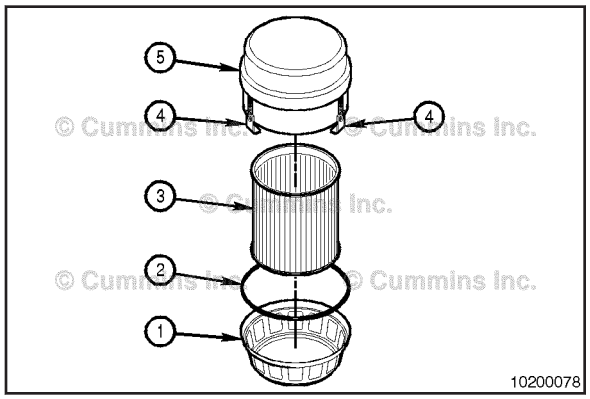
Install zinc plugs in aftercooler.

Torque Value: 22 N•m [196 in-lb]



Open the sea water inlet valve.



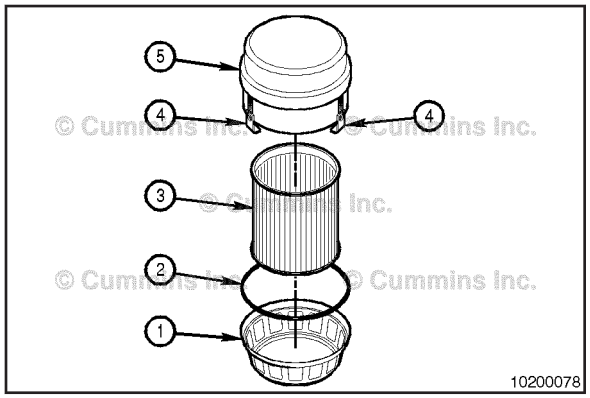


Air Cleaner Assembly (Engine-Mounted)

Maintenance Check

⚠CAUTION⚠
Holes, loose-end seals, dented sealing surfaces, and other forms of damage render the air cleaner inoperative and require immediate replacement.

Elements that have been cleaned several times will finally clog and airflow to the engine will be restricted. After cleaning the element, check the intake air restriction as previously described. Replace the element, if necessary.



⚠CAUTION⚠
To avoid damage to the element, pull the cover and the element straight out when removing them from the air cleaner housing.

Unsnap the latches (4) that secure the cover (1) to the air cleaner housing (5). Remove the cover (1).

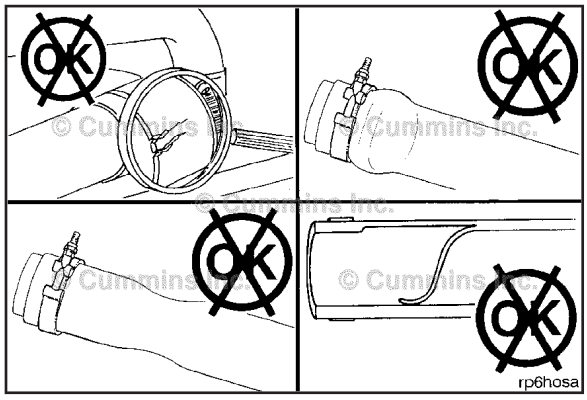
Pull the element (3) out of the housing.

Remove the o-ring (2) from the cover (1) and inspect. If the o-ring (2) is damaged, it **must** be replaced.

Install the air cleaner element (3) into the housing.

Make sure that the o-ring (2) is seated properly on the cover (1). Install the cover (1).

Snap the latches (4) to secure the cover (1).



Air Intake Piping

Maintenance Check

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

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

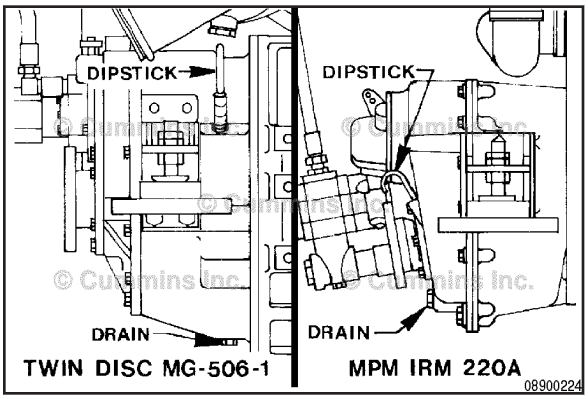
Torque Value: 8 N•m [71 in-lb]

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.

Marine Gear Oil

Maintenance Check

Consult the marine gear manufacturer's operator manual for oil specifications, quantities, and all necessary maintenance required.

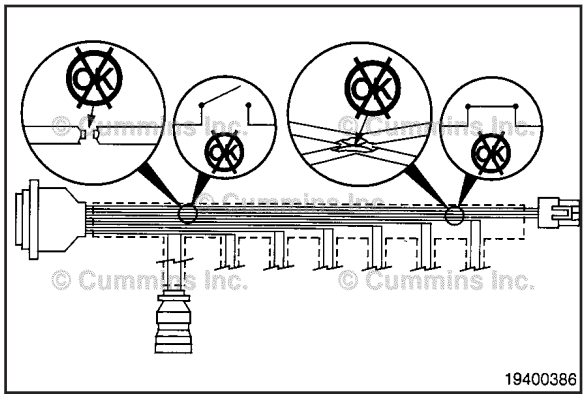


Engine Wiring Harness

Maintenance Check

⚠WARNING⚠
To reduce the possibility of personal injury, never touch the wiring connections when the start, stop, run switch or keyswitch is turned on or in the run position. Electrical shock can result.

Inspect all wiring connections and wiring harnesses for damage. Faulty wiring can cause improper engine operation and poor performance.



Notes

Section 7 - Maintenance Procedures at 500 Hours or 6 Months

Section Contents

This Page Left Intentionally Blank

Maintenance Procedures - Overview

General Information

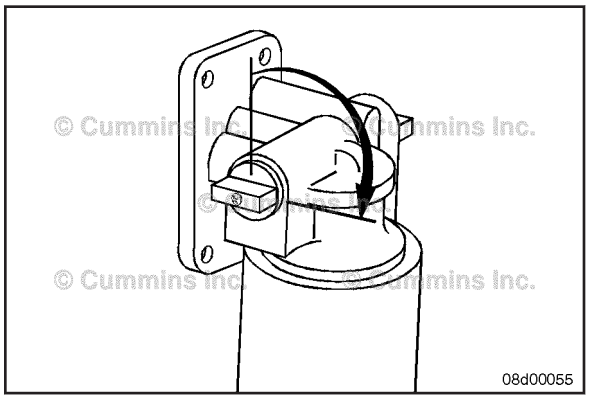
All maintenance checks and inspections listed in previous maintenance intervals **must** also be performed at this time, in addition to those listed under this maintenance interval.

Coolant Filter

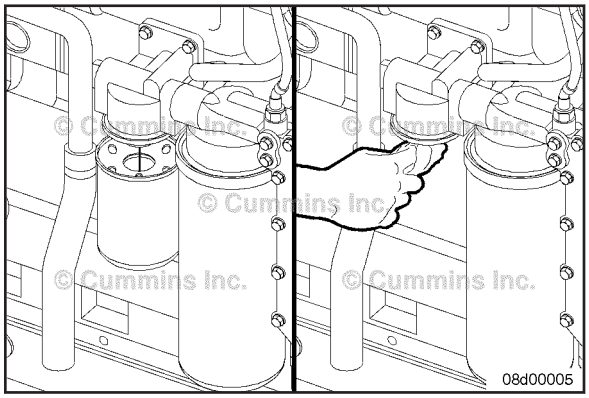
Remove

⚠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

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

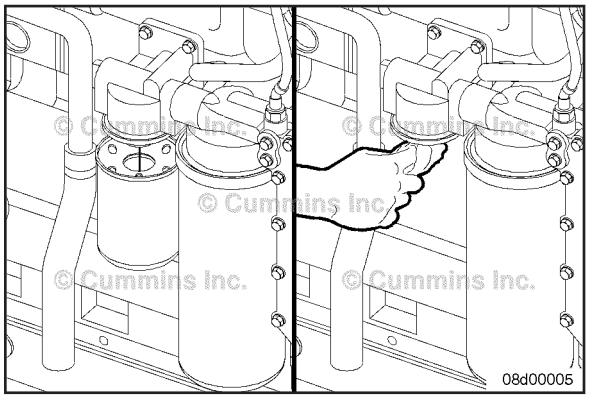


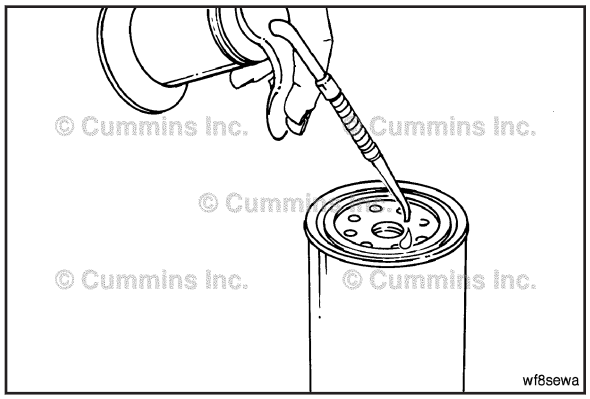
Remove and discard the coolant filter.



Clean

Clean the gasket surface.





Install

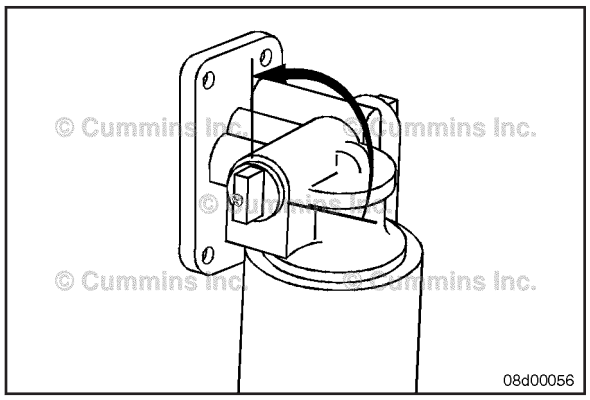
⚠CAUTION⚠
Do not allow oil to get into the filter. Oil will damage the DCA.

⚠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.

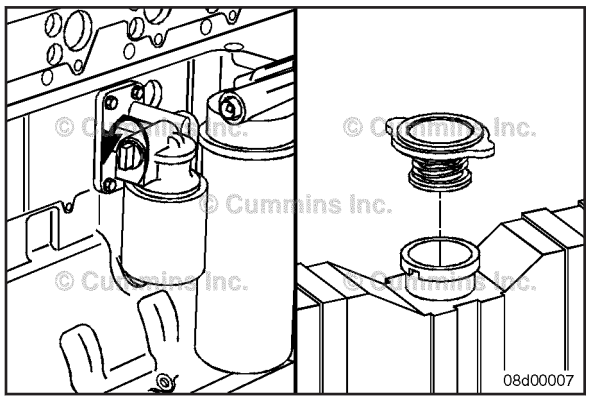
Install the coolant filter on the filter head. Tighten the filter until the gasket contacts the filter head surface.

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

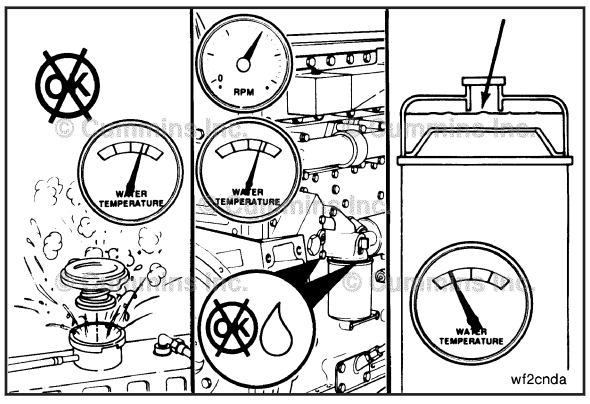


⚠CAUTION⚠
The valve must be in the ON position to prevent engine damage.

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.



Operate the engine and check for coolant leaks.

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

Supplemental Coolant Additive (SCA) and Antifreeze Concentration

Maintenance Check

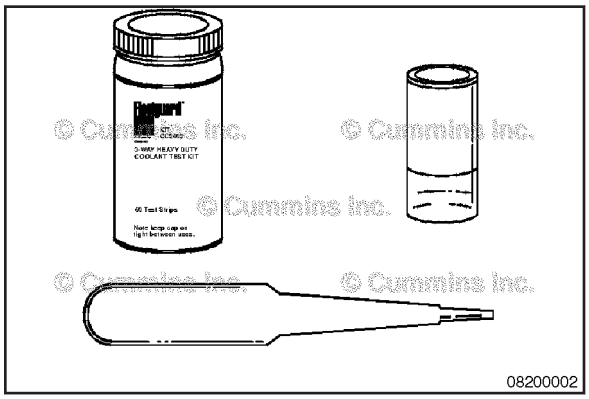
Supplemental Coolant Additive (SCA)

⚠CAUTION⚠
Failing to maintain the required SCA concentration level can cause engine damage.

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. Use the Coolant Recommendations and Specifications in Maintenance Specifications (Section V) for the correct SCA and antifreeze level.



Antifreeze

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

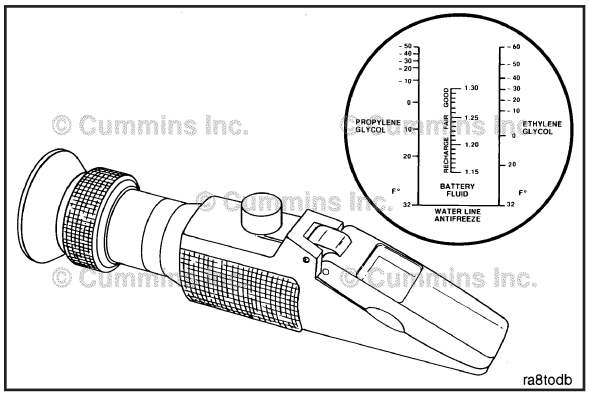
Check the antifreeze concentration. Use a mixture of 50-percent water and 50-percent ethylene glycol or propylene glycol-based antifreeze to protect the engine to -32°C [-26°F] year-around.

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

Antifreeze is essential in every climate.

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

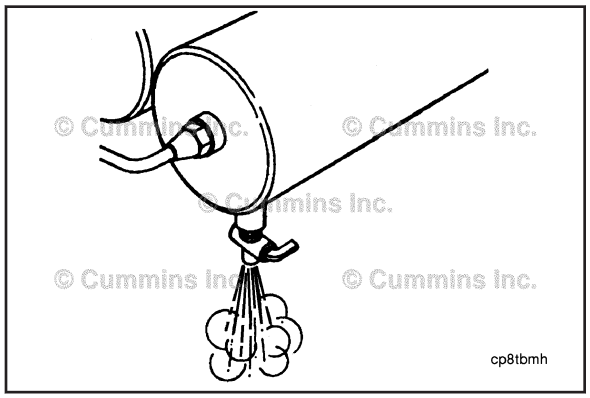
The corrosion inhibitors also protect the cooling system components from corrosion and prolong component life.



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.

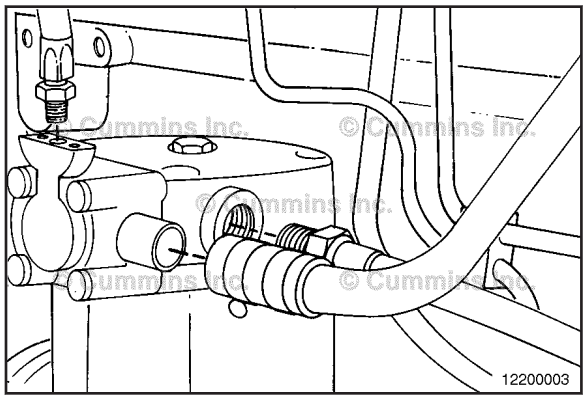


Maintenance Check

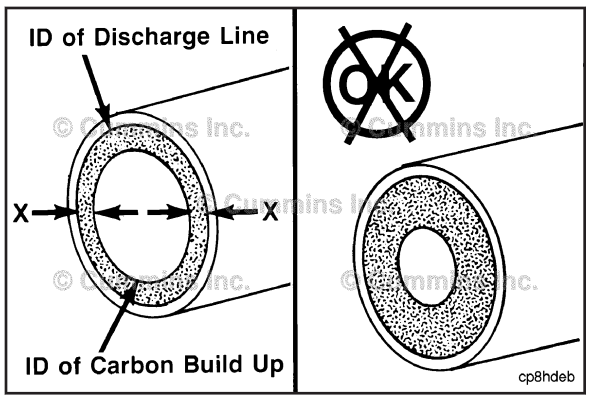
⚠WARNING⚠
Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

Shut off the engine.

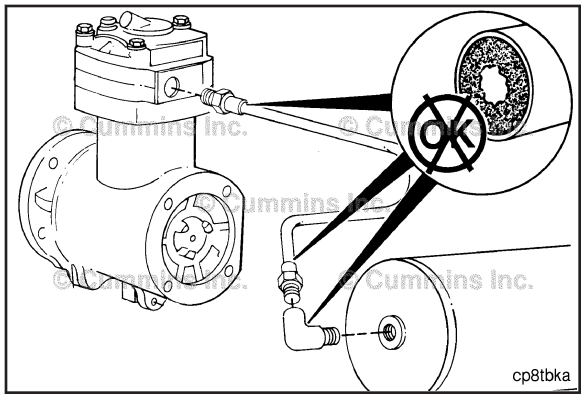
Open the drain valve on the wet tank to release the system air pressure.



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).

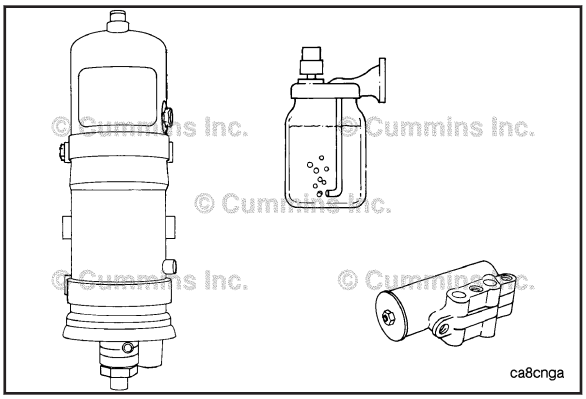


Measure the total carbon deposit thickness inside the air discharge line as shown. If the total carbon deposit (X + X) exceeds 2 mm [1/16 in], clean and inspect the cylinder head, the valve assembly, and the discharge line. Replace if necessary. Contact the Cummins Authorized Repair Location for procedures.



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.



Notes

Section 8 - Maintenance Procedures at 600 Hours or 2 Years

Section Contents

This Page Left Intentionally Blank

Maintenance Procedures - Overview

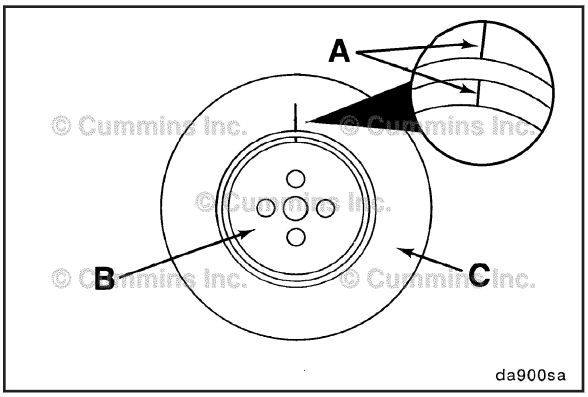
General Information

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.

Vibration Damper, Rubber

Inspect

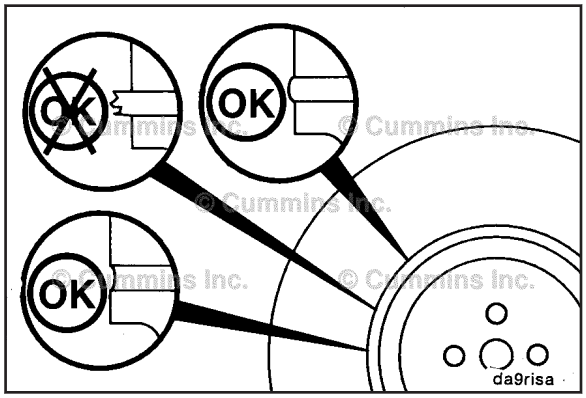
Check the index lines (A) in the vibration damper hub (B) and the inertia member (C). If the lines are more than 1.59 mm [1/16 in] out of alignment, replace the vibration damper.

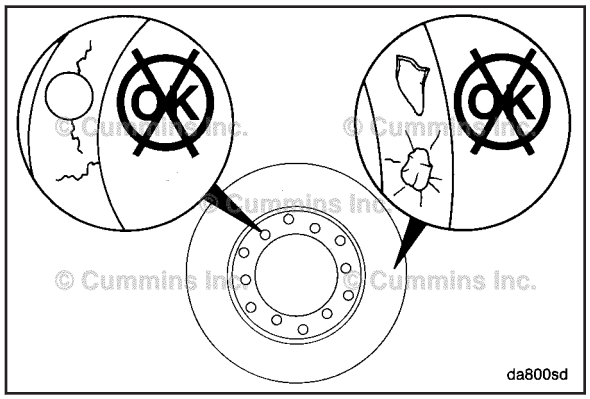


Inspect the rubber member for deterioration. If pieces of rubber are missing or if the elastic member is more than 3.18 mm [1/8 in] below the metal surface, replace the damper.

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

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





Vibration Damper, Viscous

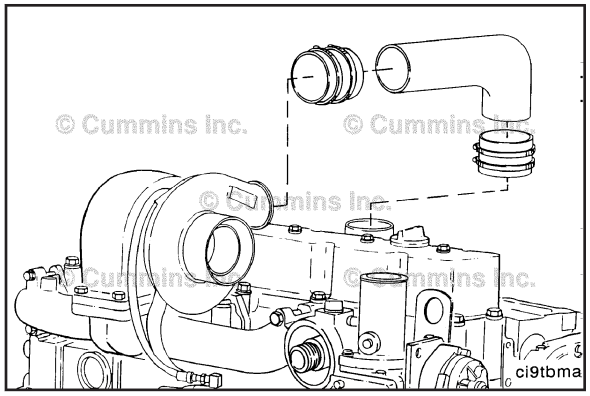
Inspect

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

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

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

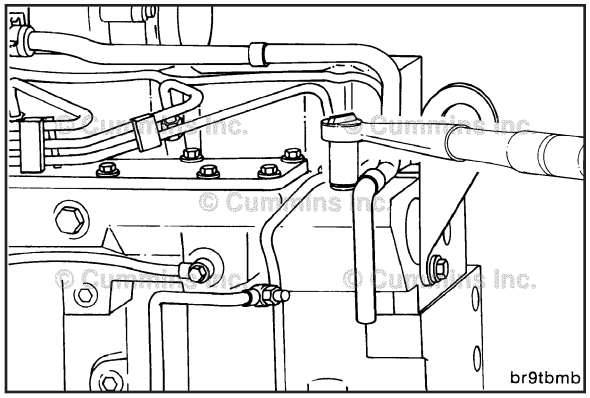
For vibration damper location, refer to Engine Diagrams in Engine Identification (Section E).



Overhead Set

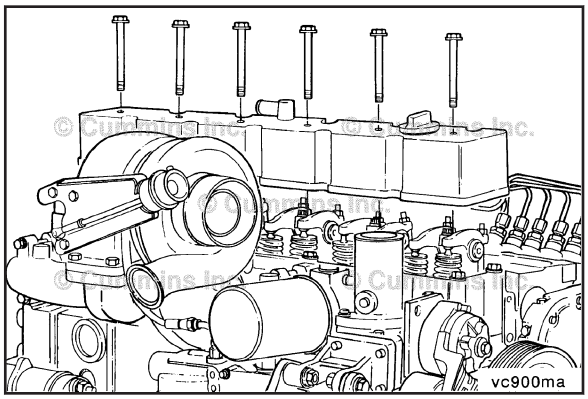
Adjust

Remove the air crossover tube from the engine if equipped.



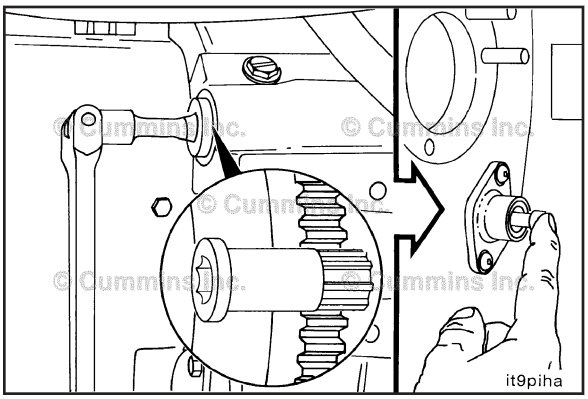
Disconnect the support clamps, hose clamp, and wastegate sensing line. Remove the crankcase vent tube and any other parts that would prevent removal of the valve cover.

Remove valve cover.

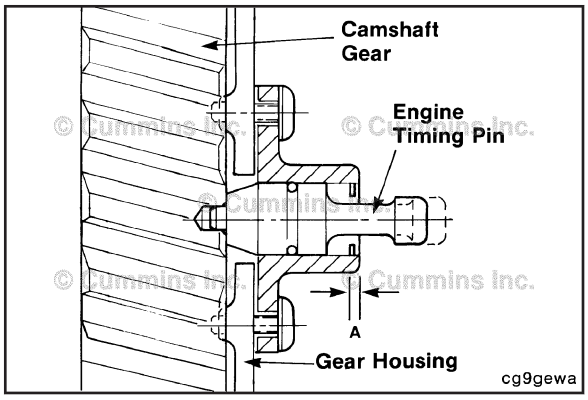


Locate top dead center for cylinder Number 1 by rotating the crankshaft slowly while pressing on the engine timing pin.

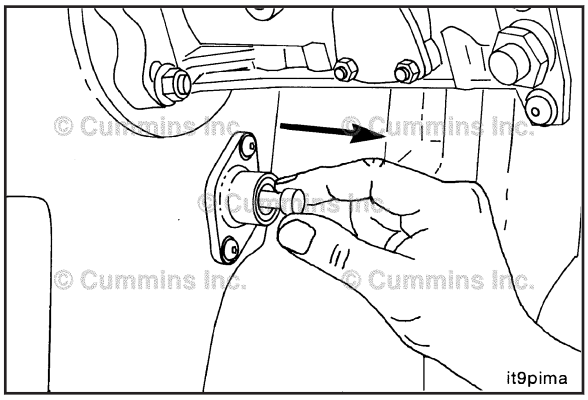
The barring gear inserts into the flywheel housing and engages the flywheel ring gear. The engine can then be rotated by hand using a 127-cm [1/2-in] ratchet or breaker bar.

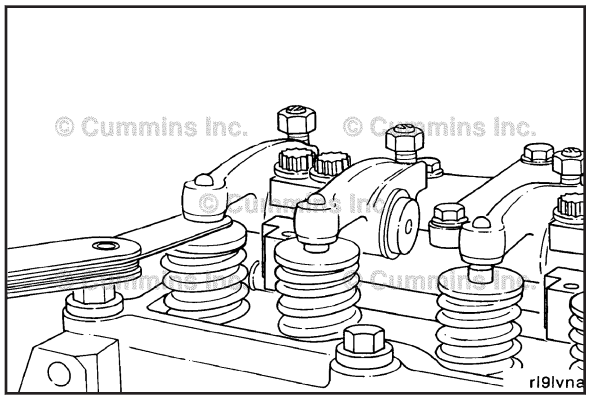


When the engine timing pin engages the hole in the camshaft gear, cylinder Number 1 is at top dead center on the compression stroke.



⚠CAUTION⚠
Be sure to disengage the engine timing pin after locating top dead center to prevent damage to the engine timing pin.



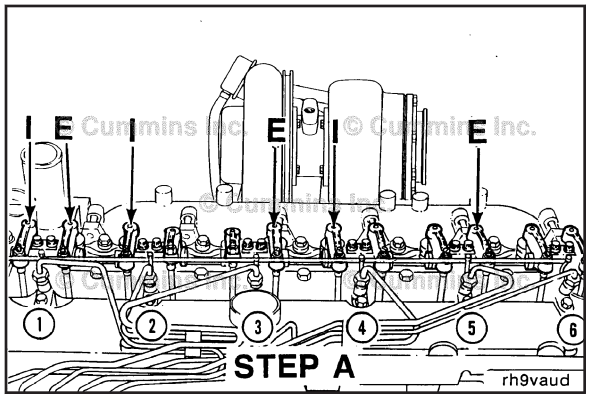


Intake clearance: 0.30 mm [0.012 in].

Exhaust clearance: 0.61 mm [0.024 in].

Check/set valves with engine cold - below 60°C [140°F].

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

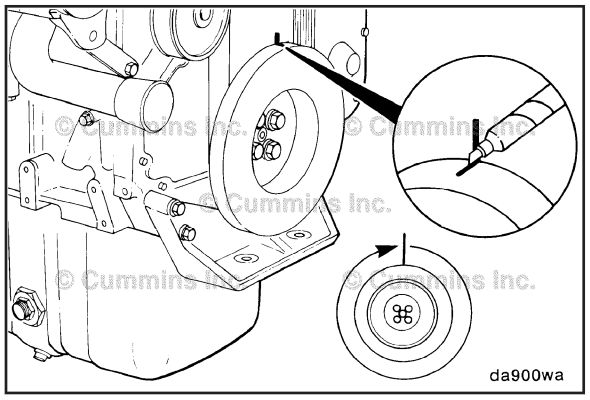


Locate top dead center for cylinder Number 1.

Check/adjust the valves indicated for STEP A (I = intake; E = exhaust).

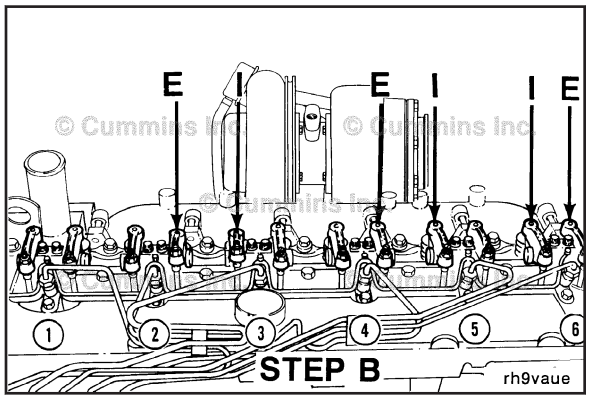
After tightening the rocker lever locknut, check the valve clearance to make sure the valve clearance has **not** changed.

Torque Value: 24 N•m [212 in-lb]



⚠CAUTION⚠
Be sure the engine timing pin is disengaged to prevent damage to the engine timing pin.

Mark vibration damper and rotate the crankshaft 360 degrees.



Set the valves indicated for STEP B.

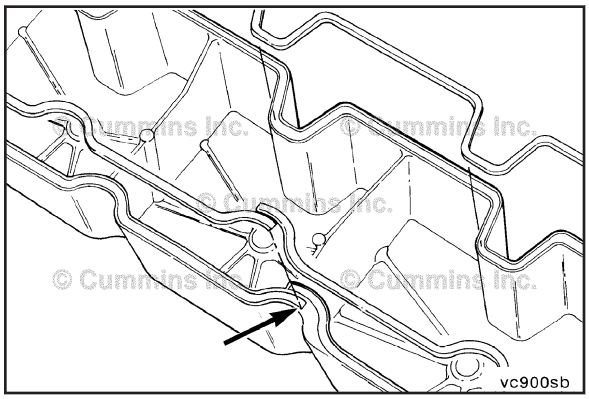
After tightening the rocker lever locknut, check the valve clearance to make sure the valve clearance has **not** changed.

Torque Value: 24 N•m [212 in-lb]

NOTE: If the seal is **not** damaged, it can be used again. If the seal is damaged, install a new seal.

Install the rubber seal into the groove in the valve cover. Start the installation at the overlap area shown in the illustration. Do **not** stretch the rubber seal.

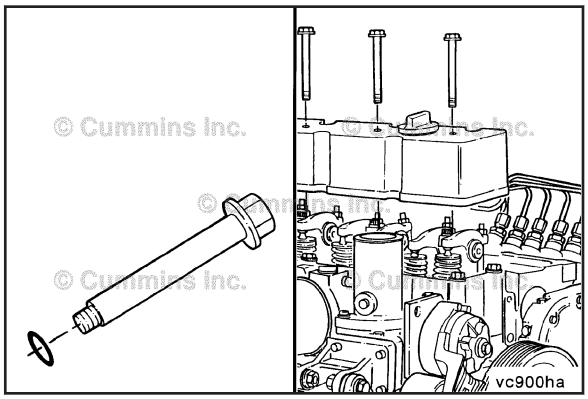
If the seal has more overlap than shown in the illustration, trim the length to provide the correct overlap.



Install new sealing o-rings on the capscrews.

Install the valve cover and wastegate sensing tube.

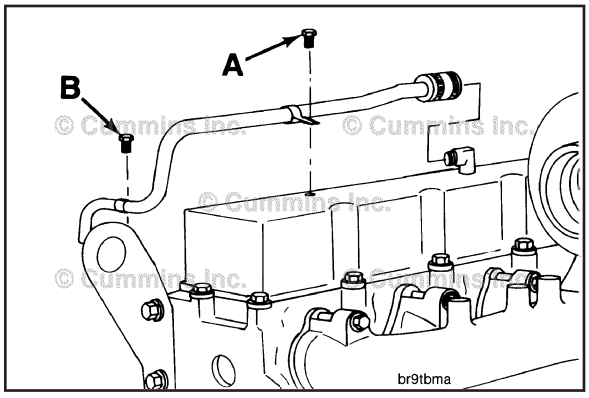
Torque Value: 24 N•m [212 in-lb]



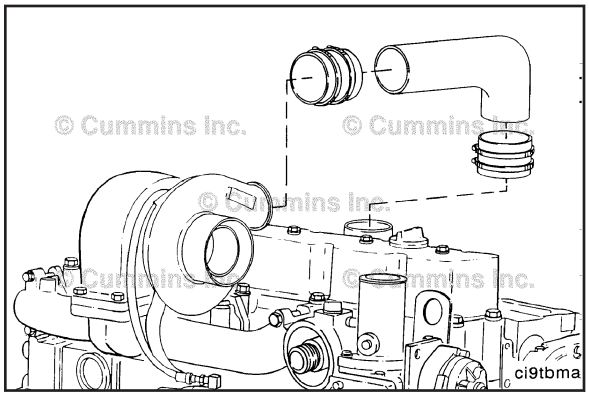
Install the crankcase vent tube, and secure with the support clamps and hose clamp.

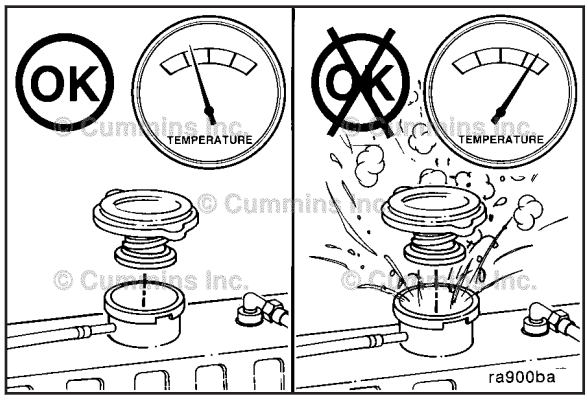
Torque Value:

A =	24 N•m [212 in-lb].
B =	43 N•m [32 in-lb].



Install the air crossover tube and any other parts previously removed to gain access to the valve cover.

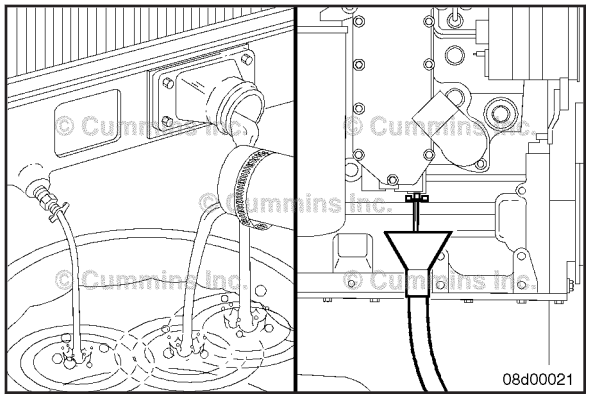




Cooling System

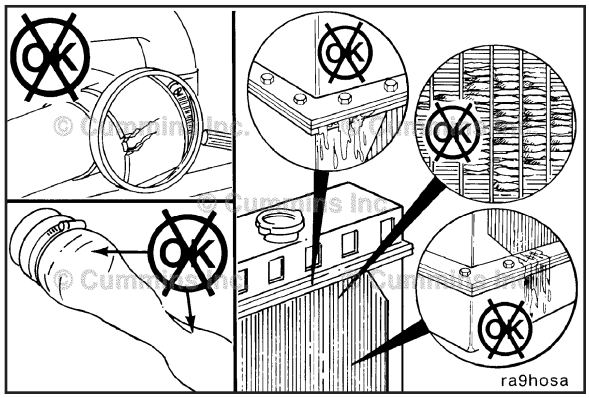
Drain

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



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

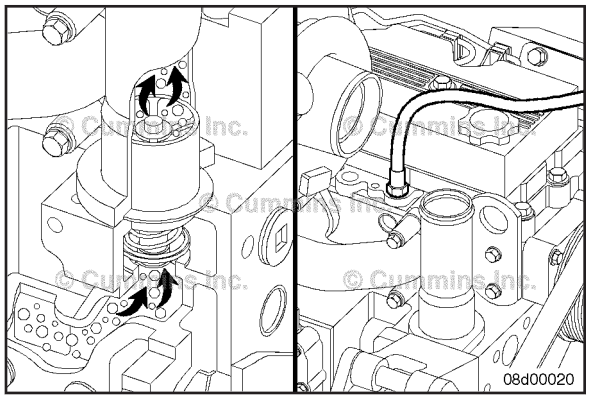
Drain the cooling system by opening the drain valve on the radiator and removing the plug in the bottom of the water inlet hose. A drain pan with a capacity of 19 liters [5 gal] will be adequate for most applications.



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

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

Clean and replace as required.



Flush

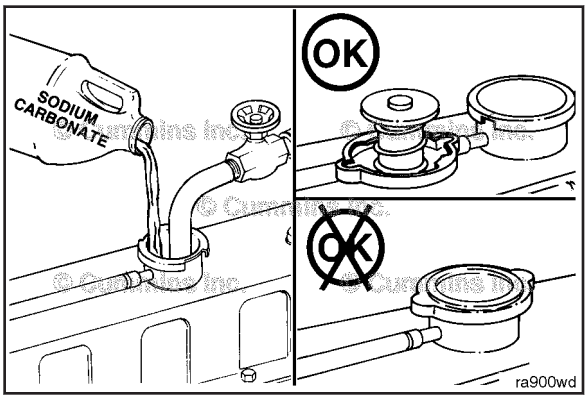
△CAUTION△
The system must be filled properly to prevent air locks. During filling, air must be purged from the engine coolant passages. Be sure to open the petcock on the aftercooler for aftercooled engines. Wait 2 to 3 minutes to allow air to be vented; then add mixture to bring the level to the top.

Adequate venting is provided for a fill rate of 19 liters [5 gal] per minute.

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

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

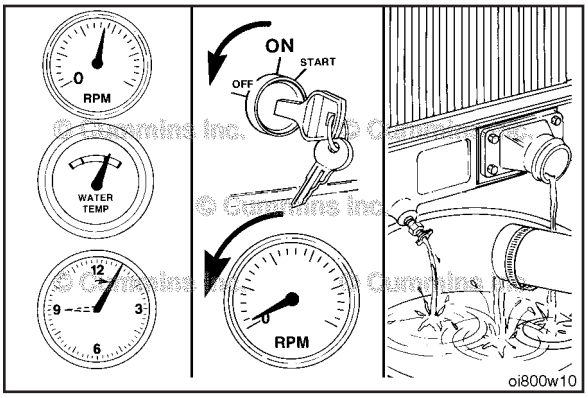
Use 0.5 kg [1 lb] of sodium carbonate for every 23 liters [6 gal] of water.



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

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

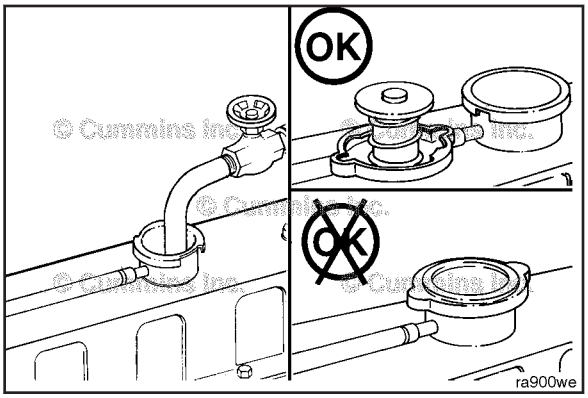
Shut the engine off, and drain the cooling system.



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

Fill the cooling system with high-quality water.

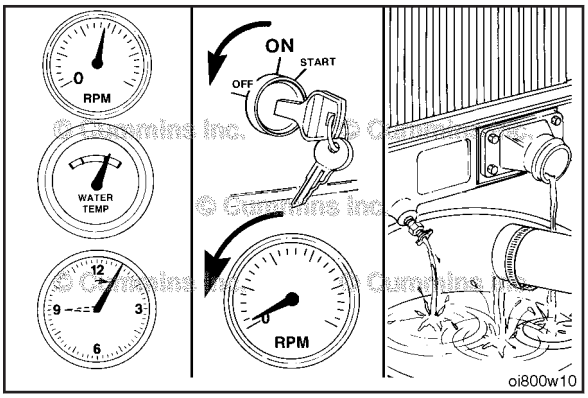
Do **not** install the radiator cap or the new coolant filter.



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

Shut the engine off, and drain the cooling system.

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



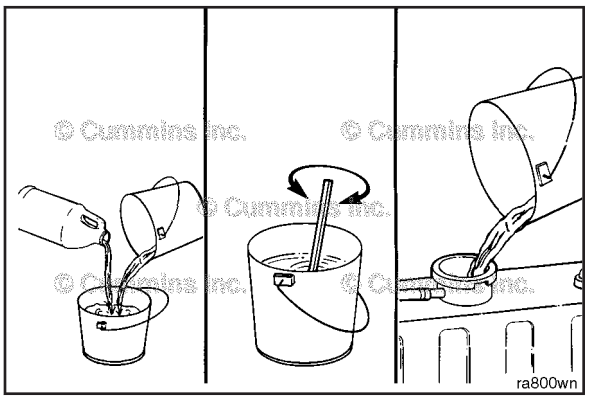
Fill

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

The system is designed to use a specific quantity of coolant. If the coolant level is low, the engine will run hot.

If frequent addition of coolant is necessary, the engine or system has a leak. Find and repair the leak.

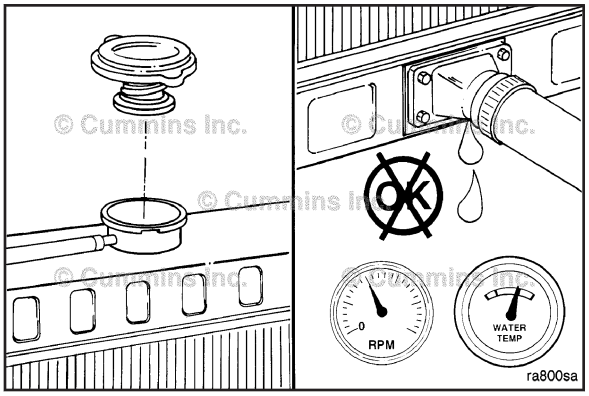
The system has a designed fill rate of 19 liters [5 gal] per minute.



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

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

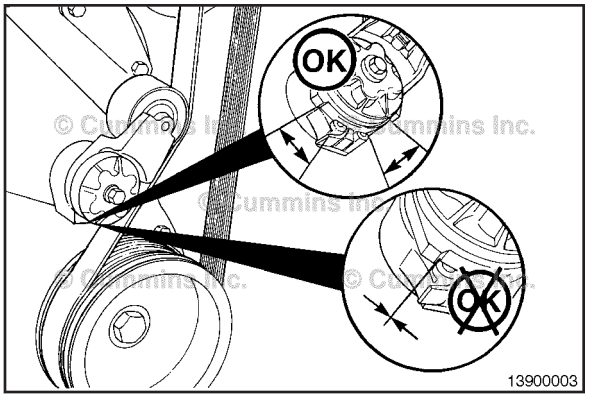
Coolant Capacity (Engine Only)	liters		U.S.gal
6C 8.3 Engine	10.9	MAX	11.5



⚠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 of steam can cause personal injury.

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

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



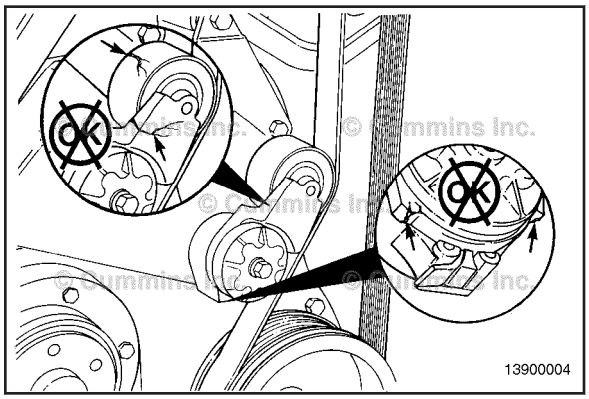
Cooling Fan Belt Tensioner

Maintenance Check

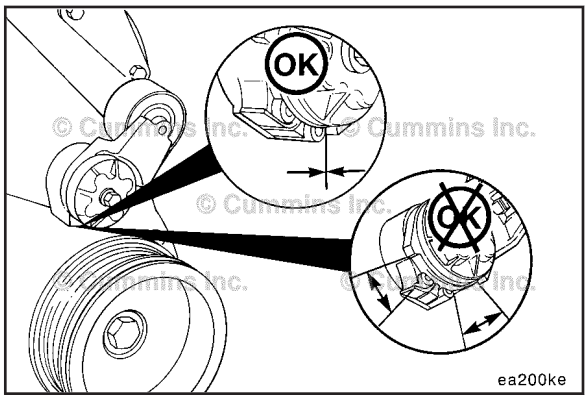
Every 48,000 km [30,000 mi], 1000 hours, or 1 year, whichever occurs first, inspect the automatic belt tensioner.

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

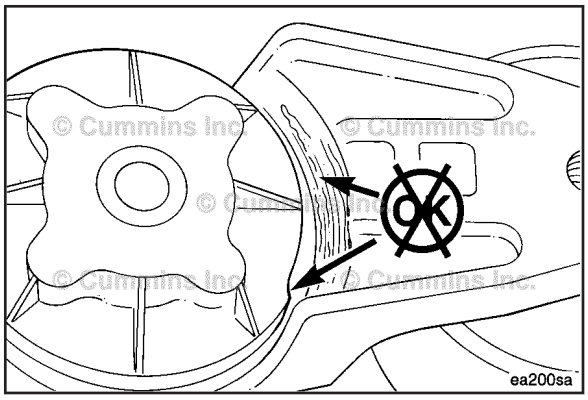
Check the tensioner pulley and body for cracks. If any cracks are noticed, the tensioner **must** be replaced. Refer to a Cummins Authorized Repair Facility. Check the tensioner for dirt buildup. If this condition exists, the tensioner **must** be removed and steam-cleaned.



Check that the bottom tensioner arm stop is in contact with the bottom tensioner arm stop boss on the tensioner body. If these two are **not** touching, the tensioner **must** be replaced.



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

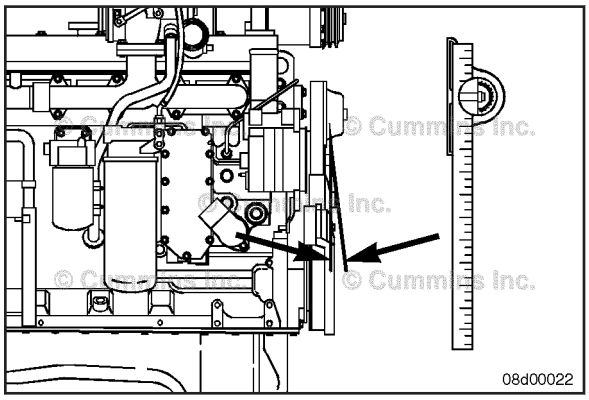


A worn tensioner that has play in it or a belt that “walks” off its pulley possibly indicates pulley misalignment.

NOTE: Maximum pulley misalignment is 3 degrees.

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

Install the belt.



Notes

Section 9 - Maintenance Procedures at 1000 Hours or 1 Year

Section Contents

This Page Left Intentionally Blank

Maintenance Procedures - Overview

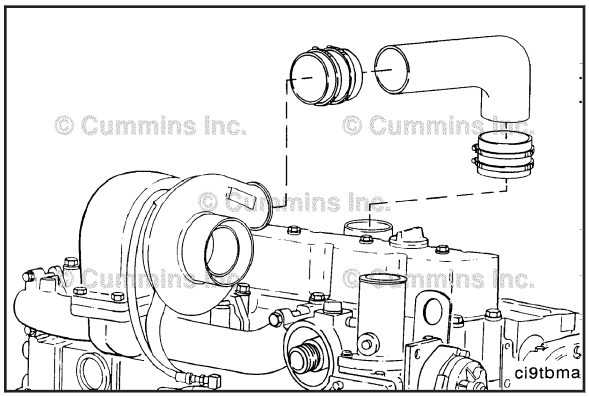
General Information

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.

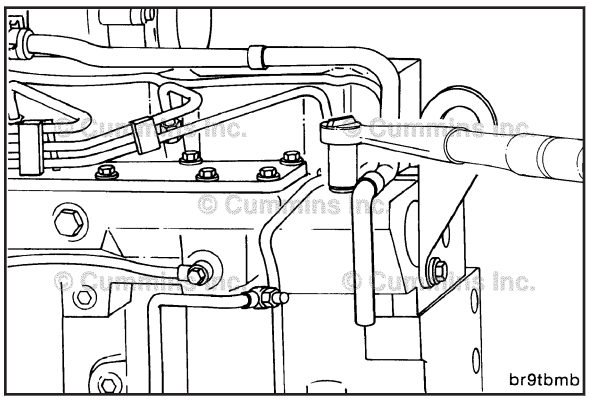
Overhead Set

Adjust

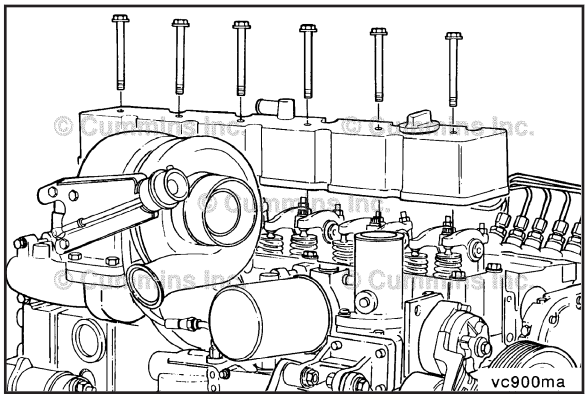
Remove the air crossover tube from the engine if equipped.

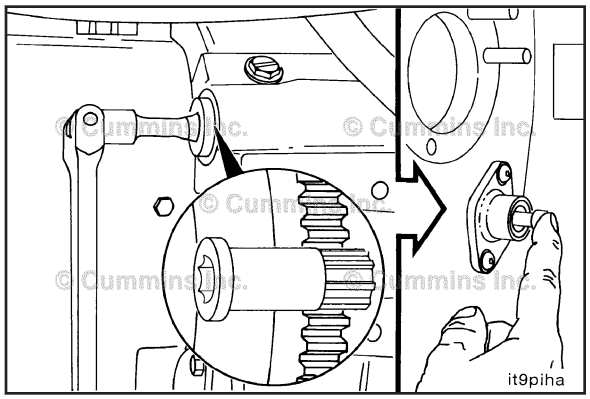


Disconnect the support clamps, hose clamp, and wastegate sensing line. Remove the crankcase vent tube and any other parts that would prevent removal of the valve cover.



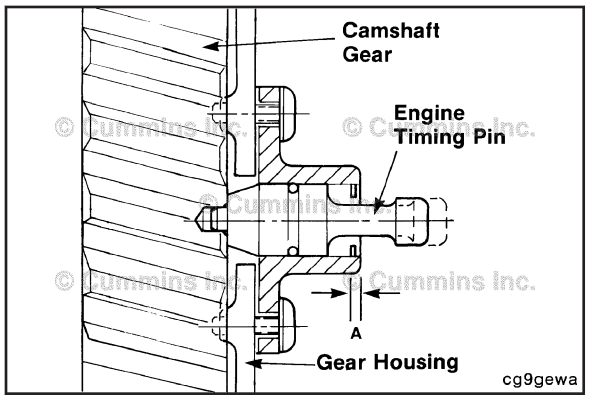
Remove valve cover.



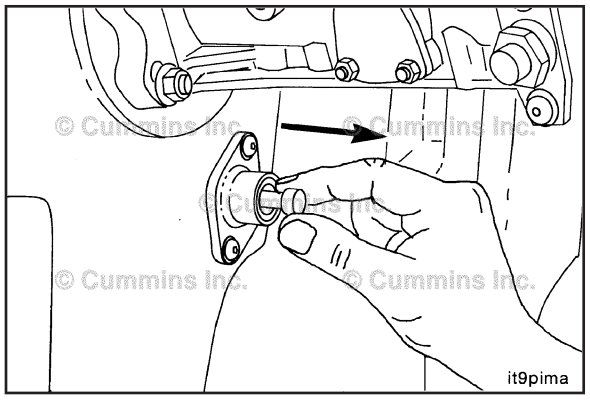


Locate top dead center for cylinder Number 1 by rotating the crankshaft slowly while pressing on the engine timing pin.

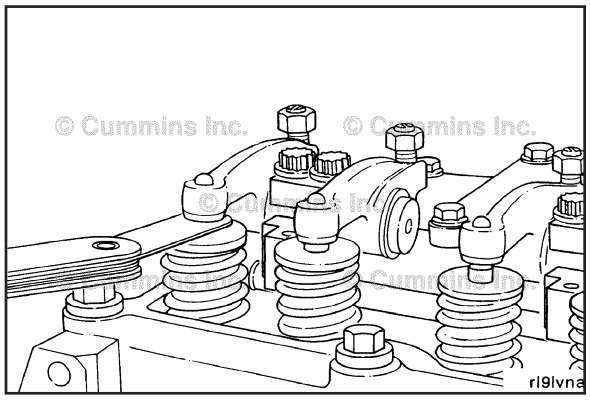
The barring gear inserts into the flywheel housing and engages the flywheel ring gear. The engine can then be rotated by hand using a 127-cm [1/2-in] ratchet or breaker bar.



When the engine timing pin engages the hole in the camshaft gear, cylinder Number 1 is at top dead center on the compression stroke.



⚠CAUTION⚠
Be sure to disengage the engine timing pin after locating top dead center to prevent damage to the engine timing pin.



Intake clearance: 0.30 mm [0.012 in].

Exhaust clearance: 0.61 mm [0.024 in].

Check/set valves with engine cold - below 60°C [140°F].

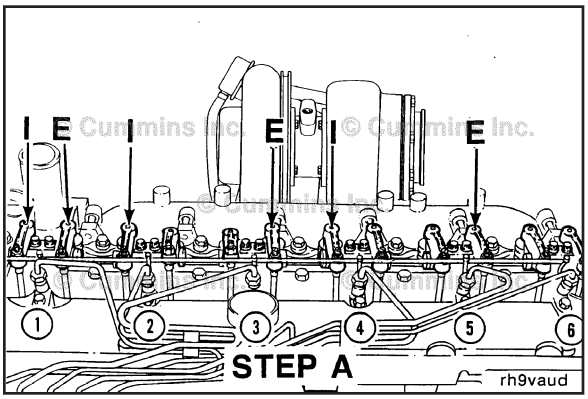
NOTE: The clearance is correct when some resistance is “felt” when the feeler gauge is slipped between the valve stem and the rocker lever.

Locate top dead center for cylinder Number 1.

Check/adjust the valves indicated for STEP A (I = intake; E = exhaust).

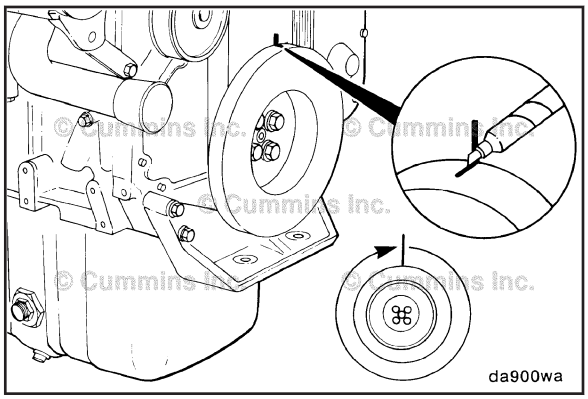
After tightening the rocker lever locknut, check the valve clearance to make sure the valve clearance has **not** changed.

Torque Value: 24 N•m [212 in-lb]



⚠CAUTION⚠
Be sure the engine timing pin is disengaged to prevent damage to the engine timing pin.

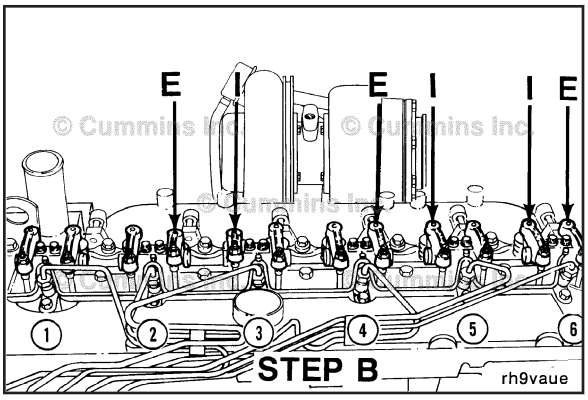
Mark vibration damper and rotate the crankshaft 360 degrees.



Set the valves indicated for STEP B.

After tightening the rocker lever locknut, check the valve clearance to make sure the valve clearance has **not** changed.

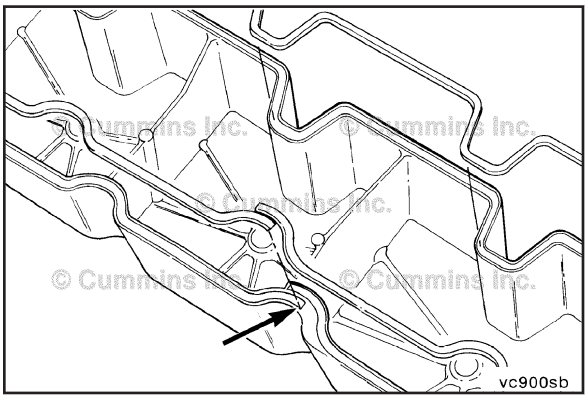
Torque Value: 24 N•m [212 in-lb]

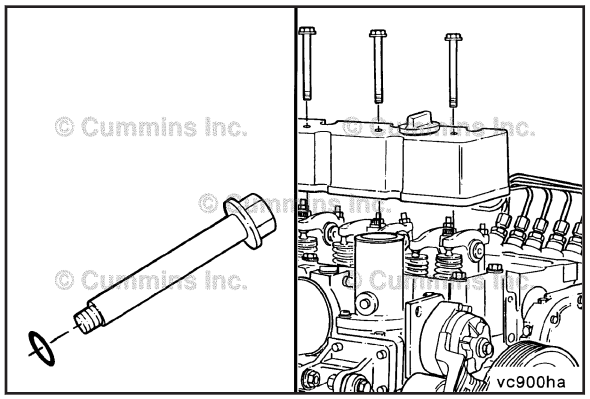


NOTE: If the seal is **not** damaged, it can be used again. If the seal is damaged, install a new seal.

Install the rubber seal into the groove in the valve cover. Start the installation at the overlap area shown in the illustration. Do **not** stretch the rubber seal.

If the seal has more overlap than shown in the illustration, trim the length to provide the correct overlap.

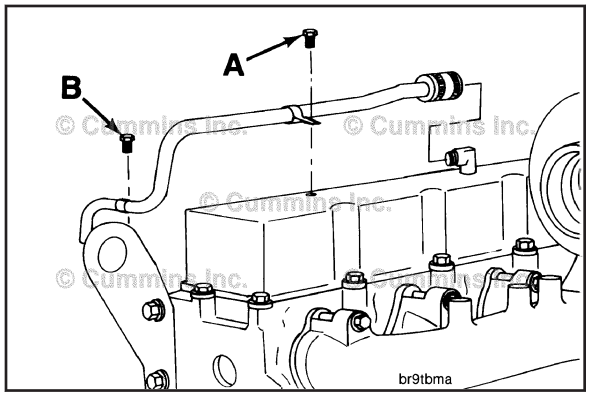




Install new sealing o-rings on the capscrews.

Install the valve cover and wastegate sensing tube.

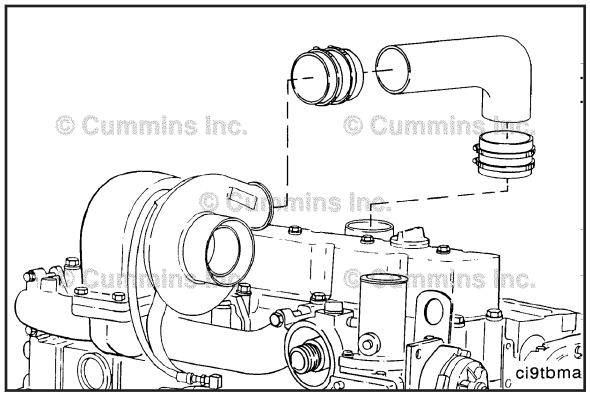
Torque Value: 24 N•m [212 in-lb]



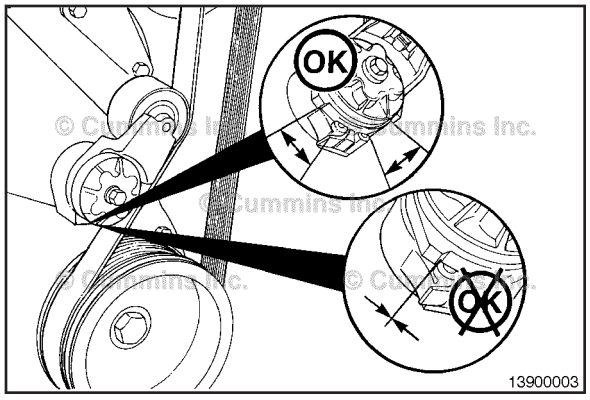
Install the crankcase vent tube, and secure with the support clamps and hose clamp.

Torque Value:

A =	24 N•m [212 in-lb].
B =	43 N•m [32 in-lb].



Install the air crossover tube and any other parts previously removed to gain access to the valve cover.



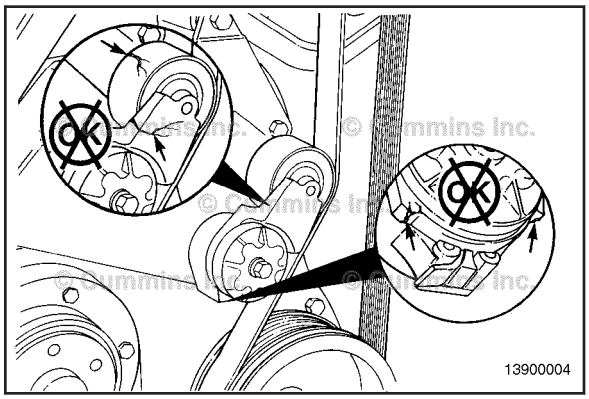
Cooling Fan Belt Tensioner

Maintenance Check

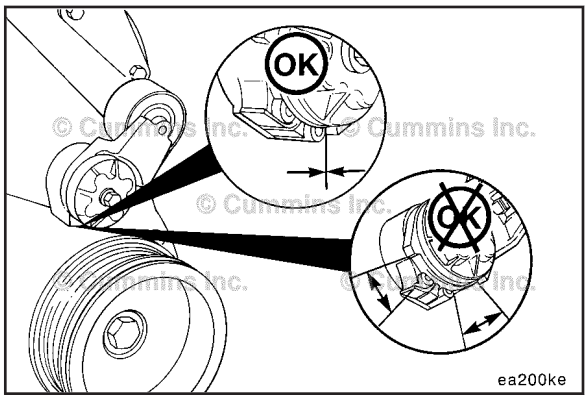
Every 48,000 km [30,000 mi], 1000 hours, or 1 year, whichever occurs first, inspect the automatic belt tensioner.

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

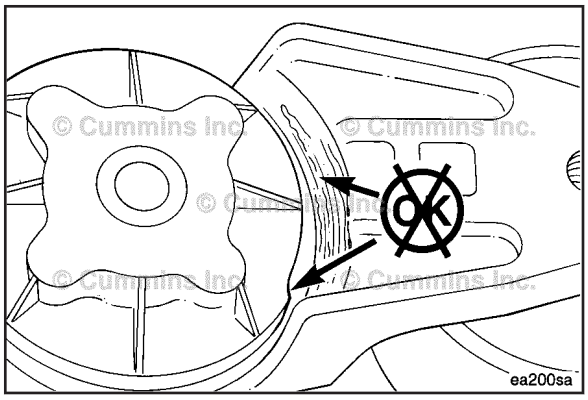
Check the tensioner pulley and body for cracks. If any cracks are noticed, the tensioner **must** be replaced. Refer to a Cummins Authorized Repair Facility. Check the tensioner for dirt buildup. If this condition exists, the tensioner **must** be removed and steam-cleaned.



Check that the bottom tensioner arm stop is in contact with the bottom tensioner arm stop boss on the tensioner body. If these two are **not** touching, the tensioner **must** be replaced.



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

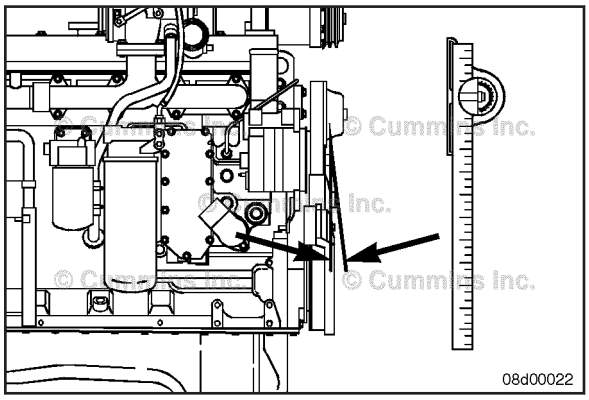


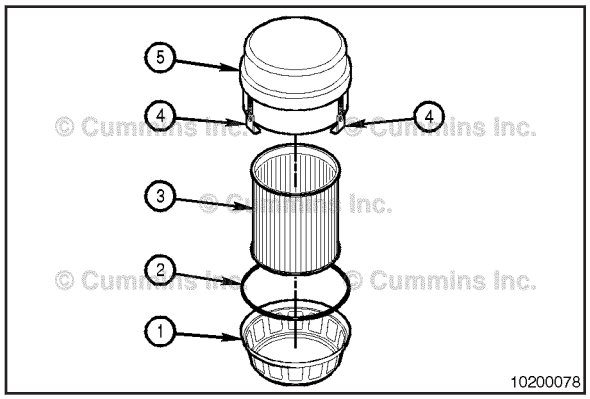
A worn tensioner that has play in it or a belt that “walks” off its pulley possibly indicates pulley misalignment.

NOTE: Maximum pulley misalignment is 3 degrees.

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

Install the belt.



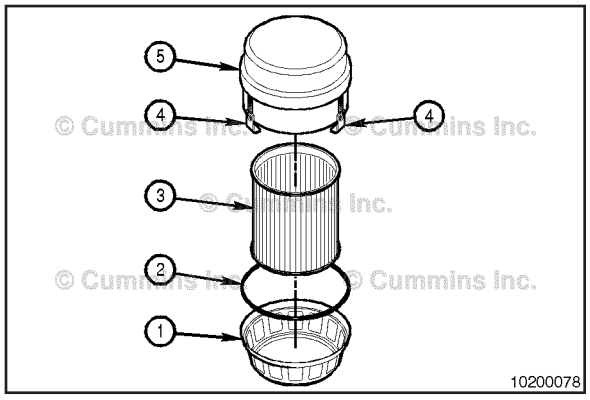


Air Cleaner Assembly (Engine-Mounted)

Maintenance Check

⚠CAUTION⚠
Holes, loose-end seals, dented sealing surfaces, and other forms of damage render the air cleaner inoperative and require immediate replacement.

Elements that have been cleaned several times will finally clog and airflow to the engine will be restricted. After cleaning the element, check the intake air restriction as previously described. Replace the element, if necessary.



⚠CAUTION⚠
To avoid damage to the element, pull the cover and the element straight out when removing them from the air cleaner housing.

Unsnap the latches (4) that secure the cover (1) to the air cleaner housing (5). Remove the cover (1).

Pull the element (3) out of the housing.

Remove the o-ring (2) from the cover (1) and inspect. If the o-ring (2) is damaged, it **must** be replaced.

Install the air cleaner element (3) into the housing.

Make sure that the o-ring (2) is seated properly on the cover (1). Install the cover (1).

Snap the latches (4) to secure the cover (1).

Section 10 - Maintenance Procedures at 2000 Hours or 2 Years

Section Contents

This Page Left Intentionally Blank

Maintenance Procedures - Overview

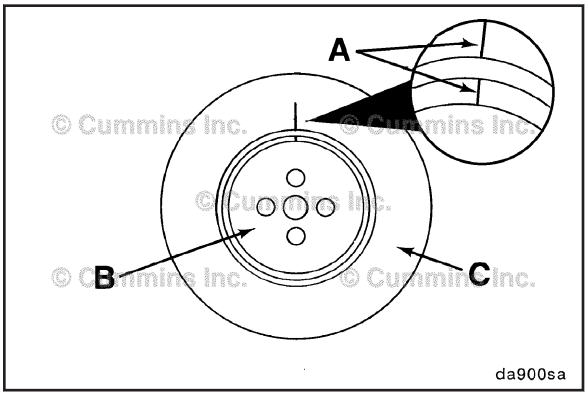
General Information

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.

Vibration Damper, Rubber

Inspect

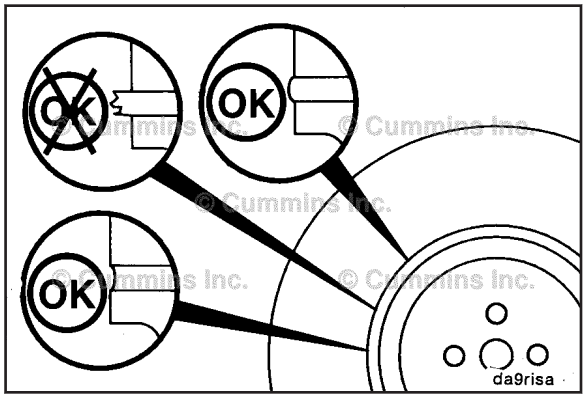
Check the index lines (A) in the vibration damper hub (B) and the inertia member (C). If the lines are more than 1.59 mm [1/16 in] out of alignment, replace the vibration damper.

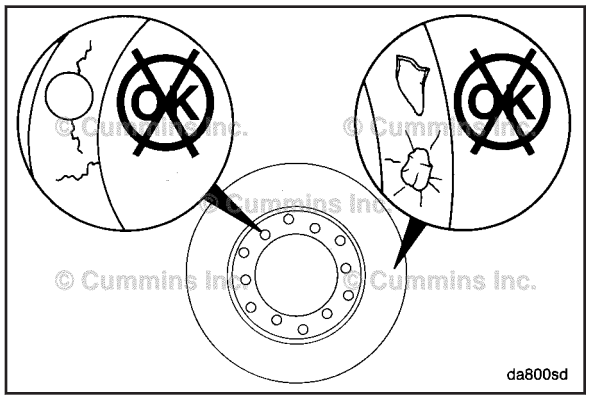


Inspect the rubber member for deterioration. If pieces of rubber are missing or if the elastic member is more than 3.18 mm [1/8 in] below the metal surface, replace the damper.

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

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





Vibration Damper, Viscous

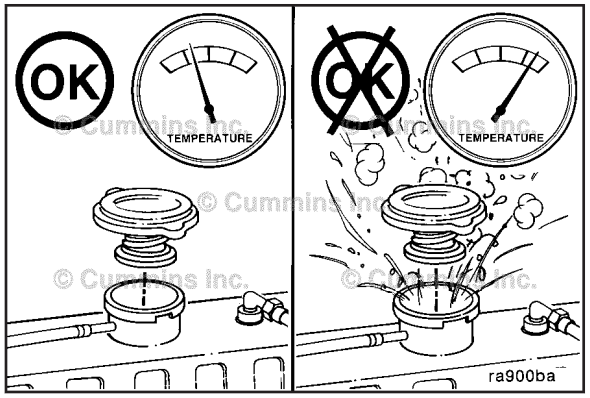
Inspect

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

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

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

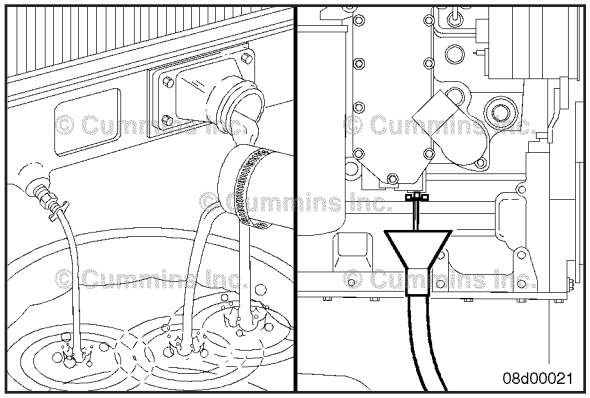
For vibration damper location, refer to Engine Diagrams in Engine Identification (Section E).



Cooling System

Drain

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



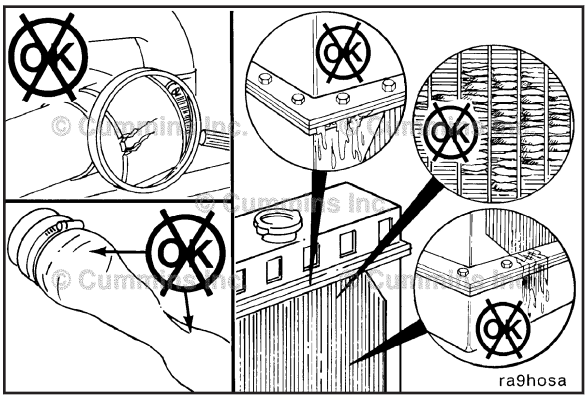
⚠WARNING⚠
Coolant is toxic. Keep away from children and pets. If not reused, dispose of in accordance with local environmental regulations.

Drain the cooling system by opening the drain valve on the radiator and removing the plug in the bottom of the water inlet hose. A drain pan with a capacity of 19 liters [5 gal] will be adequate for most applications.

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

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

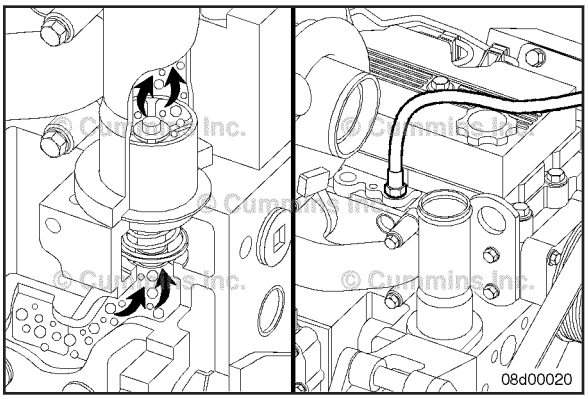
Clean and replace as required.



Flush

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

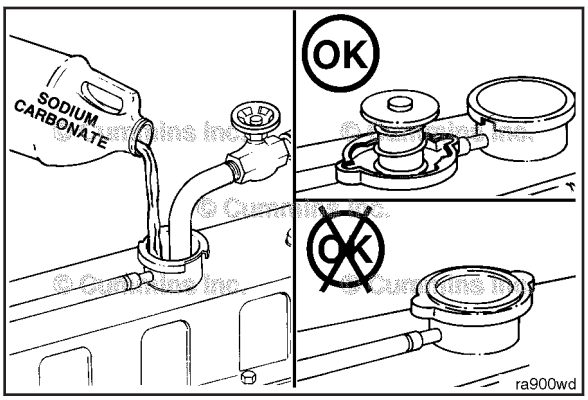
Adequate venting is provided for a fill rate of 19 liters [5 gal] per minute.



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

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

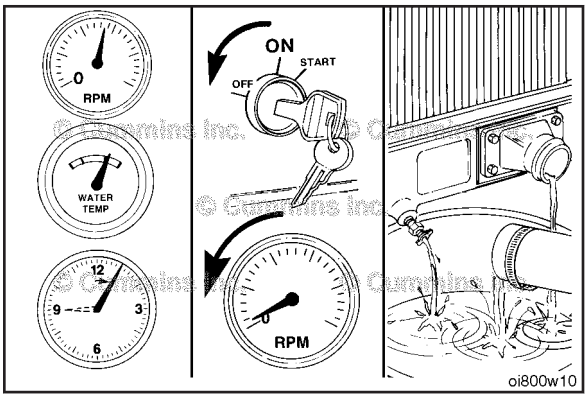
Use 0.5 kg [1 lb] of sodium carbonate for every 23 liters [6 gal] of water.

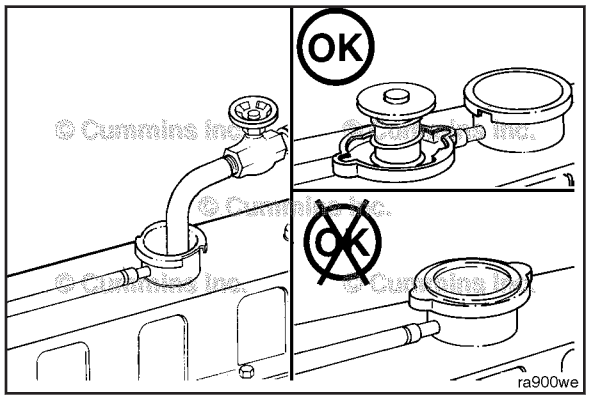


⚠WARNING⚠
Coolant is toxic. Keep away from children and pets. If not reused, dispose of in accordance with local environmental regulations.

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

Shut the engine off, and drain the cooling system.

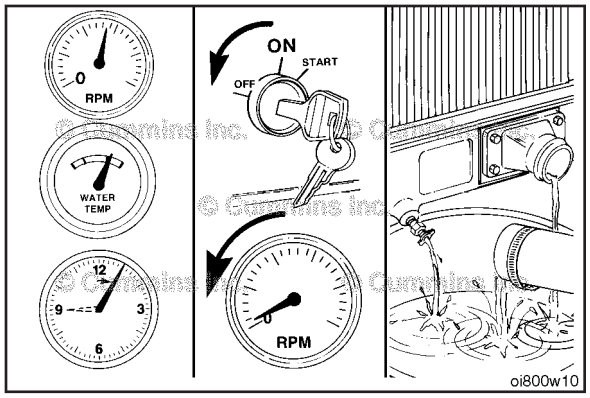




⚠CAUTION⚠
The system must be filled properly to prevent air locks. During filling, air must be purged from the engine coolant passages. Be sure to open the petcock on the aftercooler for aftercooled engines. Wait 2 to 3 minutes to allow air to be vented; then add water to bring the level to the top.

Fill the cooling system with high-quality water.

Do **not** install the radiator cap or the new coolant filter.



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

Shut the engine off, and drain the cooling system.

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

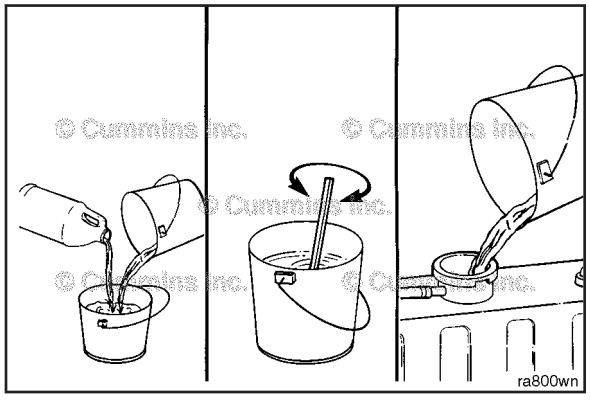
Fill

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

The system is designed to use a specific quantity of coolant. If the coolant level is low, the engine will run hot.

If frequent 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.

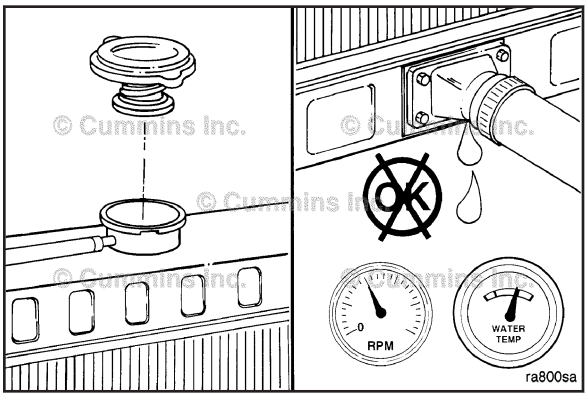
Use a mixture of 50-percent water and 50-percent ethylene glycol or propylene glycol antifreeze to fill the cooling system.

Coolant Capacity (Engine Only)			
	liters		U.S.gal
6C 8.3 Engine	10.9	MAX	11.5

⚠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 of steam can cause personal injury.

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

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



Air Compressor Discharge Lines

General Information

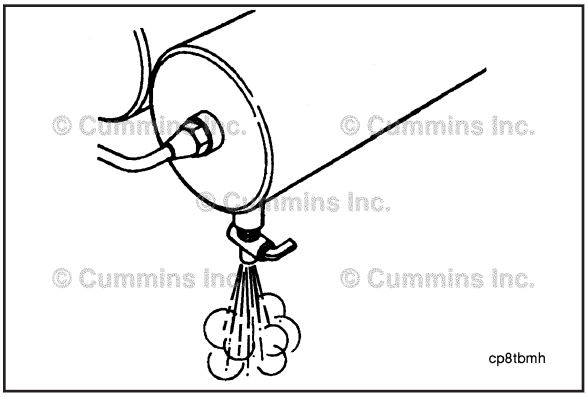
All air compressors have a small amount of lubricating oil carryover that lubricates the piston rings and moving parts. When this lubricating oil is exposed to normal air compressor operating temperatures over time, the lubricating oil will form varnish or carbon deposits. If the following maintenance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

Maintenance Check

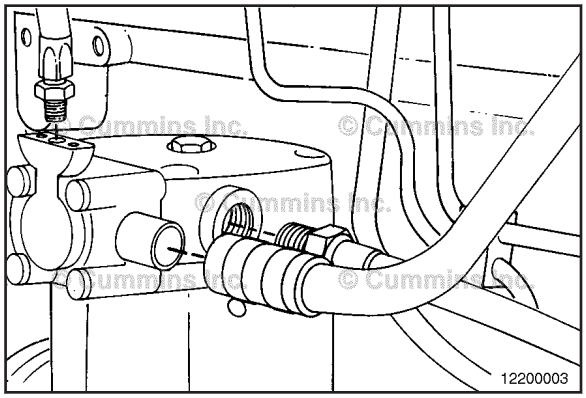
⚠WARNING⚠
Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

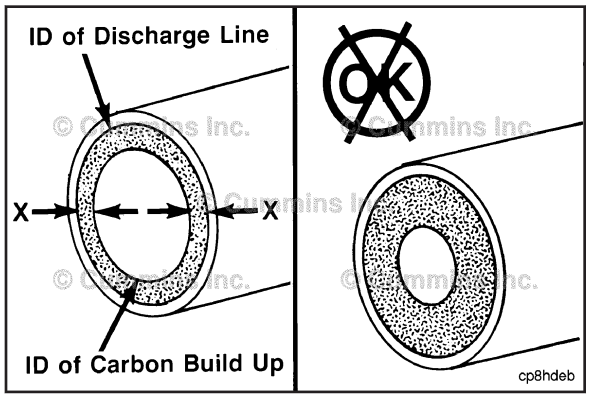
Shut off the engine.

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

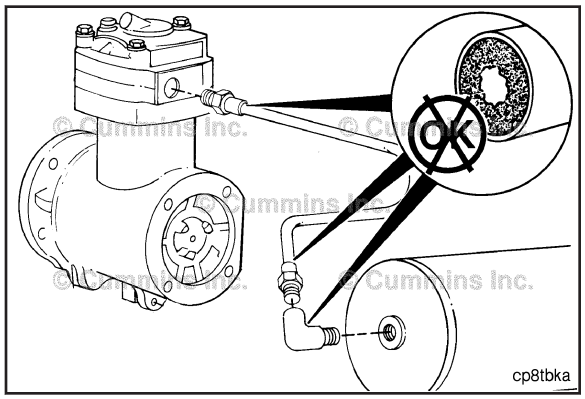


Remove the air compressor discharge line from the air compressor. Location of the air compressor discharge line can be found in Flow Diagram, Compressed Air System in System Diagrams (Section D).

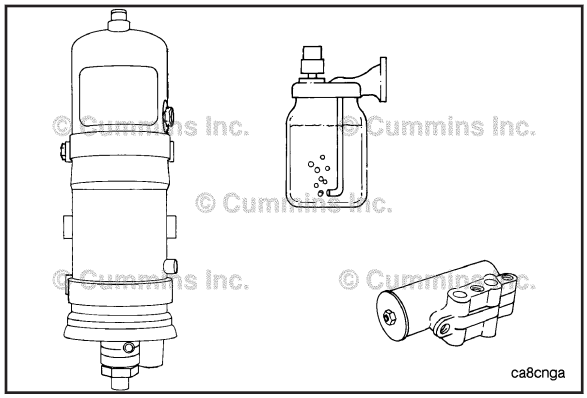




Measure the total carbon deposit thickness inside the air discharge line as shown. If the total carbon deposit (X + X) exceeds 2 mm [1/16 in], clean and inspect the cylinder head, the valve assembly, and the discharge line. Replace if necessary. Contact the Cummins Authorized Repair Location for procedures.



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.

Section A - Adjustment, Repair, and Replacement

Section Contents

This Page Left Intentionally Blank

Fuel Shutoff Valve

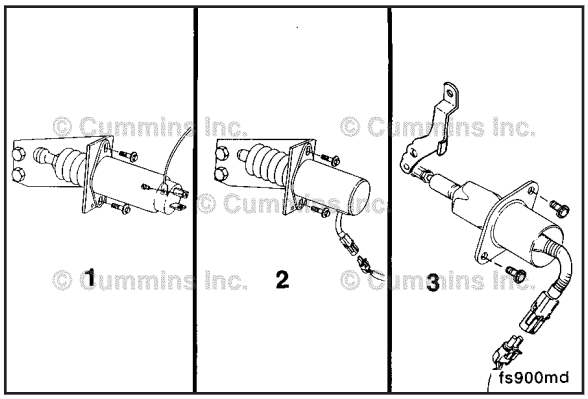
Preparatory Steps

Label and disconnect the wiring.

Remove

Remove the two mounting capscrews, and remove the solenoid from the bracket.

1. Synchro-start
2. Trombetta
3. Direct link.



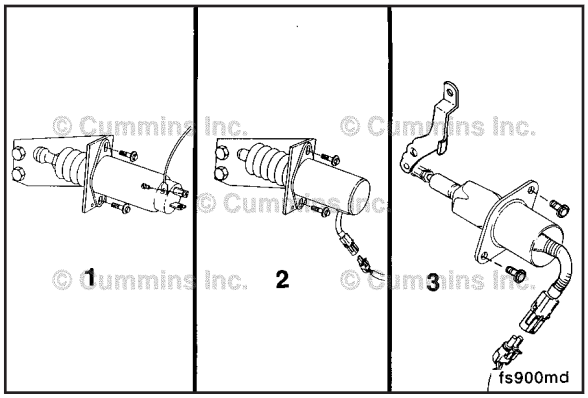
Install

NOTE: Make sure the acorn nut is tightened to be snugly on the fuel shutoff solenoid shaft (Synchro-start **only**).

Install the new fuel shutoff solenoid to the bracket, and connect the wires. Make sure the wiring harness one the Trombetta solenoid is installed in the six-o'clock position.

Torque Value: 10 N•m [89 in-lb]

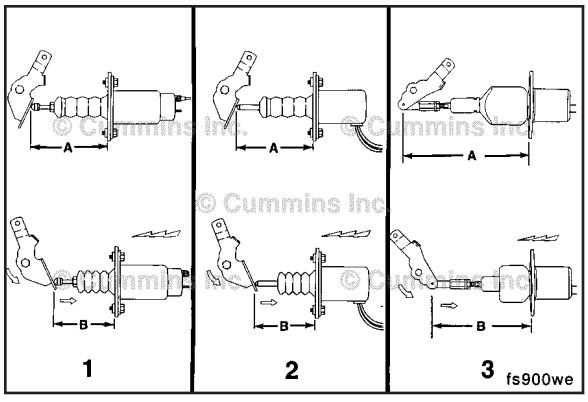
1. Synchro-start
2. Trombetta
3. Direct link.

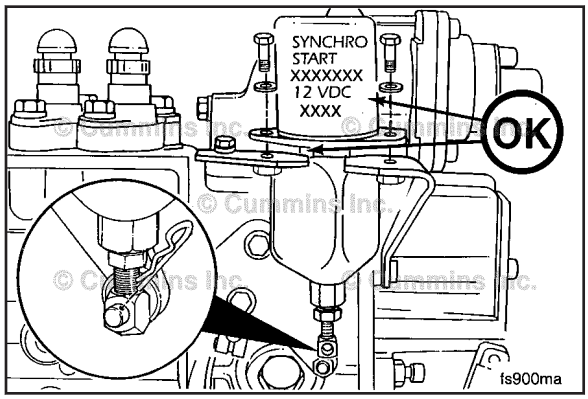


Activate the switch and check the plunger travel.

	Synchro-start	Trombetta	Direct link
A =	86.8 mm [3.4 in]	91.4 mm [3.6 in]	
B =	60.2 mm [2.4 in]	63.5 mm [2.5 in]	117.1 mm [4.61 in]

The plunger **must** be retracted when the fuel shutoff solenoid is activated to the RUN position B. The fuel shutoff solenoid **must** operate without binding.

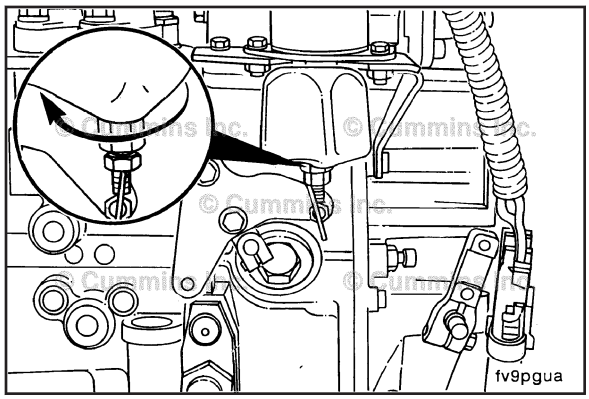




Remove the hitch pin clip, the mounting capscrews, and the fuel shutoff solenoid.

Install the new solenoid in reverse order of removal, and connect the wires.

Torque Value: 10 N•m [89 in-lb]



Adjust the solenoid linkage as necessary so that the plunger is magnetically held in with the shutoff lever in the absolute full-run position. Turn the large hex nut on the end of the plunger to make adjustments, and secure in place with a locknut.

Air in Fuel

General Information

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

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

The low-pressure fuel system for Cummins diesel installed in the vehicle consists of the fuel tank, lines between tank and engine, transfer pump and lines, and fuel filter and lines. Air or bubbles at the injection pump can cause no or erratic engine operation and/or subsequent malfunction of the fuel injection pump. Air can be introduced by leaks in the fuel system prior to the transfer pump since fuel pressure is a vacuum. Bubbles can result from any number of restrictions in the system:

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

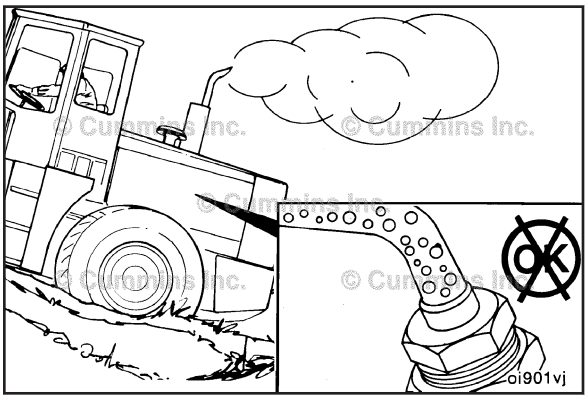
If sufficient fuel reaches the injection pump from the low-pressure system, then solutions to engine operational problems are elsewhere. The following steps will aid in evaluating low-pressure fuel system performance in absence of fault codes.

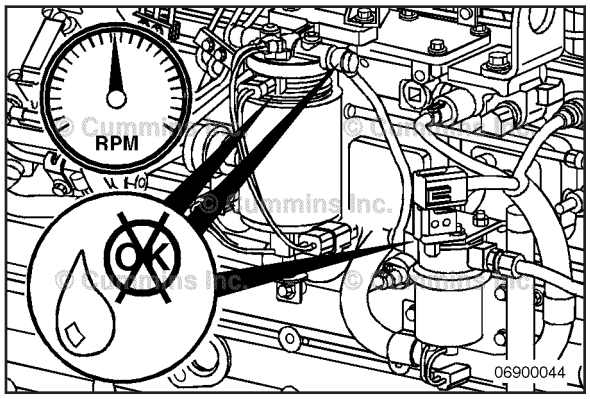
NOTE: For cold-start/performance problems, perform the following steps:

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

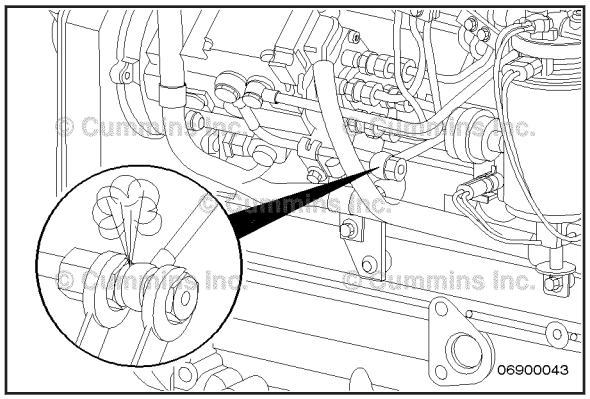
Test

A replacement of fuel supply lines, fuel filters, fuel injection pump, high-pressure fuel lines, and injectors will let air enter the fuel system. Air in the system will make the engine hard to start, run rough, misfire, produce low power, and can cause excessive smoke and a fuel knock.





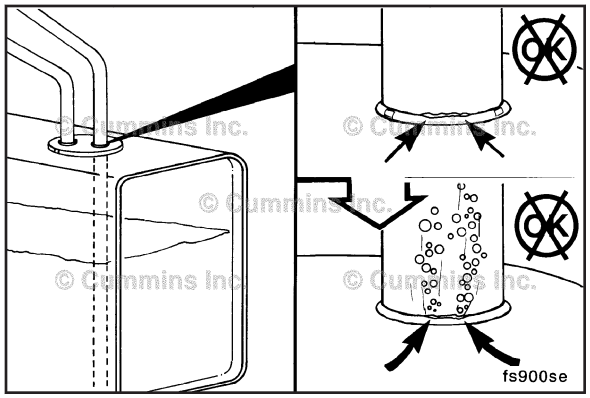
Since the fuel lift pump provides positive pressure through the fuel filter and supply line to the fuel injection pump, loose connections or defective seals can show as a fuel leak, **not** as an air leak.



NOTE: If an excessive amount of air has entered into the system, the system will need to be vented.

Loosen the return banjo fitting on the fuel lift pump. Run the fuel lift pump until all the air has been vented. When all the air has been vented, retighten the fitting.

NOTE: To run the fuel pump for 25 seconds, crank the engine for a split second, and leave the key in the ON position.

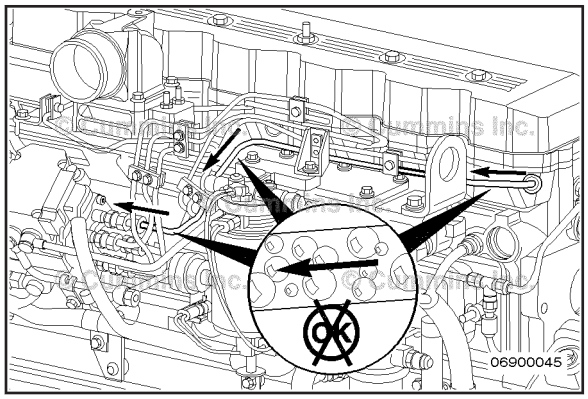


If air continues to bubble out of the system for several minutes, then an air leak is present.

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

Also, check to make sure all the fittings from the fuel supply line on the tank to the inlet of the fuel transfer pump are tight.

Use a sight glass at the fuel lift pump inlet to check for air in the fuel supply lines.

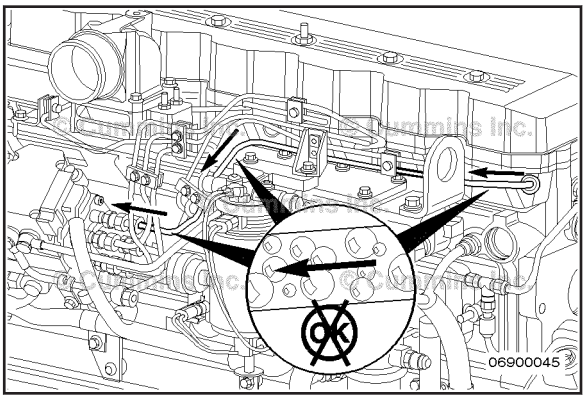


Since the fuel pump provides a positive pressure through the fuel filter and supply line to the fuel injection pump, loose connections or defective seals should show as a fuel leak, **not** as an air leak.

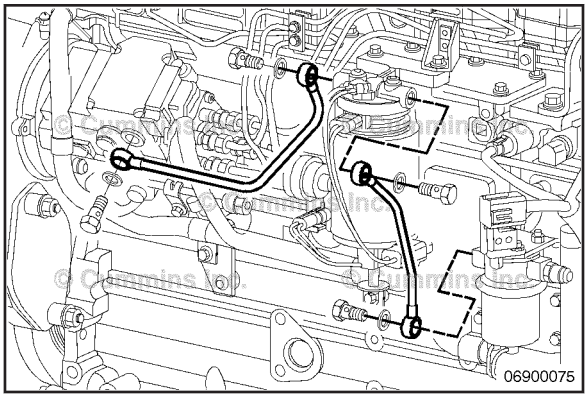
A stuck-open injector can also blow combustion gas back into the pump and cause air to be present in the overflow. If the engine seems to be misfiring or running rough, break all the injector supply lines loose at the pump end. Crank the engine, and observe the lines. If combustion gas seems to be blowing back through the line, the injector is stuck open. Remove the injector. Take the vehicle to an Authorized Cummis Repair Facility/Dealer Location for testing.

Torque Value: 24 N•m [212 in-lb]

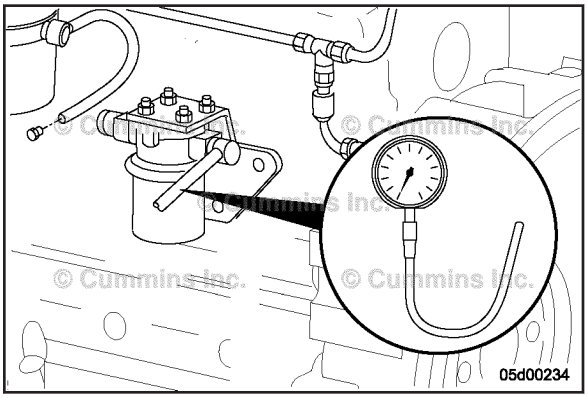
NOTE: Use two wrenches when loosening the lines at the fuel pump: One to hold the delivery valve and one to loosen the fuel line.



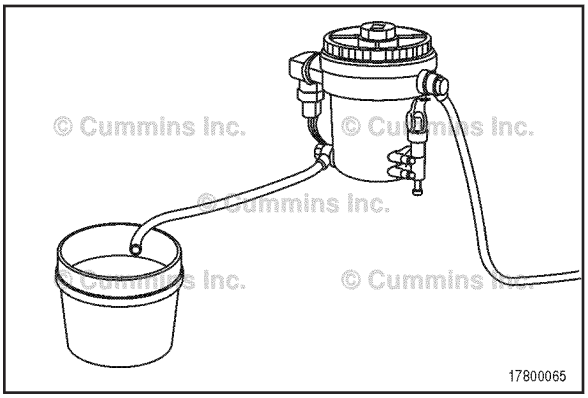
Disconnect the fuel line from the outlet of the fuel filter.

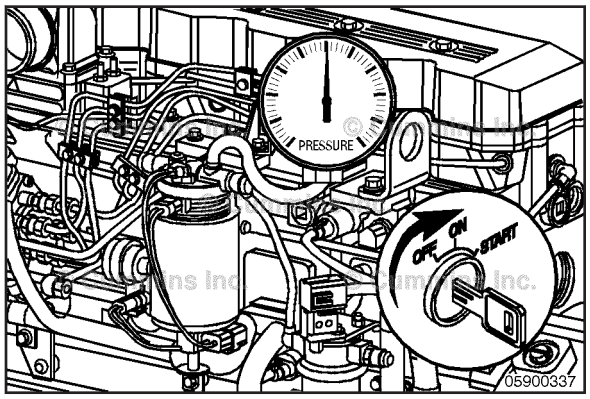


Attach a preferably clear hose to the outlet of the fuel filter. (Do **not** use pressure test fitting.) Place a pressure gauge on the inlet side of the fuel filter and a vacuum gauge on the inlet side to the transfer pump.



Insert a hose into an empty 3.8-liter [1-gal] container.



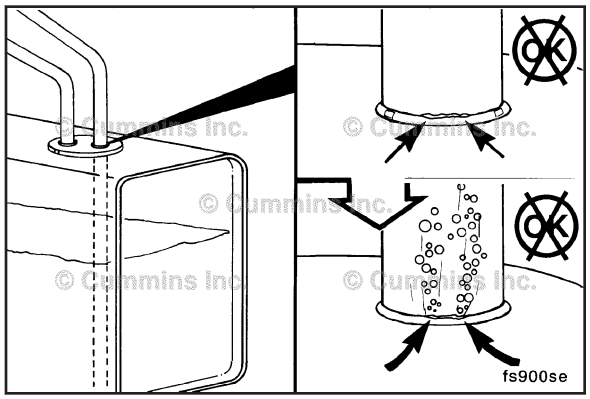


Operate the fuel lift pump by bumping the starter. (The lift pump should run for 25 to 30 seconds.) Check for bubbles in fuel.

Record filter inlet pressure and transfer pump inlet restriction.

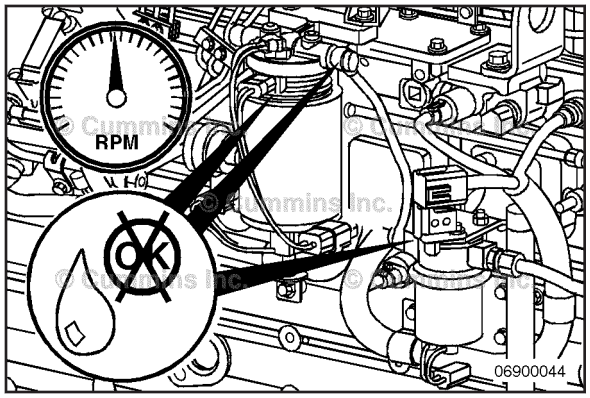
If filter inlet pressure is greater than 34.8 kPa [5 psi], the filter element **must** be replaced. Repeat test.

If inlet restriction is greater than 152.4 mm Hg [6 in Hg] or 155.1 mm Hg [3 psi], then excessive restriction exists between fuel in the tank and the transfer pump, which **must** be repaired (e.g., fuel line or tank module). Repeat test.

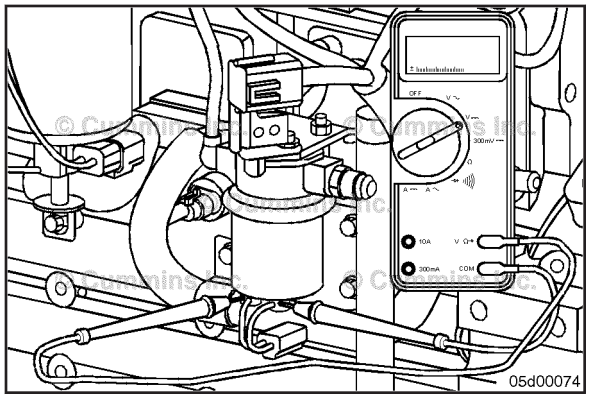


If bubbles are present, check for air leaks in the fuel supply circuit.

Measure the amount of fuel in the container. If more than 1.33 liters [45 fl oz] are collected and the fuel is bubble-free, then it is unlikely the low-pressure fuel system is the cause of engine operational problems.



Reconnect the lift pump that is retaining the fuel filter pressure connections. Running engine at high idle, the filter inlet pressure should be greater than 42.3 kPa [6 psi]; otherwise, there is a fuel lift pump malfunction.



If the fuel transfer pump does **not** run, check electrical circuits, and verify voltage is present at lift pump connector.

NOTE: When an engine is **not** running, with key on, the lift pump will run less than 2 seconds (varies with ECM calibration); with starter bump, about 25 to 30 seconds. If voltage is present, replace fuel transfer pump. Resistance measurement across the transfer pump terminals can be made for confirmation of pump malfunction. Resistance greater than 200 ohms or less than 0.2 ohm does confirm an electrical fault when voltage is present but the fuel pump is **not** running.

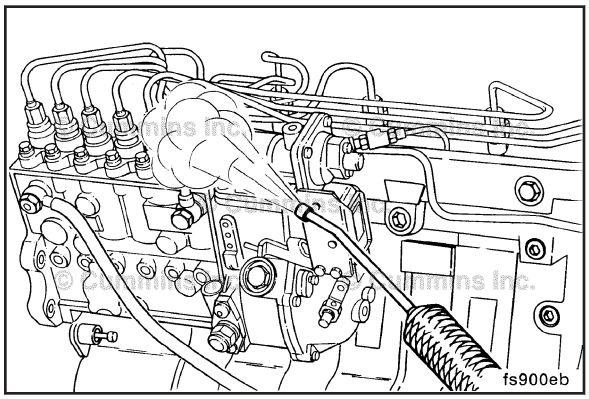
Fuel Filter Adapter

Preparatory Steps

Bosch®

Clean debris.

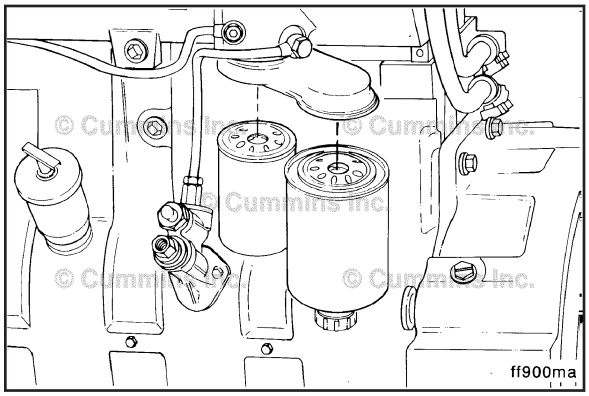
Remove fuel filters.



Remove

Bosch®

Remove the retaining nut, fuel filter head adapter, and sealing washers.

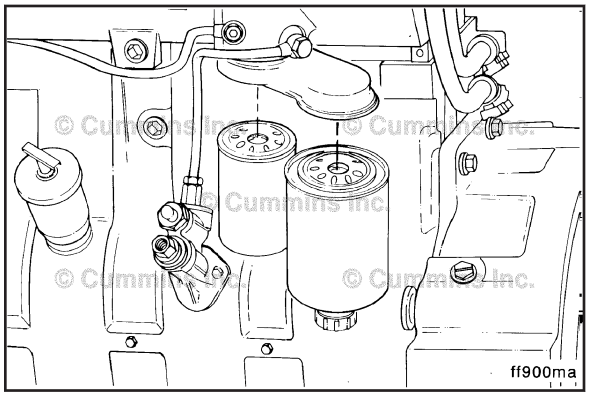


Install

Bosch®

Install in the reverse order of removal.

Torque Value: 32 N•m [24 ft-lb]



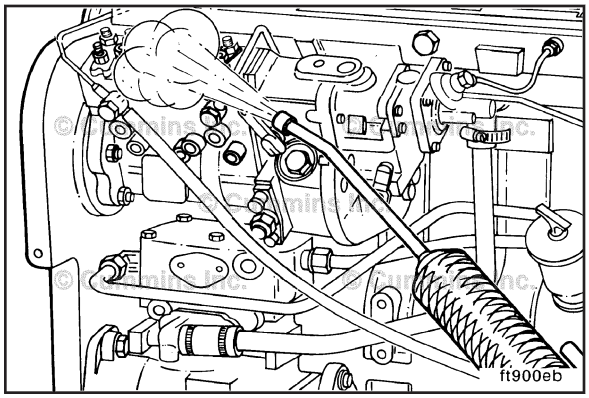
Fuel Supply Lines

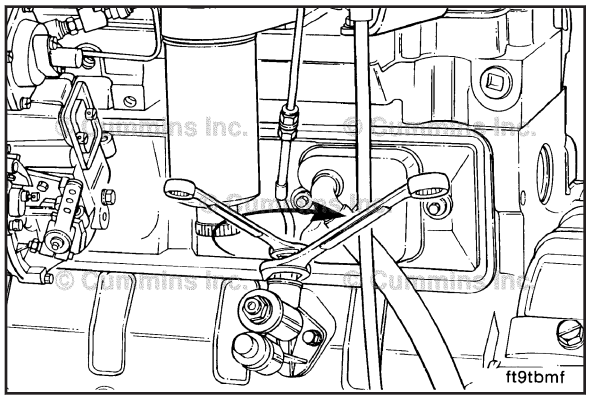
Preparatory Steps

Low Pressure Fuel Line(s)

Clean any debris from the fittings.

NOTE: Thoroughly clean all fittings and components before removal. Make sure that the debris, water steam, or cleaning solution does **not** get inside the fuel system.

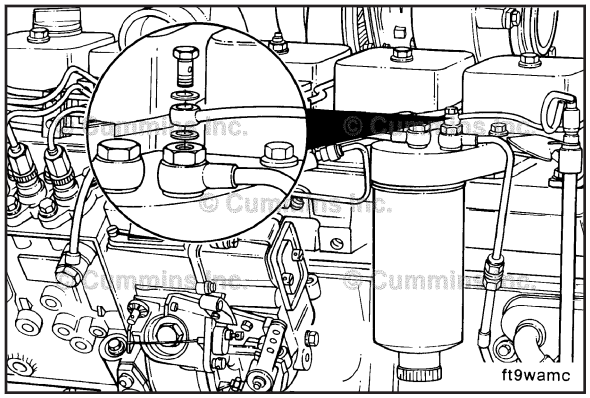




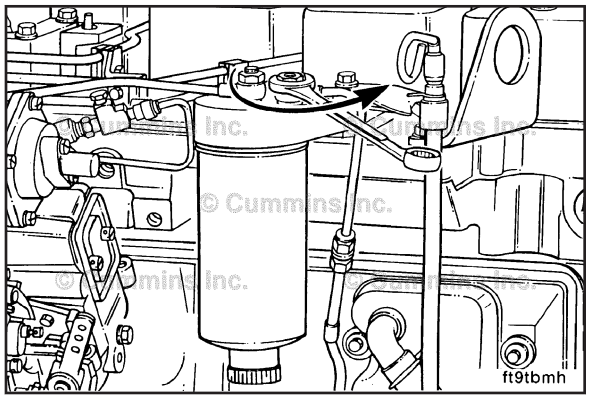
Remove

In-line Fuel Injection Pumps

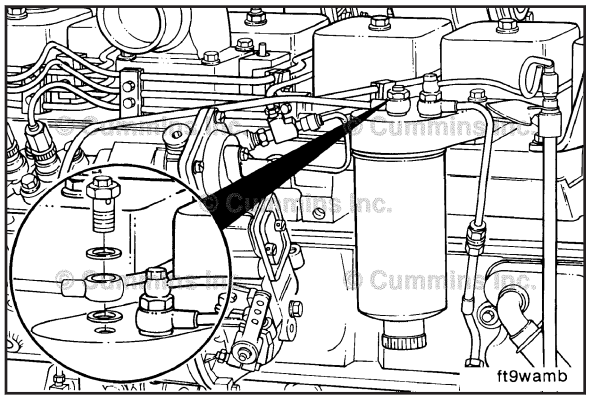
Remove the fuel line from the piston-style fuel transfer pump.



Remove the fuel drain manifold line at the fuel filter head.



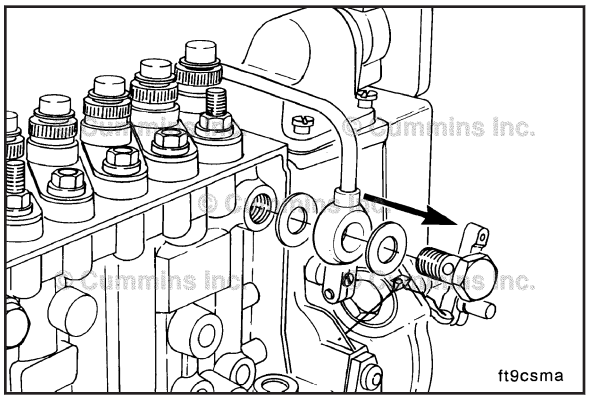
Remove the fuel line from the filter head.



Bosch® In-line

Remove the banjo capscrew and sealing washers at the fuel filter head.

Remove the banjo capscrew and copper sealing washer at the fuel injection pump inlet.

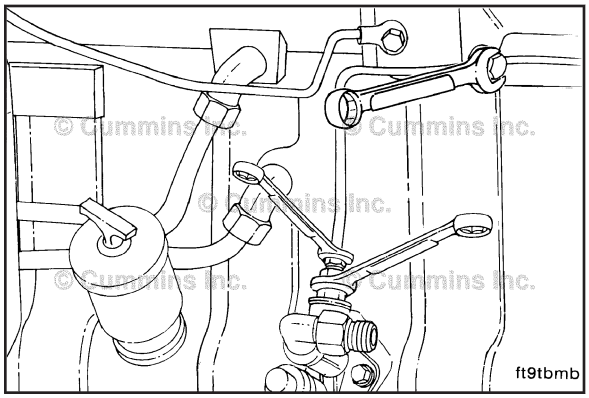


Install

⚠CAUTION⚠
Do not overtighten the fuel supply line fittings. A fuel leak can occur.

Install the fuel line between the fuel lift pump and the fuel filter head. Use two wrenches to tighten the connection on the fuel lift pump.

Torque Value: 24 N•m [18 ft-lb]

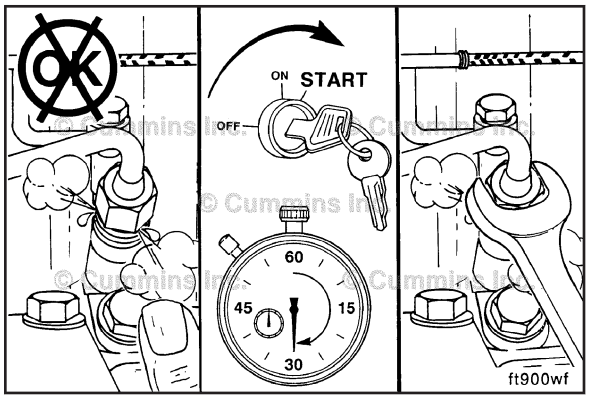


Vent

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

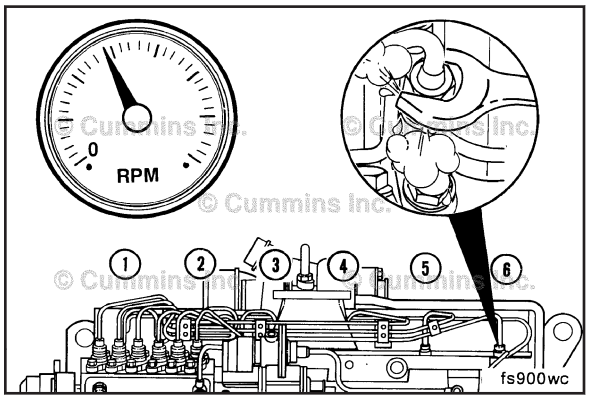
Vent the high-pressure fuel lines. Loosen the fitting at the injector Number 1. Place the fuel control in the RUN position. Crank the engine so air can bleed from the fuel lines then tighten the fitting.

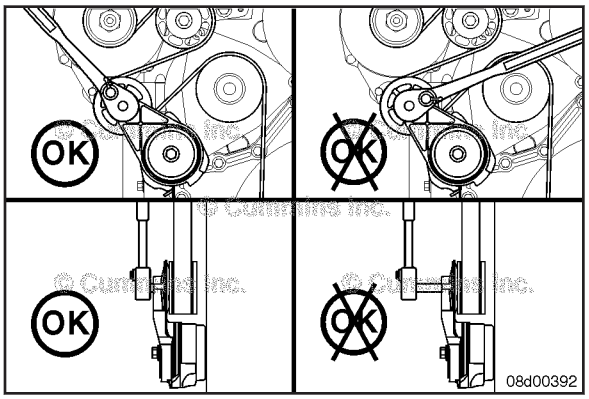
Torque Value: 30 N•m [22 ft-lb]



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

Vent each high-pressure line separately until the engine runs smoothly.



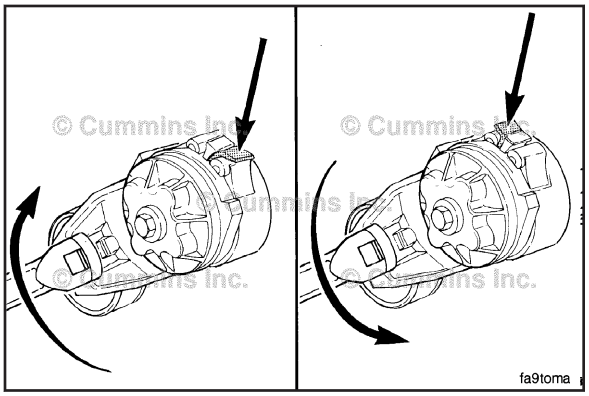


Drive Belt, Cooling Fan

Remove

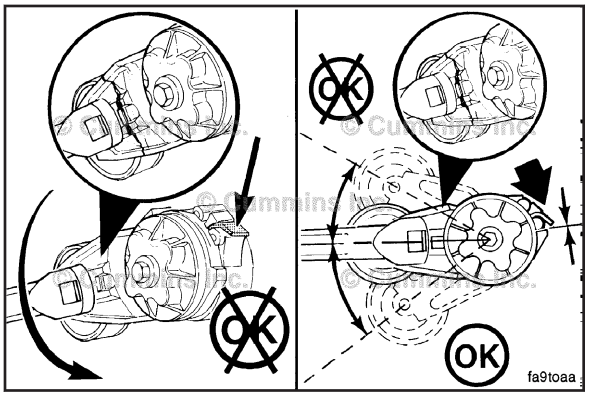
⚠CAUTION⚠
Using a socket extension is not recommended because it can cause axial twisting damage to the belt tensioner.

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

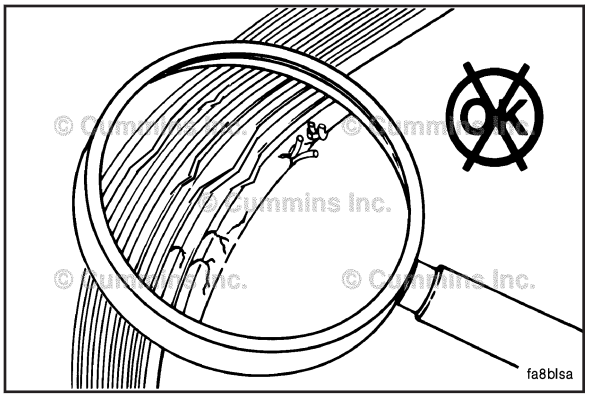


Lift the tensioner to remove the drive belt.

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



⚠CAUTION⚠
Applying excessive force in the opposite direction of windup or after the tensioner has been wound up to the positive stop can cause the tensioner arm to break.



Inspect for Reuse

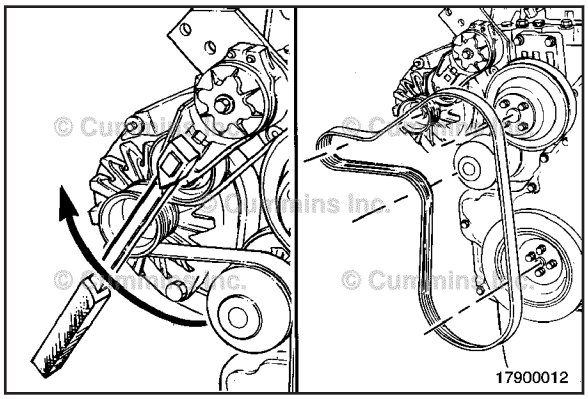
Inspect the drive belt for:

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

Install

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

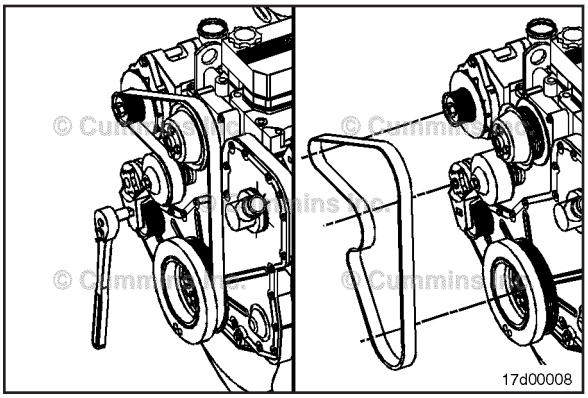
Lift the tensioner to install the drive belt.



Fan Spacer and Pulley

Preparatory Steps

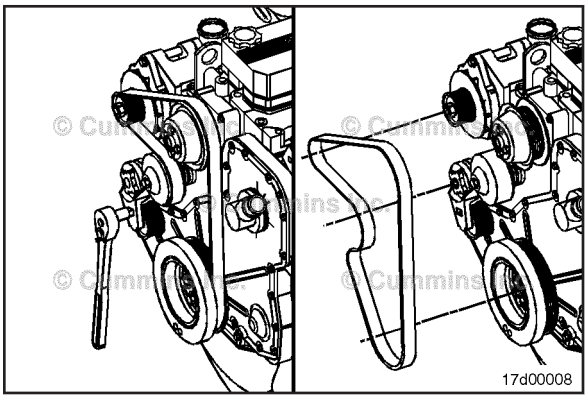
Loosen the fan capscrews before removing the drive belt.



Remove

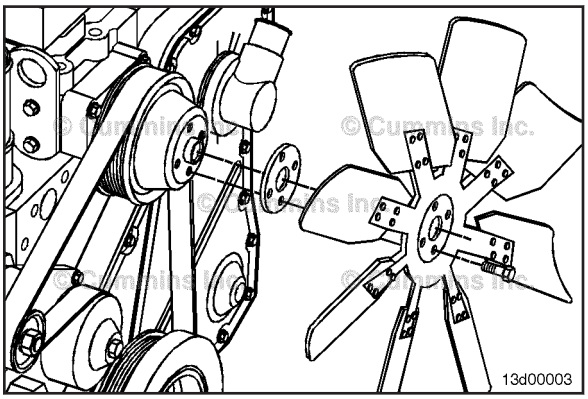
⚠CAUTION⚠
The belt tensioner is spring-loaded and must be pivoted away from the drive belt. Pivoting in the wrong direction can result in damage to the belt tensioner.

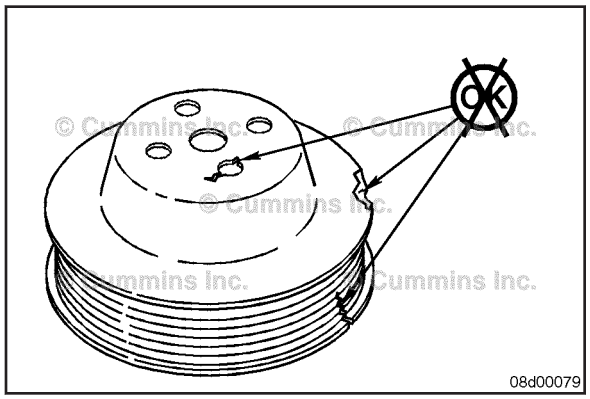
Lift the tensioner to relieve tension in the drive belt. Remove the belt.



Remove the fan capscrews, fan, and spacer.

Remove the fan pulley.

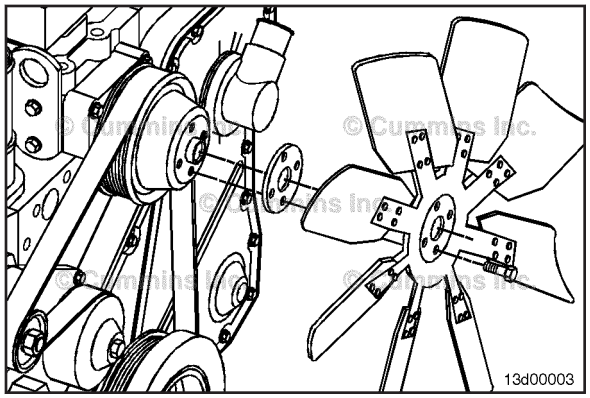




Inspect for Reuse

Inspect the fan pulley for cracks near bolt holes.

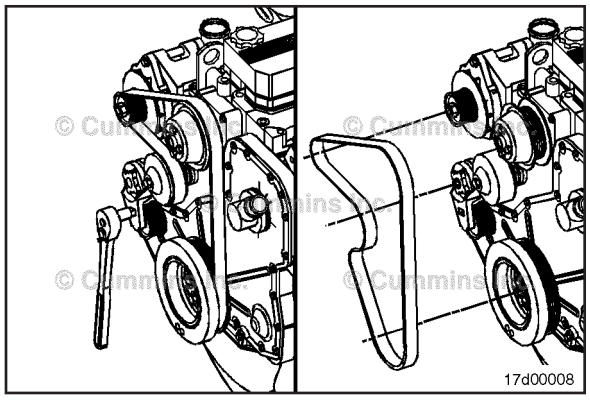
Check for cracks, loose rivets, and bent or loose fan blades.



Install

Install the fan pulley.

Install the spacer, fan, and fan capscrews.



Finishing Steps

⚠CAUTION⚠

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

Install the drive belt.

Lift the tensioner to relieve tension in the drive belt. Tighten the fan capscrews.

Torque Value: 24 N•m [212 in-lb]

Service Tip:

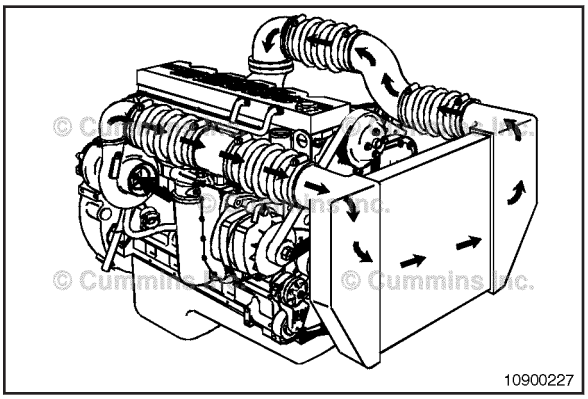
If difficulty is experienced installing the drive belt or if the belt seems too short, position the belt over the grooved pulleys first; then, while holding the tensioner up, slide the belt over the water pump pulley.

Charge-Air Cooler

General Information

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

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

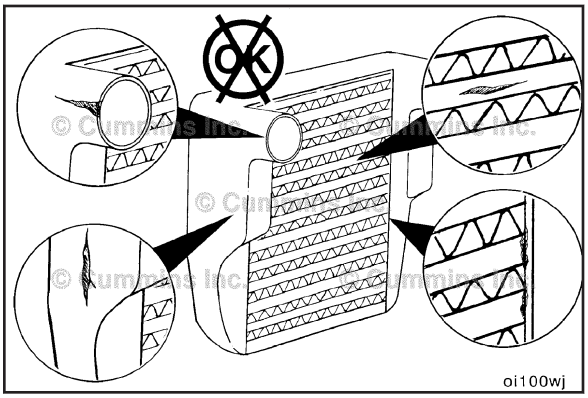


Initial Check

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

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

Inspect the charge-air cooler plumbing for cracks and damage.



Remove

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

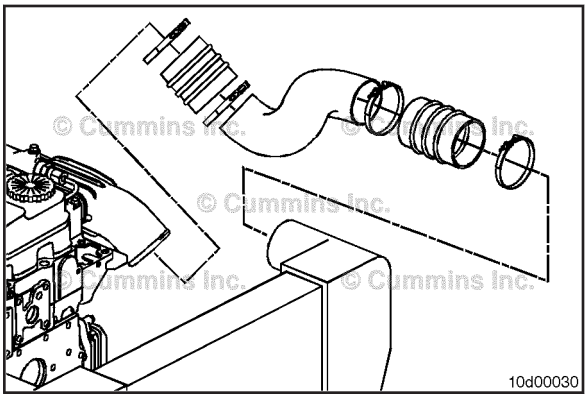
⚠WARNING⚠
Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [120°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

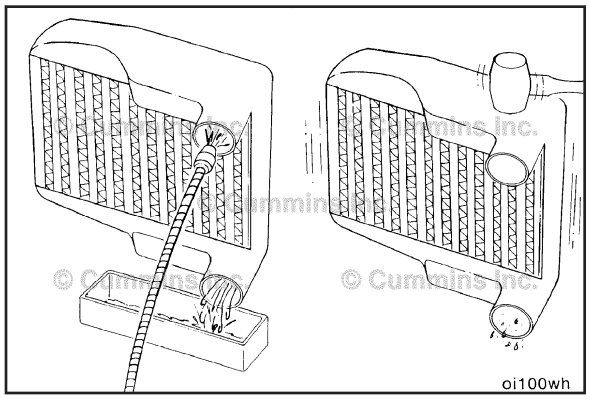
⚠WARNING⚠
Coolant is toxic. Keep away from children and pets. If not reused, dispose of in accordance with local environmental regulations.

Drain the coolant.

Remove the charge air cooler plumbing and cooler. Refer to original equipment manufacturer (OEM) service manual.

Use compressed air to clean debris from the outside of the charge-air cooler.





Clean

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

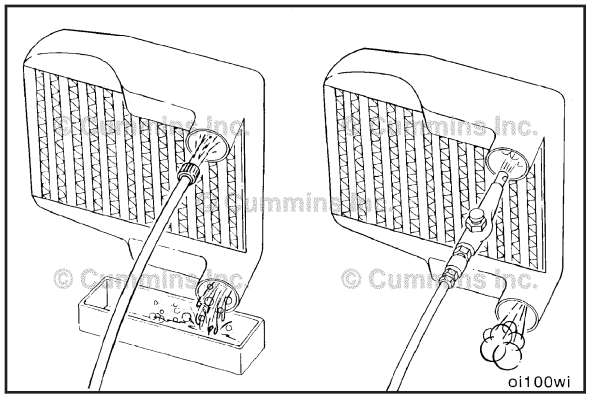
⚠WARNING⚠
Some solvents are flammable and toxic. Read the manufacturer's instructions before using.

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

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

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

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



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

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

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

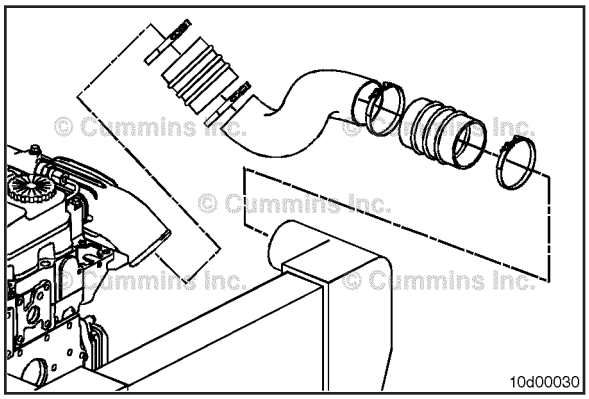
After the charge-air cooler has been thoroughly cleaned of all oil and debris with solvent, wash the charge-air cooler internally with hot, soapy water to remove the remaining solvent. Rinse thoroughly with clean water.

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

Install

Install the charge-air cooler.

Install the charge-air cooler plumbing. Refer to the OEM service manual for instructions.



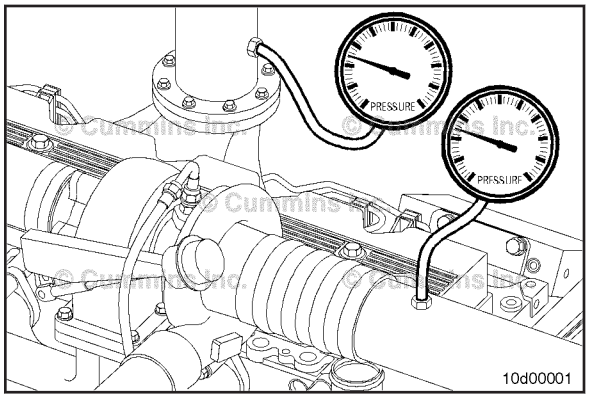
Pressure Test

Install the pressure gauge, Part Number ST-1273, or equivalent, to the fitting in the turbocharger outlet.

Install another pressure gauge, Part Number ST-1273, or equivalent, 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 21 kPa [3 psi], check the charge-air cooler for plugging. Clean or replace if necessary.

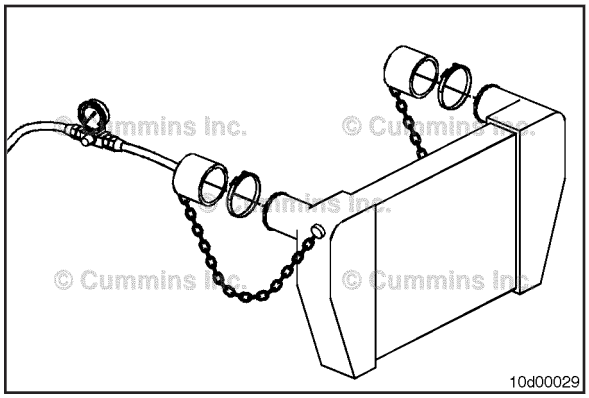


Leak Test

⚠WARNING⚠
To reduce the possibility of 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 not be performed without 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.

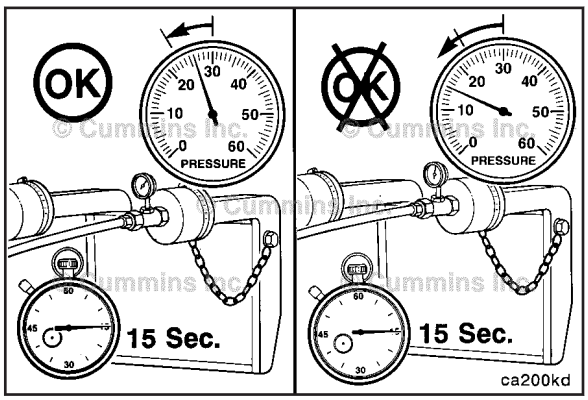


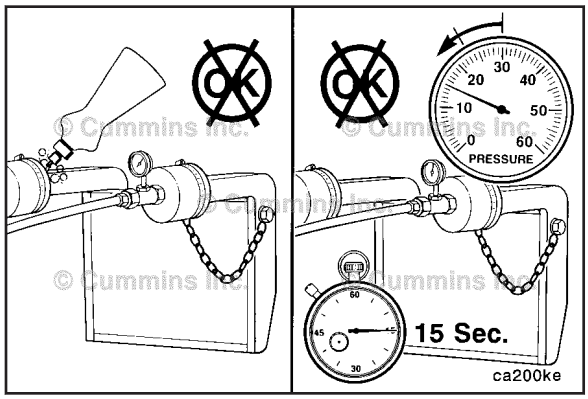
Apply air pressure to the cooler until the pressure gauge reads a steady 207 kPa [30 psi] of air pressure.

Shut off the airflow 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.

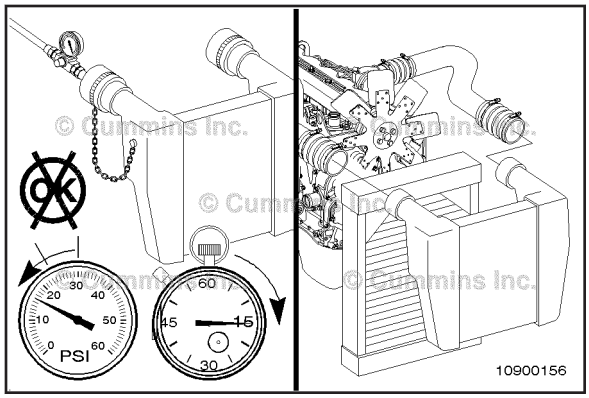




Determine if the pressure drop is caused by a leaky charge-air cooler or a leaky connection. Spray soapy water on all hose connections, and watch for bubbles to appear at the location of the leak.

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 in at least three consecutive tests before the reading can be considered accurate.

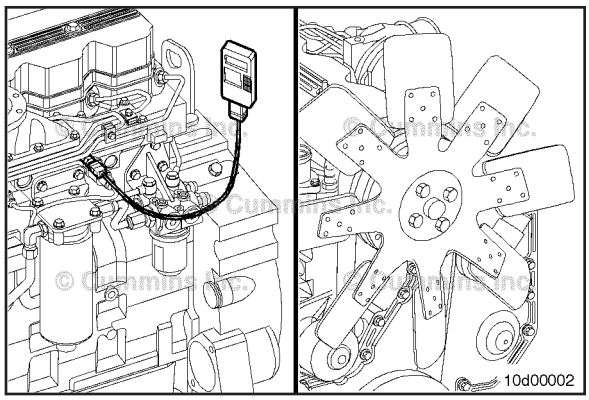
NOTE: If a charge-air cooler leaks more than 48 kPa [7 psi] in 15 seconds, it will appear as a major leak in a leak tank.



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

Refer to the OEM 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.

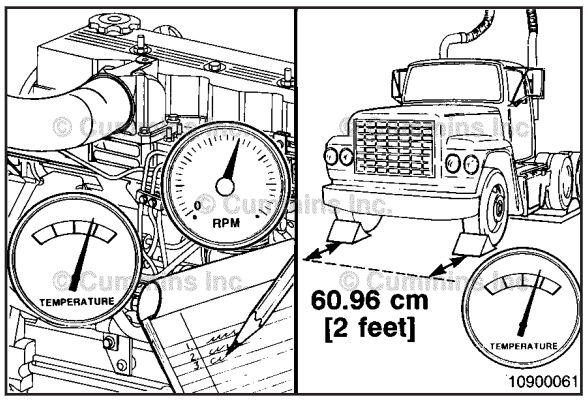


Temperature Differential Test

Install a temperature gauge in the intake manifold.

Lock the fan drive in the ON mode to prevent erratic test results. This can be done by installing a jumper across the temperature switch or supplying shop air to the fan. Refer to the OEM service manual for the lockup procedure.

NOTE: Some applications have a manual switch that will lock the fan on.



Operate the engine at rated rpm and load. Record the intake manifold temperature.

Measure the ambient temperature at least 2 feet in front of the vehicle.

The maximum temperature differential **must not** be greater than 25°C [77°F].

If the temperature differential is greater than 25°C [77°F], check the charge-air cooler for dirt and debris on the fins, and clean as necessary. If the problem still exists, check the cooler for internal contamination or plugging.

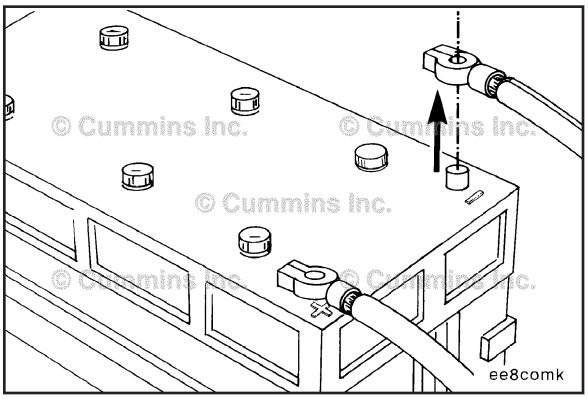
Alternator

Preparatory Steps

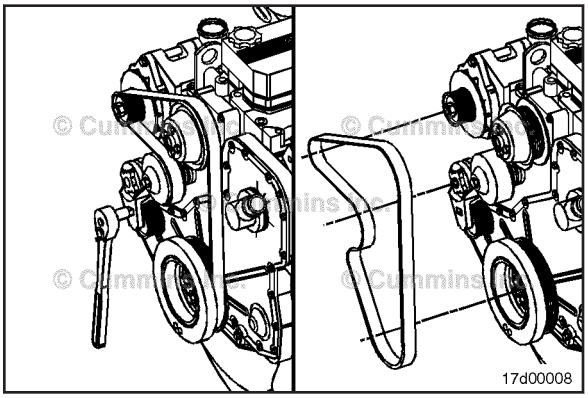
⚠WARNING⚠
Always connect the ground or negative (-) cable last to avoid arcing that can ignite explosive battery gases.

Disconnect the ground cable from the battery terminal.

Remove and tag all wires.

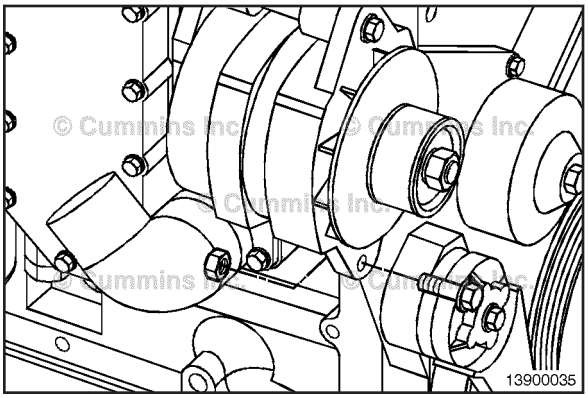


Remove the drive belt from the alternator pulley.



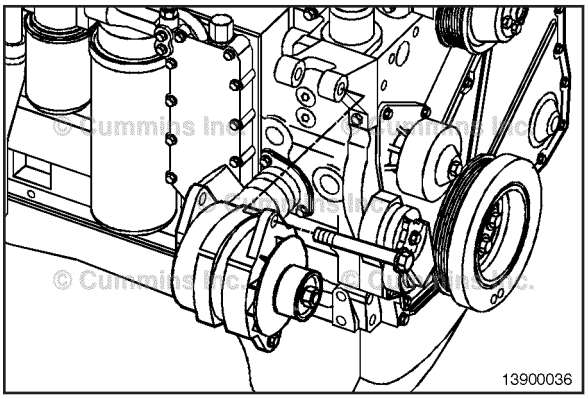
Remove

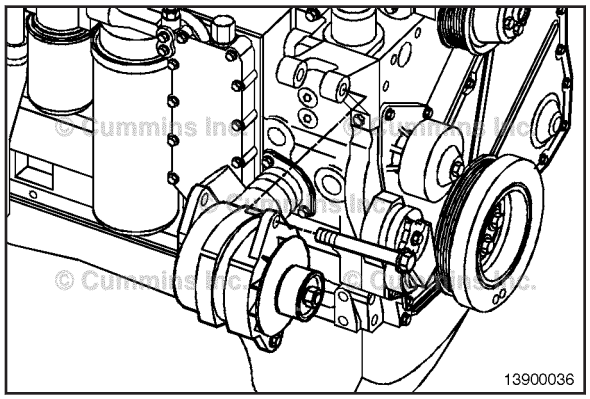
Remove the alternator link capscrew.



Remove the alternator mounting capscrew.

Remove the alternator.



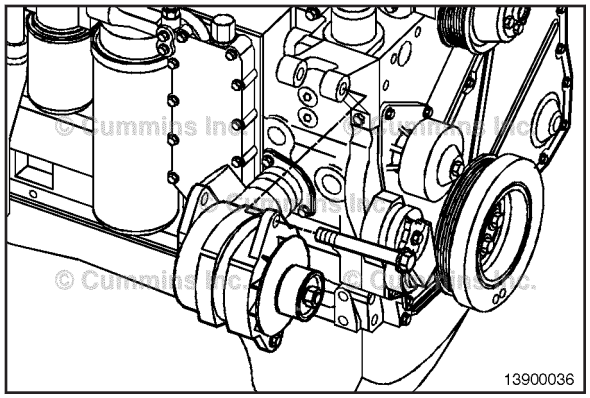


Install

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

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

NOTE: The wrench size and torque value is determined by the make and model of the alternator.



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

1. Alternator-to-alternator bracket capscrew

Torque Value: 43 N•m [32 ft-lb]

2. Lower brace-to-alternator capscrew

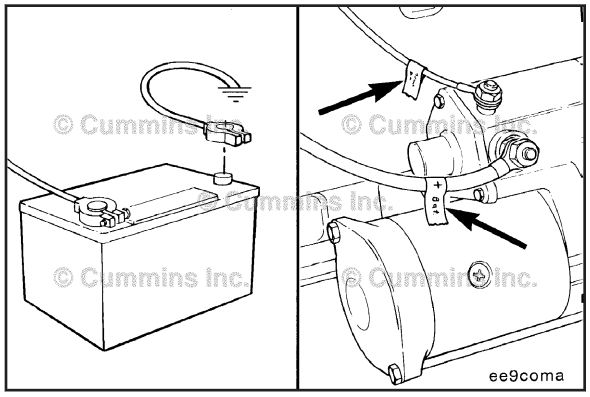
Torque Value: 24 N•m [18 ft-lb]

3. Lower alternator brace-to-water pump capscrew

Torque Value: 24 N•m [18 ft-lb]

4. Water inlet-to-block capscrews.

Torque Value: 24 N•m [18 ft-lb]

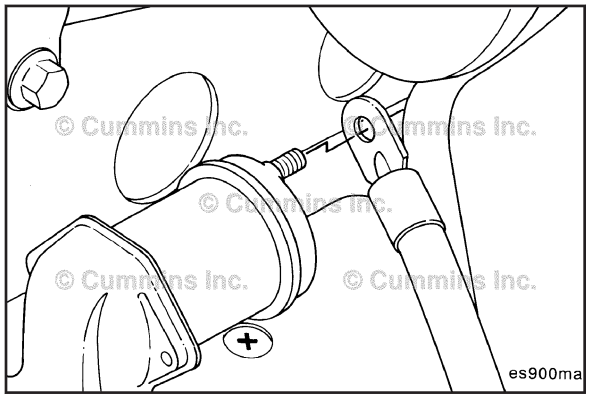


Starting Motor

Preparatory Steps

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

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

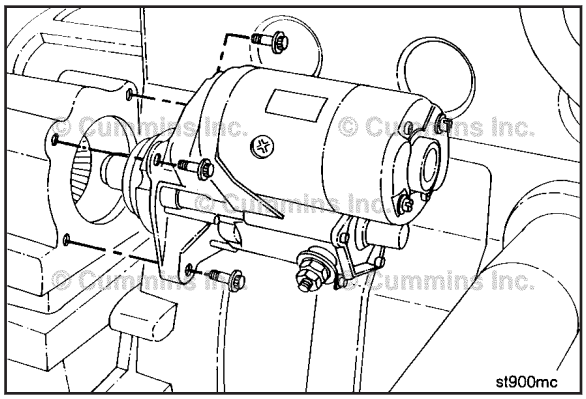


Remove

Remove the battery cable from the solenoid.

Remove all other wires connected to the starter.

Remove the starter motor.

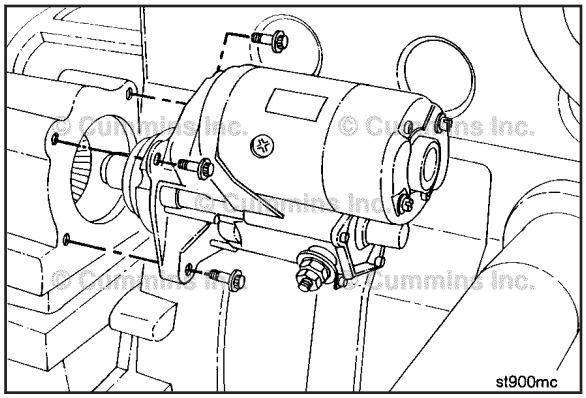


Install

Install the starter motor.

Torque Value: 43 N•m [32 ft-lb]

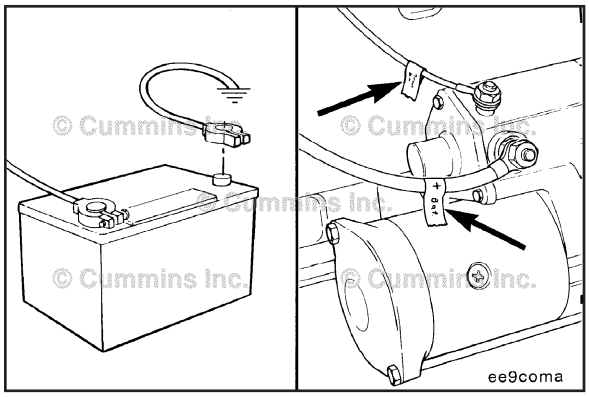
Connect all cables and all other wires connected to the starter.



Finishing Steps

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

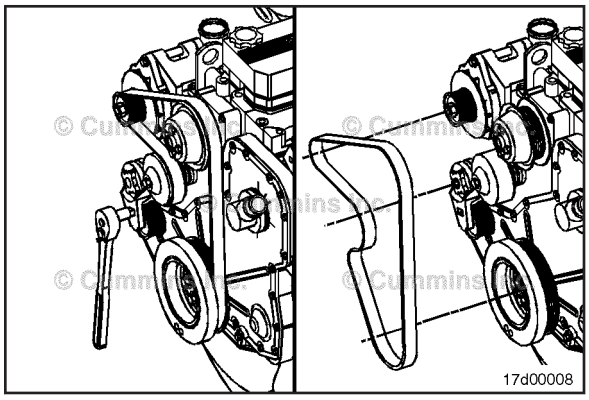
Connect the ground cable from the battery terminal.

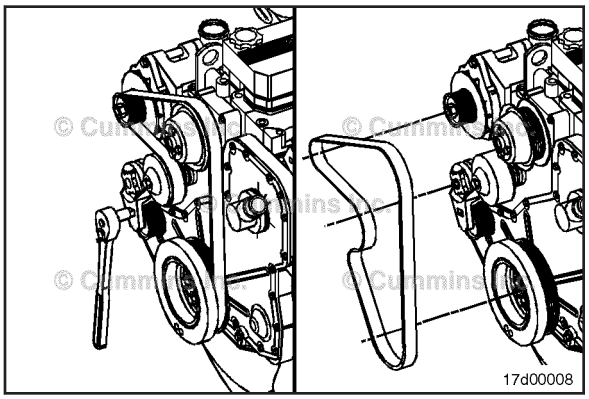


Belt Tensioner, Automatic (Alternator)

Preparatory Steps

Remove the drive belt.

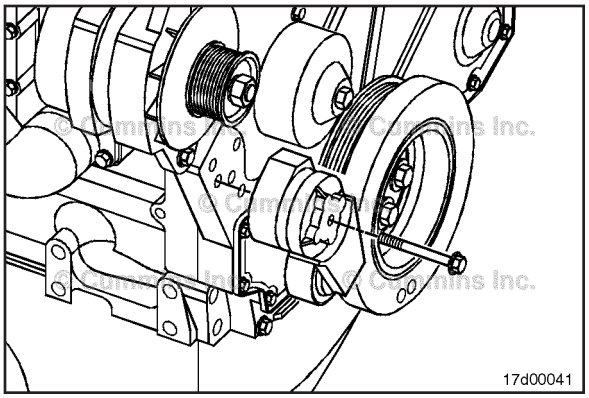




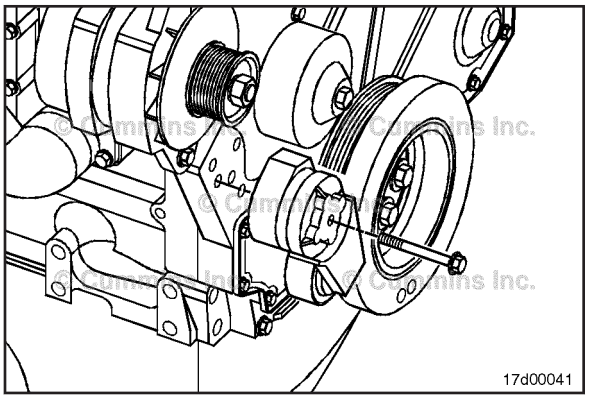
Remove

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

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



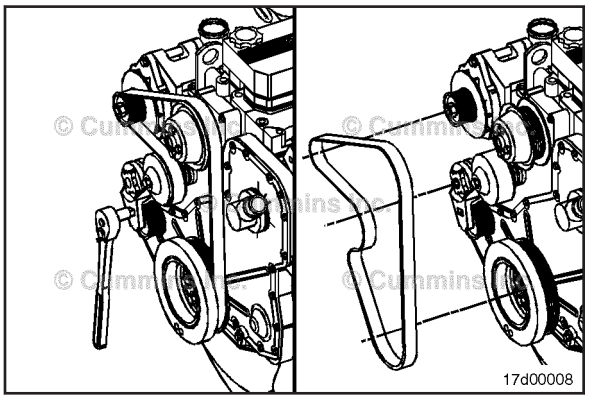
Remove the capscrew and belt tensioner from the bracket.



Install

Install the belt tensioner and capscrews.

Torque Value: 43 N•m [32 ft-lb]



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

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

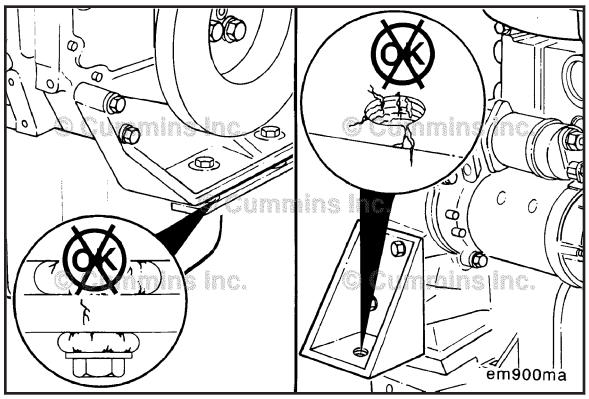
Engine Mounts

Inspect

Inspect all rubber-cushioned mounts for cracks or damage.

Inspect all mounting brackets for cracks or damaged bolt holes.

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



Notes

Section D - System Diagrams

Section Contents

This Page Left Intentionally Blank

System Diagrams - Overview

General Information

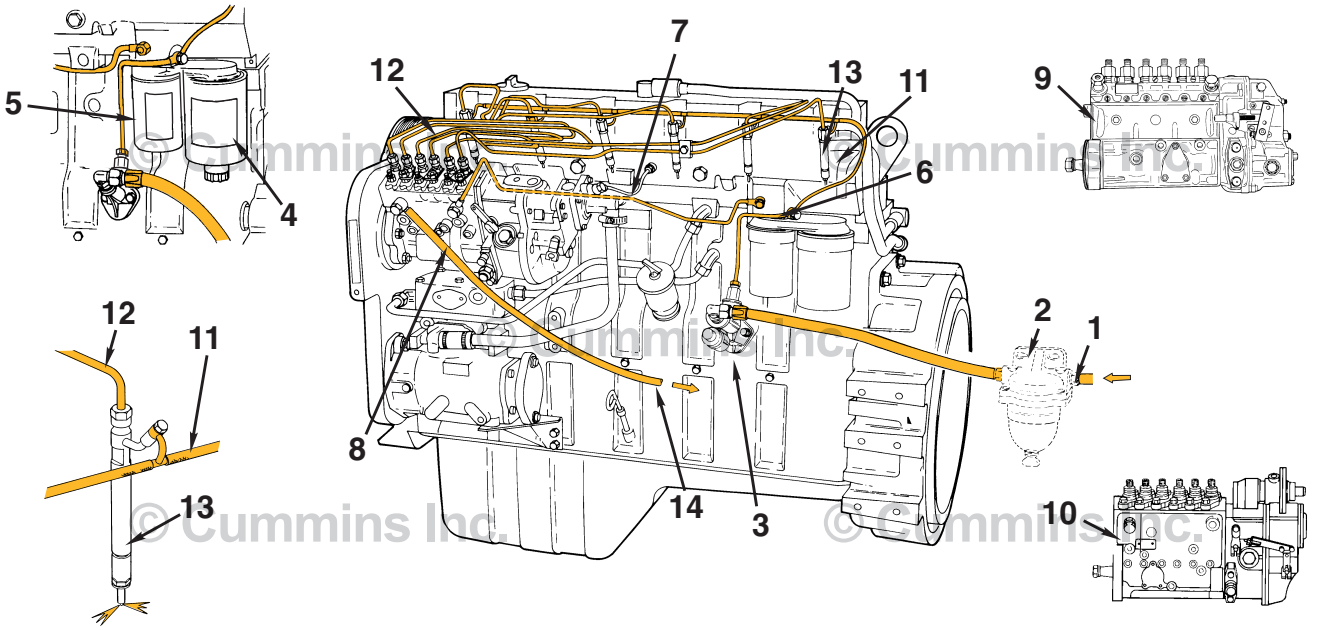
The following drawings show the flow through the engine systems. Although parts can change between different applications and installations, the flow remains the same. The systems shown are:

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

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

Flow Diagram, Fuel System

General Information



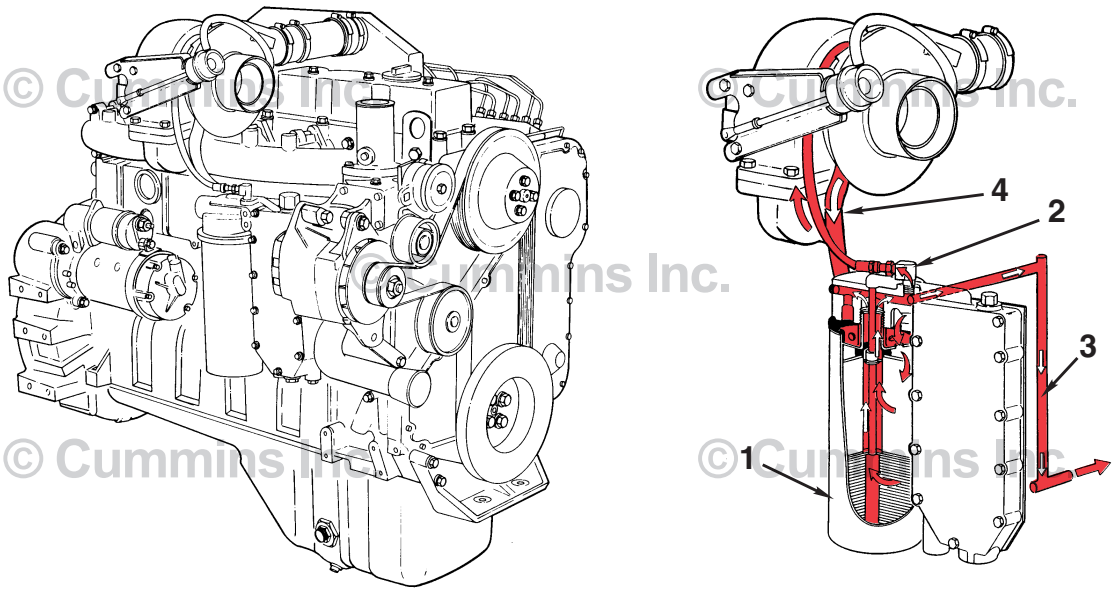
05900658

1 Fuel from supply tank
2 Prefilter or screen
3 Fuel transfer pump
4 Fuel/water separator
5 Fuel filter
6 Low-pressure supply line
7 Turbocharger boost control line
8 Bosch® PES.MW injection pump
9 Bosch® PES.A injection pump
10 Bosch® PES.P injection pump
11 Fuel drain manifold
12 High-pressure fuel lines
13 Hole-type injectors
14 Fuel return to supply tank.

Flow Diagram, Lubricating Oil System

Engine Views

All Applications



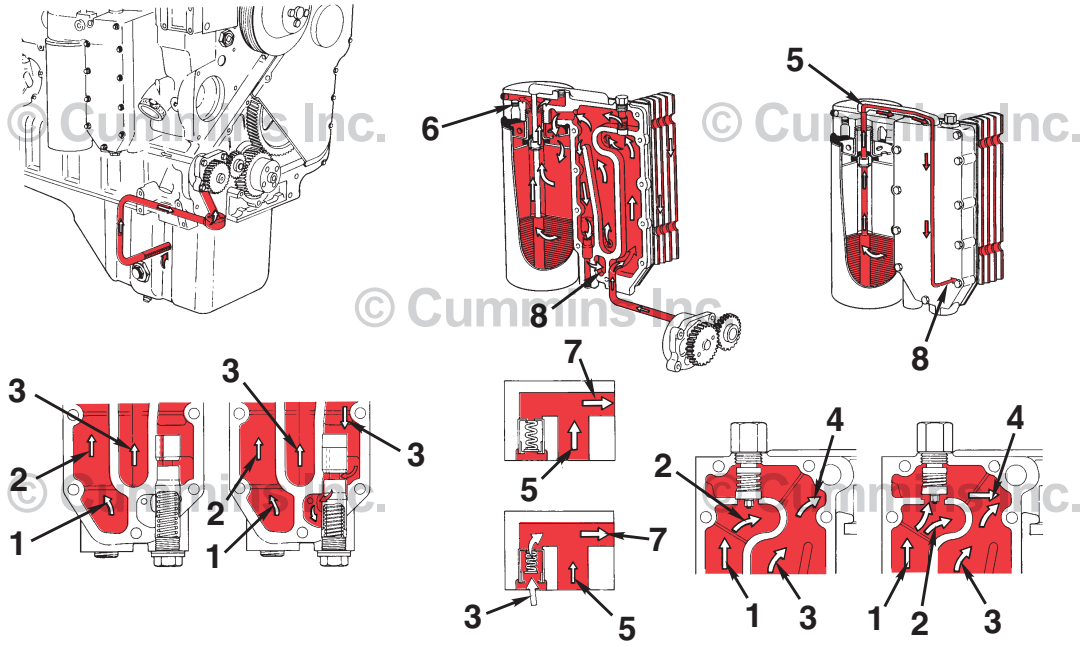
07900228

1 Oil filter
2 Turbocharger oil supply line
3 Flow to main oil rifle
4 Turbocharger oil drain line.

Flow Diagram, Lubricating Oil System

Engine Views

All Applications



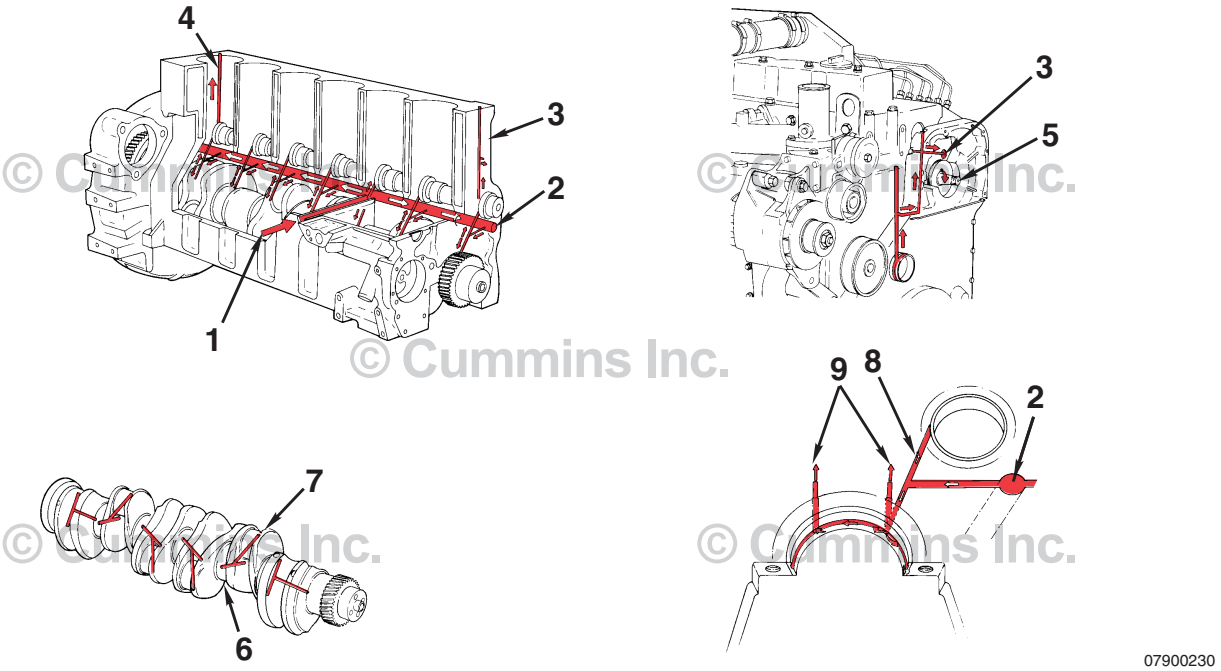
07900239

1 Flow from oil pump
2 Flow to oil cooler
3 Flow from oil cooler
4 Flow to oil filter
5 Flow from oil filter
6 Oil filter bypass valve
7 Flow to main oil rifle
8 Flow to oil pan.

Flow Diagram, Lubricating Oil System

Engine Views

All Applications



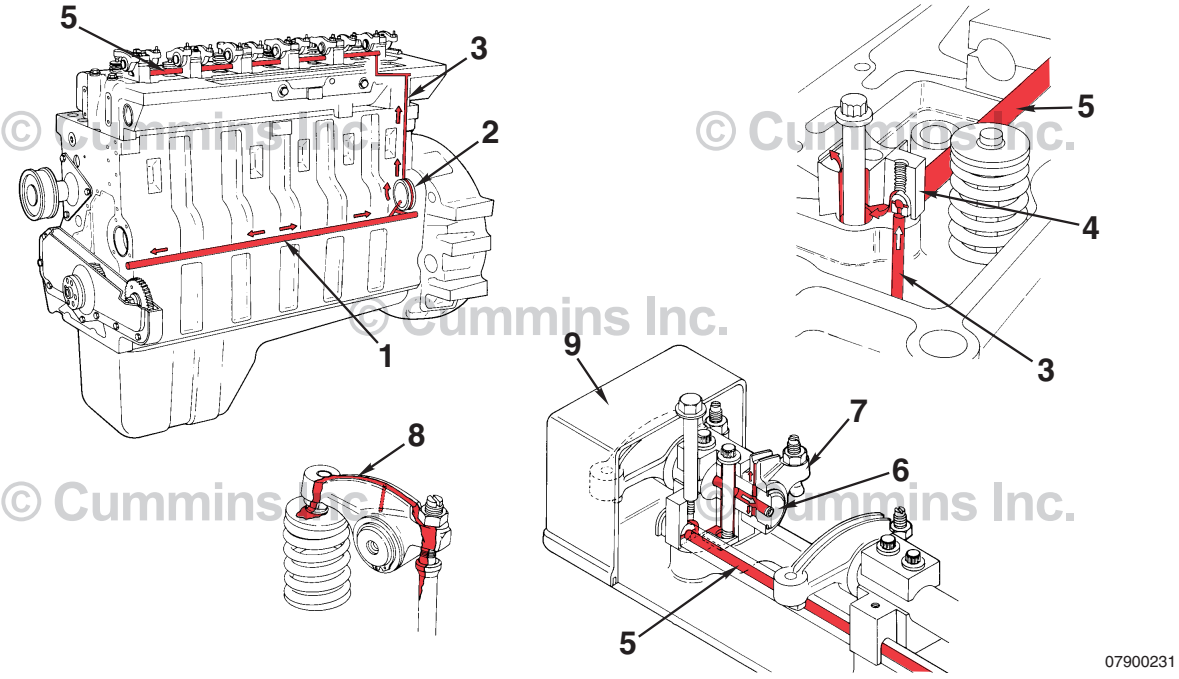
07900230

1 Flow from oil cooler
2 Main oil rifle
3 Flow to injection pump
4 Flow to overhead
5 Injection pump oil drain
6 Crankshaft main journal
7 Connecting rod journal
8 Flow to camshaft bore
9 Piston cooling nozzle.

Flow Diagram, Lubricating Oil System

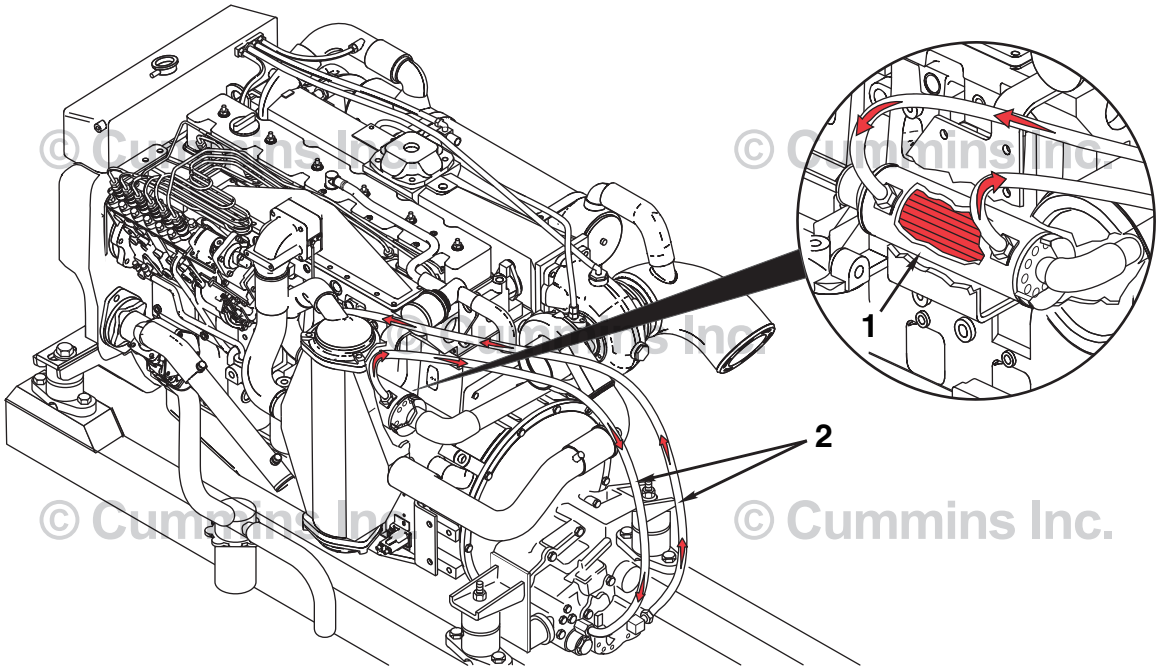
Engine Views

All Applications



1 Main oil rifle
2 Number 7 camshaft bushing
3 Flow from number 7 camshaft bore
4 Rocker lever support
5 Oil transfer tube
6 Rocker lever shaft
7 Rocker lever
8 Oil trough
9 Rocker lever cover.

Marine Applications



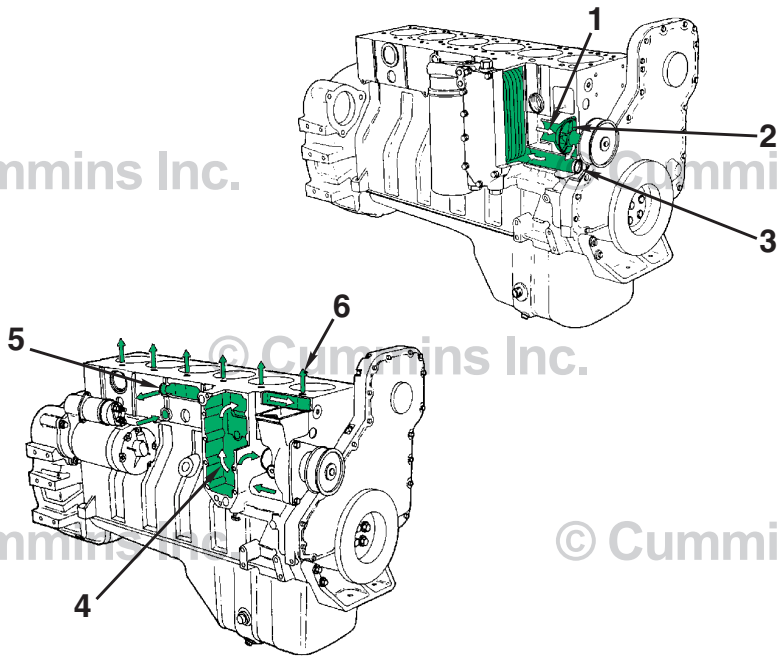
Sea Water Aftercooled

1 Marine gear oil cooler

2 Marine gear oil lines.

Flow Diagram, Cooling System

Engine Views



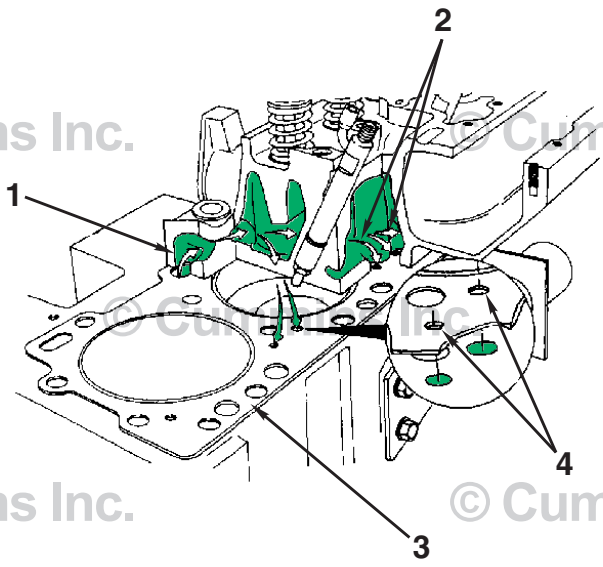
08900201

Cylinder Block

1. Coolant inlet
2. Water pump impeller
3. Coolant flow to oil cooler
4. Coolant flow past oil cooler
5. Upper coolant manifold
6. Coolant flow to cylinder head.

Flow Diagram, Cooling System

Engine Views



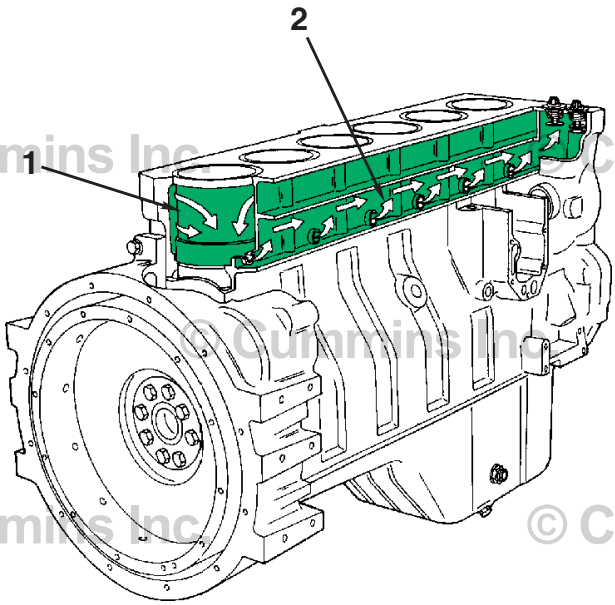
08900203

Cylinder Head

1. Flow from upper coolant manifold
2. Flow to liner cavity
3. Cylinder head gasket
4. Coolant flow orifice.

Flow Diagram, Cooling System

Engine Views



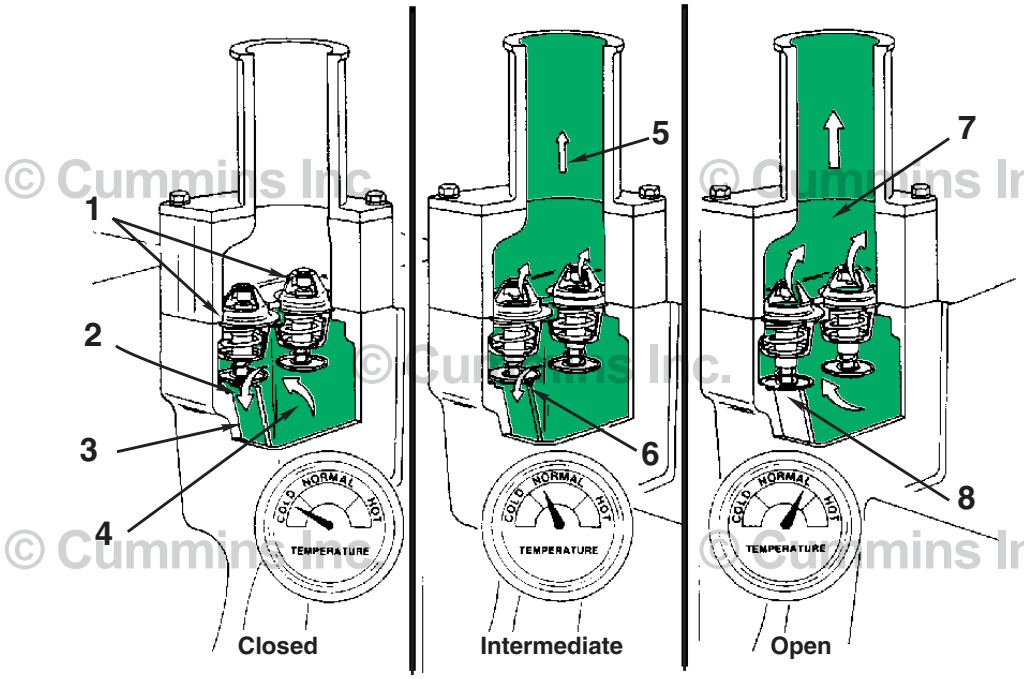
08900200

Cylinder Block

1. Flow past cylinder liners
2. Lower coolant manifold.

Flow Diagram, Cooling System

Engine Views



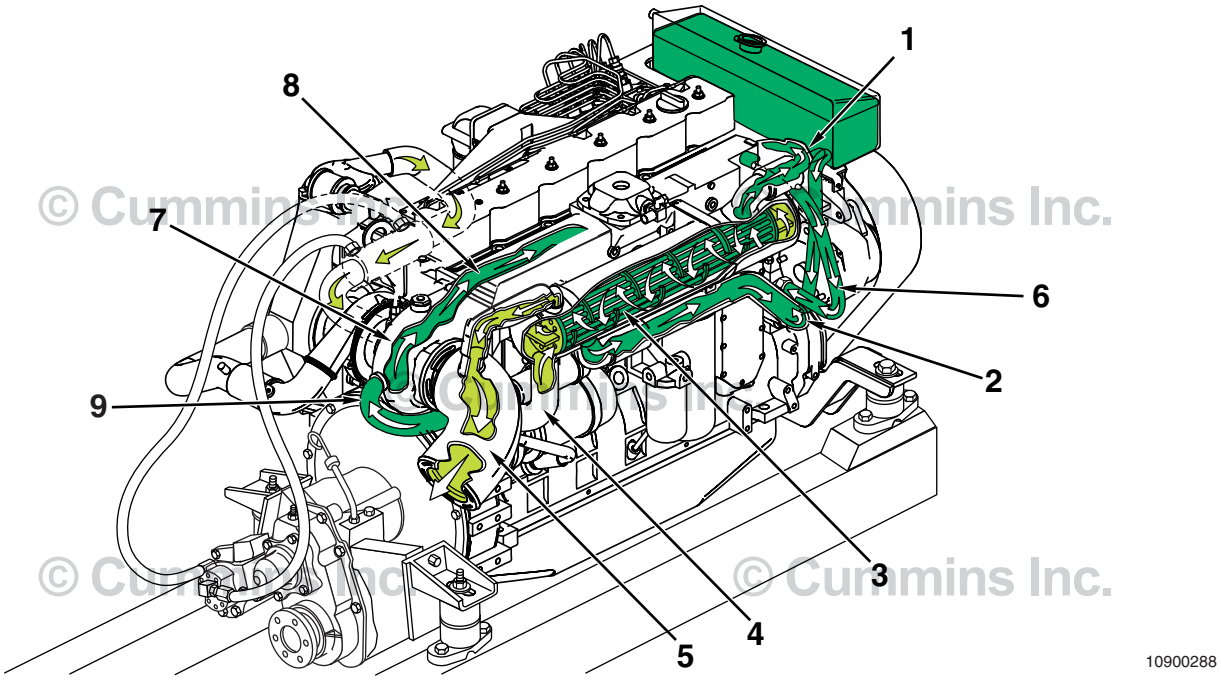
08900202

Thermostat

1. Thermostats
2. Flow to water pump inlet
3. Bypass passage open
4. Flow from lower coolant manifold
5. Partial coolant flow to radiator
6. Restricted flow to bypass
7. Flow to radiator
8. Bypass closed.

Flow Diagram, Cooling System

Engine Views

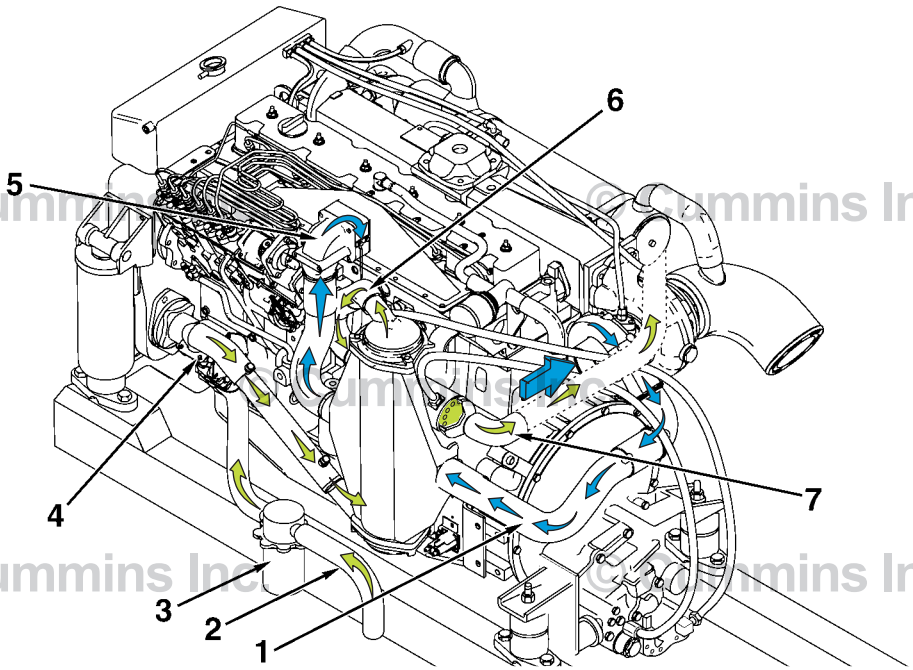


Sea Water Aftercooled

1. From thermostat (coolant outlet)
2. To water pump (coolant inlet)
3. Heat exchanger
4. Sea water from pump
5. Sea water outlet (in exhaust)
6. Coolant from exhaust manifold to block
7. Turbocharger exhaust housing
8. Exhaust manifold
9. Coolant from block.

Flow Diagram, Cooling System

Engine Views



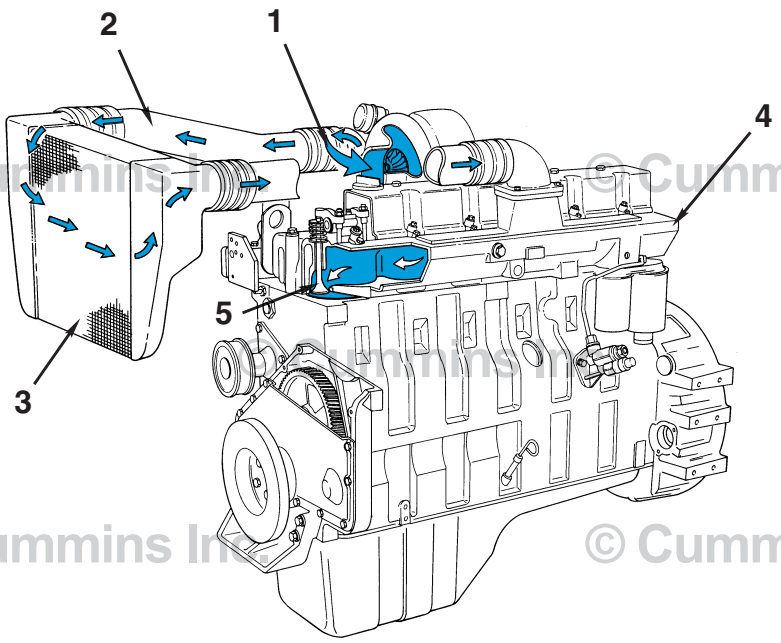
Sea Water Aftercooled

1. Turbocharger air to aftercooler
2. Sea water inlet
3. Sea water strainer
4. Sea water pump
5. Cooled air to intake manifold
6. Sea water from aftercooler to gear cooler
7. Sea water from gear cooler to heat exchanger.

Flow Diagram, Air Intake System

Engine Views

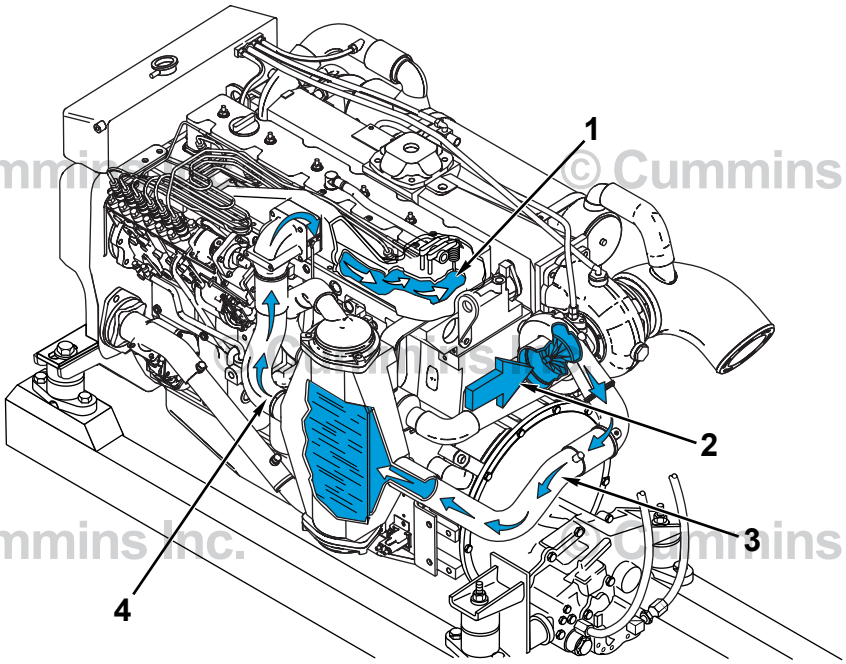
Industrial Applications



10900277

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.

Marine Applications



10900284

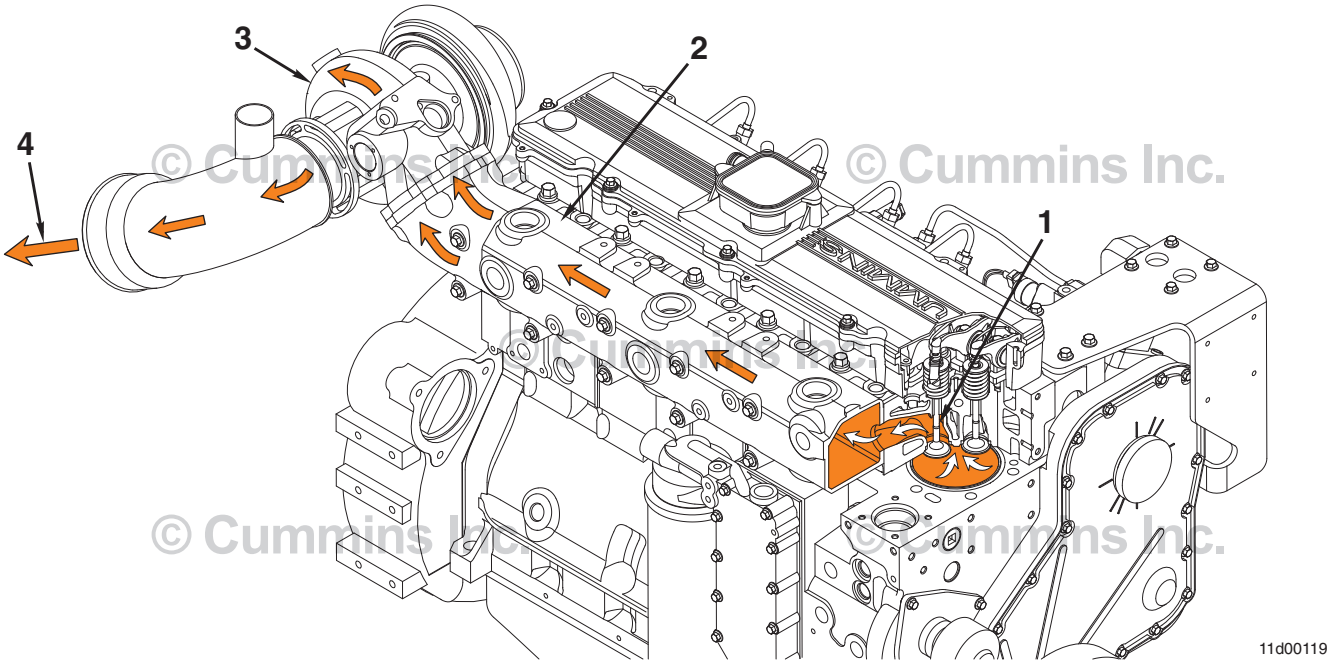
Sea Water Aftercooled

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

Flow Diagram, Exhaust System

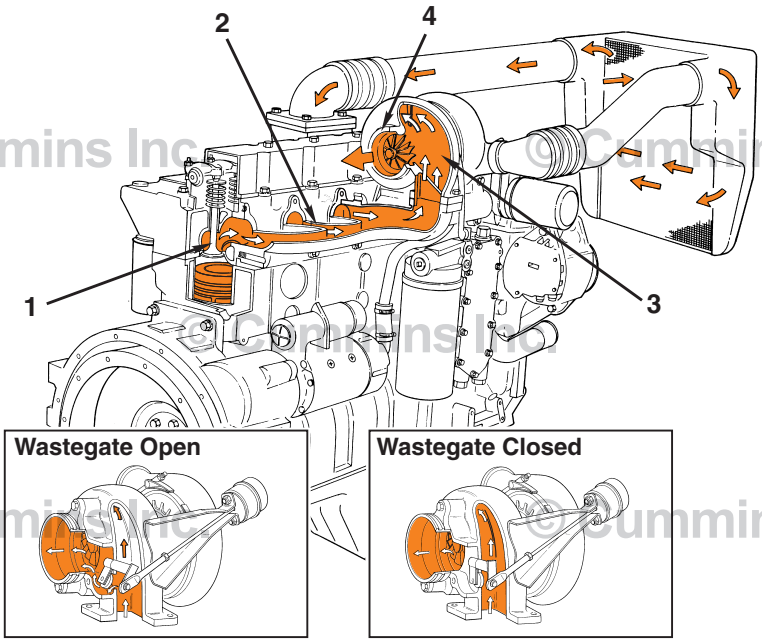
Engine Views

Marine Applications



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

Industrial Applications



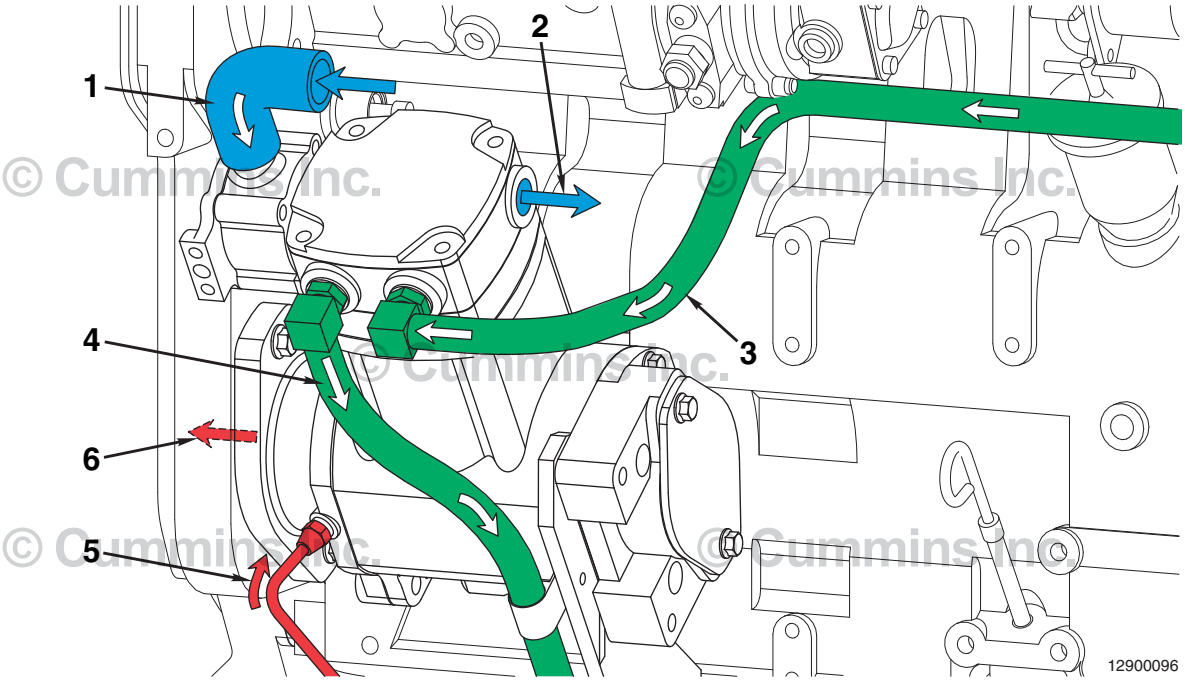
11900058

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

Flow Diagram, Compressed Air System

Engine Views

Marine and Industrial Applications



1. Air in
2. Air out
3. Coolant in
4. Coolant out
5. Lubricating oil in
6. Lubricating oil drain.

Section L - Service Literature

Section Contents

This Page Left Intentionally Blank

Additional Service Literature

General Information

The following publications can be purchased by contacting the nearest local distributor.

Bulletin Number	Title of Publication
3666003	C Series Troubleshooting and Repair Manual
3666008	C Series Engine Shop Manual
3666021	C Series Specifications Manual
3379001	Fuel for Cummins Engines Bulletin
3666132	Coolant Requirements and Maintenance Bulletin
3379009	Operation, Cold Weather
3810340	Cummins Engine Oil Recommendations Bulletin
3666109	Alternative Repair Manual, B and C Series Engines
3379000	Air for Your Engines
3381700	Worldwide Service Locations
3666109	C Series Alternative Repair Manual

Service Literature Ordering Location

Contact Information

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

Cummins Customized Parts Catalog

General Information

Cummins is pleased to announce the availability of a parts catalog compiled specifically for you. Unlike the generic versions of parts catalogs that support general high volume parts content; Cummins Customized catalogs 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 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

Section S - Service Assistance

Section Contents

This Page Left Intentionally Blank

Routine Service and Parts

General Information

Personnel at Cummins Authorized Repair Locations can assist you with the correct operation and service of your system. 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, refer to the directory in this section, or the Service Locator at www.cummins.com for the nearest Cummins Authorized Repair Location.

Emergency and Technical Service

General Information

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

If additional assistance is required, call Toll-Free:

- 1-800-DIESELS
- (1-800-343-7357)
- Includes all 50 states, Bermuda, Puerto Rico, Virgin Islands, and the Bahamas.
- East Asia - Customer Assistance Center also for Chinese Domestic Market support Toll-Free:
- 400-810-5252
- Outside of North America contact your Regional Office. Telephone numbers and addresses are listed in the International Directory.

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, the directory in this section, or the Service Locator at www.cummins.com for the nearest Cummins Authorized Repair Location. If the problem has **not** been handled satisfactorily, follow the steps outlined below:

- If the disagreement is with a Dealer, talk to the Cummins Distributor with whom he has his service agreement.
- 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:
  - Engine model and serial number
  - Type and make of equipment
  - Total kilometers [miles] or hours of operation
  - Warranty start date
  - Nature of problem
  - Summary of the current problem arranged in the order of occurrence
  - Name and location of the Cummins Distributor or Dealer
- If a problem can **not** be resolved satisfactorily through your Cummins Authorized Repair Location or Division Office, contact:
  - Cummins Customer Assistance Center - 41403, Cummins Inc., Box 3005, Columbus, IN 47202-3005
  - Telephone: +1 800-diesels / +1 800-343-7357 (USA Only)

- Telephone: +1 812-377-3000 (International)

Division and Regional Offices - Locations

Australia Regional Office (This office also serves New Zealand)		Cummins Engine Company Pty. Ltd., 2 Caribbean Drive Scoresby, Victoria, 3179, Australia, Telephone: (61-3) 9765-3222, Fax: (61-3) 9763-0079
Cummins Americas Regional Office (This office serves Puerto Rico and South America excluding Brazil)		Cummins Americas Inc., 3350 SW 148 Avenue, Suite 205, Miramar, FL, 33027, U.S.A, Telephone: [1-954] 431-5511, Fax: [1-954] 433-5797
China Beijing		Cummins (China) Investment Co. Ltd, 28F, Tower A, GATEWAY, No.18, Xiaguangli North Road, East Third Ring, Chaoyang District, Beijing, 100027, China, Telephone: [86-10] 84548888, Fax: [86-10] 67876347
Brazil		Cummins Brasil Ltda., Rua Jati, 26607180-900 Guarulhos, Sao Paulo, Brazil, Phone: [55-11] 6465-9811, Fax: [55-11] 6412-1483
Daventry (Africa, Middle East, Czech Republic)		Cummins Engine Company Ltd, Royal Oak Way South, Daventry, Northants, NN11 5NU, United Kingdom, Telephone: [44-1327] 886000, Fax: [44-1327] 886106
Dubai - United Arab Emirates		Cummins Middle East FZE, Units ZF 5/6Jebel Ali Free Zone, P.O.Box No 17636, Dubai, United Arab Emirates, Telephone: [971-4] 883 8998, Fax: [971-4] 883 7971
India - Pune		Cummins India Ltd., Kothrud, Pune, Maharashtra, 411029, India, Telephone: [91-20] 2538-5435 / 0240 / 1105, Fax: [91-20] 2538-0125
Korea - Seoul		Cummins Korea Ltd., 25th floor, ASEM tower,159-1, Samsung-Dong, Kangnam-ku, Seoul, 135-798, South Korea, Telephone: [82-2] 3420-0901, Fax: [82-2] 3452-4113 / 539-6569
SLP Mexico		Cummins, S. de R.L. de C.V., Arquimedes No. 209Col., Polanco, Mexico Distrito Federal, 11560, Mexico, Telephone: [52-5] 254-3822 / 3783 / 3622, Fax: [52-5] 254-3645
Russia - Moscow		Cummins Engine Company, Inc., Park Place, Office E708, 113/1 Leninskiy Prospect, Moscow, 117198, Russia, Telephone: [7-495] 956-51-22 / 23, Fax: [7-495] 956-53-62
Singapore		Cummins Diesel Sales Corporation, 8 Tanjong Penjuru, Singapore, 609019, Singapore, Telephone: [65] 6265-0155,

Distributors and Branches - United States

Alabama	**Birmingham**	Cummins Mid-South, LLC 2200 Pinson Highway P.O. Box 1147 Birmingham, AL 35217 Telephone: (205) 841-0421 FAX: (205) 849-5926
Alabama	**Mobile**	Cummins Mid-South, LLC 1924 N. Beltline Hwy. Mobile, AL 36617 Telephone: (334) 456-2236 FAX: (334) 452-6419
Alaska	**Anchorage**	Cummins Northwest, Inc. 2618 Commercial Drive Anchorage, AK 99501-3095 Telephone: (907) 279-7594 FAX: (907) 276-6340
Arizona	**Phoenix**	Cummins Rocky Mountain, LLC 2239 N. Black Canyon Hgwy Phoenix, AZ 85009 Telephone: (602) 252-8021 FAX: (602) 253-6725
Arkansas	**Little Rock**	Cummins Mid-South, Inc. 6600 Interstate 30 Little Rock, AR 72209 Telephone: Sales: (501) 569-5600 Service: (501) 569-5656 Parts: (501) 569-5613 FAX: (501) 565-2199
California	**San Leandro**	Cummins West, Inc. 14775 Wicks Blvd. San Leandro, CA 94577-6779 Telephone: (510) 351-6101 FAX: (510) 352-3925
California	**Arcata**	Cummins West, Inc. 4751 West End Road Arcata, CA 95521 Telephone: (707) 822-7392 FAX: (707) 822-7585
California	**Bakersfield**	Cummins West, Inc. 4601 East Brundage Lane Bakersfield, CA 93307 Telephone: (805) 325-9404 FAX: (805) 861-8719
California	**Fresno**	Cummins West, Inc. 5333 N Cornelia Ave Fresno, CA 93722 Telephone: (559) 277-6760 FAX: (559) 277-6769

California	**Redding**	Cummins West, Inc. 20247 Charlanne Drive Redding, CA 96002 Telephone: (530) 222-4070 FAX: (530) 224-4075
California	**Stockton**	Cummins West, Inc. 5250 Claremont Ave Suite 204 Stockton, California 95207, USA Telephone: (209) 472-3460 FAX: (209) 472-3450
California	**West Sacramento**	Cummins West, Inc. 875 Riverside Parkway West Sacramento, CA 95605-1502 Telephone: (916) 371-0630 FAX: (916) 371-2849
California	**Los Angeles**	Cummins Cal Pacific Inc. 1939 Deere Avenue (Irvine) Irvine, CA 92606 Telephone: (949) 253-6000 FAX: (949) 253-6070
California	**Montebello**	Cummins Cal Pacific Inc. 1105 South Greenwood Avenue Montebello, CA 90640 Telephone: (323) 728-8111 FAX: (323) 889-7499
California	**Bloomington**	Cummins Cal Pacific Inc. 3061 S. Riverside Avenue Bloomington, CA 92316 Telephone: (909) 877-0433 FAX: (909) 877-3787
California	**San Diego**	Cummins Cal Pacific Inc. 310 N. Johnson Avenue El Cajon, CA 92020 Telephone: (619) 593-3093 FAX: (619) 593-0600
California	**Ventura**	Cummins Cal-Pacific Inc. 3958 Transport St. Ventura, CA 93003 Telephone: (805) 644-7281 FAX: (805) 644-7284
Colorado	**Denver**	Cummins Rocky Mountain, Inc. 8211 East 96th Ave Henderson, Colorado 80640 Telephone: (303) 287-0201 FAX: (303) 288-7080
Colorado	**Grand Junction**	Cummins Rocky Mountain, Inc. 2380 U.S. Highway 6 & 50 P.O. Box 339 Grand Junction, CO 81501 Telephone: (970) 242-5776 FAX: (970) 243-5494

Connecticut	**Rocky Hill**	Cummins Metropower, Inc. 914 Cromwell Ave. Rocky Hill, CT 06067 Telephone: (860) 529-7474 FAX: (860) 529-7524
Florida	**Ft. Myers**	Cummins Power South, LLC 2671 Edison Avenue Ft. Myers, FL 33916 Telephone: (941) 337-1211 FAX: (941) 337-5374
Florida	**Jacksonville**	Cummins Power South 755 Pickettville Rd. Jacksonville, FL 32220 Telephone: (904) 378-1902 FAX: (904) 378-1904
Florida	**Hialeah (Miami)**	Cummins Power South, LLC 9900 N.W. 77th Avenue Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 FAX: (305) 557-2992
Florida	**Ocala**	Cummins Power South, LLC 321 Southwest 52nd Ave. Ocala, FL 34474-1892 Telephone: (352) 861-1122 FAX: (352) 861-1130
Florida	**Orlando**	Cummins Power South, LLC 4020 North Orange Blossom Trail Orlando, FL 32810 Telephone: (407) 298-2080 FAX: (407) 290-8727
Florida	**Tampa**	Cummins Power South, LLC 5421 N. 59th Street Tampa, FL 33610 Telephone: (813) 621-7202 FAX: (813) 621-8250
Florida		Cummins Power South, LLC 5906 Breckenridge Parkway Suite J Tampa, FL 33610 Telephone: (813) 664-5868 FAX: (813) 623-5442
Florida		Cummins Power South, LLC 5912 E. Hillsborough Avenue Tampa, FL 33610 Telephone: (813) 626-1101 FAX: (813) 628-8888
Florida		Cummins Power South, LLC 6606 N. 56th Street Tampa, FL 33610 Telephone: (813) 623-3330 FAX: (813) 628-4162

Georgia	**Atlanta**	Cummins South, Inc. 100 University Ave. S.W. Atlanta, Georgia 30315-2202 Telephone: (404) 527-7800 FAX: (404) 527-7832
Georgia		Cummins South, Inc. 5125 Georgia Highway 85 College Park, GA 30349 Telephone: (404) 763-0151 FAX: (404) 766-2132
Georgia	**Albany**	Cummins South, Inc. 1915 W. Oakridge Drive Albany, GA 31707-4938 Telephone: (912) 888-6210 FAX: (912) 883-1670
Georgia	**Augusta**	Cummins South, Inc. 1255 New Savannah Road Augusta, GA 30901-3891 Telephone: (706) 722-8825 FAX: (706) 722-7553
Georgia	**Savannah**	Cummins South, Inc. 8 Interchange Court Savannah, GA 31401-1627 Telephone: (912) 232-5565 FAX: (912) 232-5145
Hawaii	**Kapolei**	Cummins West Inc. 91-230 Kalaeloa Blvd. Kapolei, HI 96707 Telephone: (808) 682-8110 FAX: (808) 682-8477
Idaho	**Boise**	Cummins Rocky Mountain, LLC 8949 So. Federal Way City Boise, Idaho 84716 Telephone: (208) 336-5000 FAX: (208) 338-5436
Illinois	**Chicago**	Cummins Power, LLC 7145 Santa Fe Drive Hodgkins, IL 60525 Telephone: (708) 579-9222 FAX: (708) 352-7547
Illinois	**Bloomington**	Cummins Mid-States Power, Inc. (at U.S. 51 N and I-55) 414 W. Northtown Road Bloomington-Normal, IL 61761 Telephone: (309) 452-4454 FAX: (309) 452-1642
Illinois	**Onan Branch**	Cummins/Onan Northern Illinois 8745 W. 82nd Place Justin, IL 60458 Telephone: (708) 563-7070 FAX: (708) 563-7095

Illinois	**Madison**	Cummins MId-South, LLC 222 SR-203 Madison, Illinois 62060 Telephone: (618) 798-9512 FAX: (618) 798-9521
Illinois	**Rock Island**	Cummins Central Power, LLC 7820 - 42nd Street West Rock Island, IL 61201 Telephone: (309) 787-4300 FAX: (309) 787-4397
Indiana	**Indianapolis**	Cummins Mid-States Power, Inc. P.O. Box 42917 3762 West Morris Street Indianapolis, IN 46242-0917 Telephone: (317) 243-7979 FAX: (317) 240-1925
Indiana		Cummins Mid-States Power, Inc. P.O. Box 42917 3661 West Morris St Indianapolis, IN 46241 Telephone: (317) 486-5287 FAX: (317) 486-5281
Indiana		Cummins Mid-States Power, Inc. 4301 W. Morris St. 3762 West Morris Street Indianapolis, IN 46241 Telephone: (317) 240-1967 FAX: (317) 240-1975
Indiana	**Evansville**	Cummins Cumberland, Inc. 7901 Highway 41 North Evansville, IN 47725 Telephone: (812) 867-4400 FAX: (812) 867-4411
Indiana	**Ft. Wayne**	Cummins Mid-States Power, Inc. 3415 Coliseum Blvd. West (At Jct. I-69 & 30/33) Ft. Wayne, IN 46808 Telephone: (219) 482-3691 FAX: (219) 484-8930
Indiana	**Gary**	Cummins Northern Illinois, Inc. 1440 Texas Street Gary, IN 46402 Telephone: (219) 885-5591 FAX: (219) 883-4817
Indiana	**Indianapolis**	Cummins Mid-States Power, Inc. 3661 West Morris St Indianapolis, IN 46241 Telephone: (317) 486-5287 FAX: (317) 486-5281
Iowa	**Cedar Rapids**	Cummins Central Power, LLC 625 - 33rd Avenue SW Cedar Rapids, IA 52404 Telephone: (319) 366-7537 (24 hours) FAX: (319) 366-7562

Iowa	**Des Moines**	Cummins Central Power, LLC 1680 N.E. 51st Avenue Des Moines, IA 50313 Telephone: (515) 262-9591 Parts: (515) 262-9744 FAX: (515) 262-0626
Kansas	**Colby**	Cummins Central Power, LLC 1880 South Range Colby, KS 67701 Telephone: (785) 462-3945 FAX: (785) 462-3970
Kansas	**Garden City**	Cummins Central Power, LLC 1285 Acraway Garden City, KS 67846 Telephone: (316) 275-2277 FAX: (316) 275-2533
Kansas	**Wichita**	Cummins Central Power, LLC 5101 North Broadway Wichita, KS 67219 Telephone: (316) 838-0875 FAX: (316) 838-0704
Kentucky	**Louisville**	Cummins Cumberland, Inc. (Corporate Office) 2301 Nelsonville Parkway Louisville, KY 40223 Telephone: (502) 254-7375 FAX: (502) 254-1215
Kentucky	**Hazard**	Cummins Cumberland, Inc. Highway 15 South Hazard, KY 41701 Telephone: (606) 436-5718 FAX: (606) 436-5038
Kentucky	**Louisville**	Cummins Cumberland, Inc. 9820 Bluegrass Parkway Louisville, KY 40299 Telephone: (502) 491-4263 FAX: (502) 499-0896
Louisiana	**Morgan City**	Cummins Mid-South, LLC 9508 Highway 90 E Amelia, LA 70340 Telephone: (504) 631-0576 FAX: (504) 631-0081
Louisiana	**New Orleans**	Cummins Mid-South, LLC 110 E. Airline Highway Kenner, LA 70062 Telephone: (504) 465-3412 FAX: (504) 465-3408
Maine	**Scarborough**	Cummins Northeast, Inc. 10 Gibson Road Scarborough, ME 04074 Telephone: (207) 883-8155 FAX: (207) 883-5526

Maryland	**Baltimore**	Cummins Power Systems, Inc. 1907 Park 100 Drive MD 21061 Telephone: (410) 590-8700 FAX: (410) 590-8731
Massachusetts	**Boston**	Cummins Northeast, Inc. 100 Allied Drive Dedham, MA 02026 Telephone: (781) 329-1750 FAX: (781) 329-4428
Massachusetts	**Springfield**	Cummins Northeast, Inc. 177 Rocus Street Springfield, MA 01104 Telephone: (413) 737-2659 FAX: (413) 731-1082
Michigan	**Detroit (New Hudson)**	Standby Power, Div. of Cummins Bridgeway, LLC 21810 Clessie Ct New Hudson, Michigan 48165 Telephone: (248) 573-1600
Michigan		Cummins Bridgeway, LLC 54240 Grand River Ave New Hudson, Michigan 48165 Telephone: (517) 573-1900
Michigan	**Grand Rapids**	Cummins Bridgeway, LLC 3715 Clay Avenue, S.W. Grand Rapids, MI 49508 Telephone: (616) 538-2250 FAX: (616) 538-3830
Michigan	**Grand Rapids**	Standby Power, Inc. 7580 Expressway Drive S.W. Grand Rapids, MI 49548 Telephone: (616) 281-2211 FAX: (616) 281-3177
Michigan	**Iron Mountain**	Cummins NPower, LLC 1901 Stevenson Avenue Iron Mountain, MI 49801 Telephone: (906) 774-2424 FAX: (906) 774-1190
Michigan	**Saginaw**	Cummins Bridgeway, LLC 722 N. Outer Drive Saginaw, MI 48605 Telephone: (989) 752-5200 FAX:(989) 752-4194
Minnesota	**St. Paul**	Cummins NPower, LLC 3030 Centre Pointe Drive Suite 500 Roseville, MN 55113 Telephone: (651) 636-1000 FAX: (651) 638-2442
Minnesota	**Duluth**	Cummins NPower, LLC 3115 Truck Center Drive Duluth, MN 55806-1786 Telephone: (218) 628-3641 FAX: (218) 628-0488

Mississippi	**Jackson**	Cummins Mid-South, LLC 325 New Highway 49 South Jackson, MS 39288-4224 Telephone: (601) 939-7016 FAX: (601) 932-7399
Missouri	**Kansas City**	Cummins Central Power, LLC 8201 NE Parvin Road Kansas City, MO 64161 Telephone: (816) 414-8200 FAX: (816) 414-8299
Missouri	**Joplin**	Cummins Central Power, LLC 3507 East 20th Street Joplin, MO 64801 Telephone: (417) 623-1661 FAX: (417) 623-1817
Missouri	**Springfield**	Cummins Central Power, LLC 3637 East Kearney Springfield, MO 65803 Telephone: (417) 862-0777 FAX: (417) 862-4429
Missouri	**Columbia**	Cummins Mid-South, LLC 5221 Highway 763 North Columbia, MO 65205 Telephone: (314) 449-3711 FAX: (314) 449-3712
Missouri	**Sikeston**	Cummins Mid-South, LLC 101 Keystone Drive Sikeston, MO 63801 Telephone: (573) 472-0303 FAX: (573) 472-0306
Missouri	**Industrial Power Branch**	Cummins Mid-South, LLC 3256 E. Outer Road Scott City, MO 63780 Telephone: (573) 335-7399 FAX: (573) 335-7062
Montana	**Billings**	Cummins Rocky Mountain, LLC 5151 Midland Road Billings, MT 59101 Telephone: (406) 245-4194 FAX: (406) 245-7923 Toll Free #: (800) 332-7788
Montana	**Missoula**	Cummins Northwest, Inc. 4950 North Reserve Street Missoula, MT 59802-1498 Telephone: (406) 728-1300 FAX: (406) 728-8523
Nebraska	**Omaha**	Cummins Great Plains Diesel, Inc. 5515 Center Street Omaha, NE 68106 Telephone: (402) 551-7678 (24 Hours) FAX: (402) 551-1952

Nebraska	**Kearney**	Cummins Central Power, LLC 515 Central Avenue Kearney, NE 68847 Telephone: (308) 234-1994 FAX: (308) 234-5776
Nevada	**Elko**	Cummins Rocky Mountain, LLC 5370 East Idaho Street Elko, NV 89801 Telephone: (702) 738-6405 FAX: (702) 738-1719
Nevada	**Las Vegas**	Cummins Rocky Mountain, LLC 2750 Losee Road North Las Vegas, NV 89030 Telephone: (702) 399-2614 FAX: (702) 399-7457
Nevada	**Sparks**	Cummins Rocky Mountain, LLC 150 Glendale Avenue Sparks, NV 89431 Telephone: (775) 331-4983 FAX: (775) 331-7429
New Jersey	**Newark**	Cummins Metropower, Inc. 41-85 Doremus Ave. Newark, NJ 07105 Telephone: (973) 491-0100 FAX: (973) 578-8873
New Mexico	**Albuquerque**	Cummins Rocky Mountain, LLC 1921 Broadway N.E. Albuquerque, NM 87102 Telephone: (505) 247-2441 FAX: (505) 842-0436
New Mexico	**Farmington**	Cummins Rocky Mountain, LLC 1101 North Troy King Road Farmington, NM 87401 Telephone: (505) 327-7331 FAX: (505) 326-2948
New York	**Bronx**	Cummins Metropower, Inc. 890 Zerega Avenue Bronx, NY 10473 Telephone: (718) 892-2400 FAX: (718) 892-0055
New York	**Albany**	Cummins Northeast, Inc. 101 Railroad Avenue Albany, NY 12205 Telephone: (518) 459-1710 FAX: (518) 459-7815
New York	**Buffalo**	Cummins Northeast, Inc. 480 Lawrence Bell Dr. Williamsville, NY 14221-7090 Telephone: (716) 631-3211 FAX: (716) 626-0799

New York	**Syracuse**	Cummins Northeast, Inc. 6193 Eastern Avenue Syracuse, NY 13211 Telephone: (315) 437-2751 FAX: (315) 437-8141
North Carolina	**Charlotte**	Cummins Atlantic, Inc. 11101 Nations Ford Road Charlotte, NC 28273 Telephone: (704) 588-1240 FAX: (704) 587-4870
North Carolina	**Charlotte**	Cummins Atlantic, Inc. 3700 North Interstate 85 Charlotte, NC 28206 Telephone: (704) 596-7401 FAX: (704) 596-3038
North Carolina	**Greensboro**	Cummins Atlantic, Inc. 513 Preddy Boulevard >=reensboro, NC 27406 Telephone: (336) 275-4531 FAX: (336) 275-8304
North Dakota	**Fargo**	Cummins NPower, LLC 3801 - 34th Ave. SW Fargo, ND 58104 Telephone: (701) 282-2466 FAX: (701) 277-5399
North Dakota	**Grand Forks**	Cummins NPower, LLC 4728 Gateway Drive Grand Forks, ND 58201 Telephone: (701) 775-8197 FAX: (701) 775-4833
North Dakota	**Minot**	Cummins NPower, LLC 1501 - 20th Avenue, S.E. Minot, ND 58701 Telephone: (701) 852-3585 FAX: (701) 852-3588
Ohio	**Columbus**	Cummins Bridgeway, LLC 4000 Lyman Drive Hilliard (Columbus), OH 43026 Telephone: (614) 771-1000 FAX: (614) 771-0769
Ohio	**Cincinnati**	Cummins Interstate Power, Inc. 10470 Evendale Drive Cincinnati, OH 45241 Telephone: (513) 563-6670 FAX: (513) 563-0594
Ohio	**Cleveland**	Cummins Bridgeway, LLC 7585 Northfield Road Cleveland, OH 44146 Telephone: (440) 439-6800 FAX: (440) (440) 439-2131 Toll Free: (800) 243-6885

Ohio	**Toledo**	Cummins Bridgeway, LLC 801 Illinois Avenue Maumee , OH 43537 Telephone: (419) 893-8711 FAX: (419) 893-5362
Ohio	**Youngstown**	Cummins Bridgeway, LLC 7145 Masury Road Hubbard (Youngstown), OH 44425 Telephone: (216) 534-1935 FAX: (216) 534-5606
Oklahoma	**Oklahoma City**	Cummins Southern Plains ,Ltd. 5800 West Reno Oklahoma City, OK 73127 Telephone: (405) 946-4481 (24 hours) FAX: (405) 946-3336
Oklahoma	**Tulsa**	Cummins Southern Plains, Ltd. 16525 East Skelly Drive Tulsa, OK 74116 Telephone: (918) 234-3240 FAX: (918) 234-2342
Oregon	**Coburg/Eugene**	Cummins Northwest, Inc. 91201 Industrial Parkway Coburg, OR 97401 (Telephone: (541) 687-0000 FAX: (541) 687-1977 Toll Free Telephone (800)777-0336
Oregon	**Medford**	Cummins Northwest, Inc. 4045 Crater Lake Highway Medford, OR 97504-9796 Telephone: (541) 779-0151 FAX: (541) 772-2395 Toll Free Telephone (800)826-9414
Oregon	**Pendleton**	Cummins Northwest, Inc. 223 S.W. 23rd Street Pendleton, OR 97801-1810 Telephone: (541) 276-2561 FAX: (541) 276-2564 Toll Free Telephone (800)666-2561
Oregon	**Portland**	Cummins Northwest, Inc. 4711 N. Basin Avenue Portland, OR 97217-3557 Telephone: (503)286-5938 FAX: (503)286-5938 Toll Free Telephone: ((800)283-0336 FAX: (503)240-5553
Pennsylvania	**Philadelphia**	Cummins Power Systems, Inc. 2727 Ford Road Bristol, PA 19007 Telephone: (215) 785-6005 FAX: (215) 785-4085

Pennsylvania	**Pittsburgh**	Cummins Power Systems, Inc. 3 Alpha Drive Pittsburgh, PA 15138-2901 Telephone: (412) 820-8300 FAX: (412) 820-8308
Pennsylvania	**Harrisburg**	Cummins Power Systems, Inc. 4499 Lewis Road Harrisburg, PA 17111-2541 Telephone: (717) 564-1344 FAX: (717) 558-8217
Puerto Rico		Cummins de Puerto Rico, Inc. Calle 1 G1 Urb. Industrial, Barrio Palmas Cataño ZIP / Postal Code: 00962 Puerto Rico Telephone: (787) 275-2000 FAX: (787) 275-2030
South Carolina	**Charleston**	Cummins Atlantic Inc. 231 Farmington Road Charleston, SC 29483 Telephone: (843) 851-9819 FAX: (843) 875-4338
South Carolina	**Columbia**	Cummins Atlantic, Inc. 2791 Shop Road Ext Columbia, South Carolina 29209 Telephone: (803) 799-2410 FAX: (803) 779-3427
South Dakota	**Sioux Falls**	Cummins Central Power, LLC 701 East 54th Street North Sioux Falls, SD 57104 Telephone: (605) 336-1715 FAX: (605) 336-1748
Tennessee	**Memphis**	Cummins Mid-South, LLC 670 Riverside Drive Memphis, TN 38173 Telephone: (901) 577-0600 FAX: (901) 522-8758
Tennessee	**Chattanooga**	Cummins South, Inc. 1509 East 26th Street Chattanooga, TN 37407-1095 Telephone: (423) 629-1447 FAX: (423) 629-1494
Tennessee	**Knoxville**	Cummins Cumberland, Inc. 1211 Ault Road Knoxville, TN 37914 Telephone: (423) 523-0446 FAX: (423) 523-0343
Tennessee	**Memphis**	Cummins Mid-South, LLC 1784 E. Brooks Road Memphis, TN 38116 Telephone: (901) 577-0666 FAX: (901) 522-8758

Tennessee	**Nashville**	Cummins Cumberland, Inc. 706 Spence Lane Nashville, TN 37217 Telephone: (615) 366-4341 FAX: (615) 366-5693
Texas	**Arlington**	Cummins Southern Plains, Ltd. 600 N Watson Road Arlington, TX 76004-76011 Telephone: (817) 640-6801 FAX: (817) 640-6852
Texas	**Amarillo**	Cummins Southern Plains, Ltd. 5224 Interstate 40 - Expressway East Amarillo, TX 79120-1570 Telephone: (806) 373-3793 (24 hours) FAX: (806) 372-8547
Texas	**Dallas**	Cummins Southern Plains, Ltd. 3707 Irving Boulevard Dallas, TX 75247 Telephone: (214) 631-6400 (24 hours) FAX: (214) 631-2322
Texas	**El Paso**	Cummins Rocky Mountain, LLC 14333 Gateway West El Paso, TX 79927 Telephone: (915) 852-4200 FAX: (915) 852-3295
Texas	**Fort Worth**	Cummins Southern Plains, Ltd. 3250 North Freeway Fort Worth, TX 76111 Telephone: (817) 624-2107 (24 hours) FAX: (817) 624-3296
Texas	**Houston**	Cummins Southern Plains, Ltd. 7045 North Loop East Houston, Texas 77028 Telephone: (713) 679-2220 FAX: (713) 679-7774
Texas	**Mesquite**	Cummins Southern Plains, Ltd. 2615 Big Town Blvd. Mesquite, TX 75150 Telephone: (214) 321-5555 (24 hours) FAX: (214) 328-2732
Texas	**Odessa**	Cummins Southern Plains, Ltd. 1210 South Grandview P.O. Box 633 Odessa, Texas 79761 Telephone: (915) 332-9121 (24 hours) FAX: (915) 333-4655
Texas	**San Antonio**	Cummins Southern Plains, Ltd. 6226 Pan Am Expressway North San Antonio, TX 78218-0385 Telephone: (512) 655-5420 (24 hours) FAX: (512) 655-3865

Utah	**Salt Lake City**	Cummins Rocky Mountain, LLC 1030 South 300 West Salt Lake City, UT 84101 Telephone: (801) 524-1321 FAX: (801) 524-1351
Virginia		
Virginia	**Richmond**	Cummins Atlantic, Inc. 3900 Deepwater Terminal Road Richmond, VA 23234 Telephone: (804) 232-7891 FAX: (804) 232-7428
Virginia	**Tidewater**	Cummins Atlantic, Inc. 3729 Holland Blvd. Chesapeake, VA 23323 Telephone: (757) 485-4848 FAX: (757) 485-5085
Washington	**Seattle**	Cummins Northwest, Inc. 811 S.W. Grady Way Renton, WA 98055 Telephone: (425) 235-3400 FAX: (425) 235-8202 Toll Free: (800) 274-0336
Washington	**Chehalis**	Cummins Northwest, Inc. 926 N.W. Maryland Chehalis, WA 98532-0339 Telephone: (360) 748-8841 FAX: (360) 748-8843 Toll Free: (800) 451-5506
Washington	**Spokane**	Cummins Northwest, Inc. 11134 W. Westbow Blvd. Spokane, WA 99204 Telephone: (509) 455-4411 FAX: (509) 624-4681 Toll Free: (800) 825-2122
Washington	**Tacoma**	Cummins Northwest, Inc. 3701 Pacific Highway East Tacoma, WA 98424-1135 Telephone: (253) 922-2191 FAX: (253) 922-2379
Washington	**Yakima**	Cummins Northwest, Inc. 1905 East Central Avenue Yakima, WA 98901 Telephone: (509) 248-9033 FAX: (509) 248-9035 Toll Free: (800) 688-9033
West Virginia	**Charleston**	Cummins Cumberland, Inc. 3100 MacCorkle Ave. SW P.O. Box 8456 South Charleston, WV 25303 Telephone: (304) 744-6373 FAX: (304) 744-8605

West Virginia	**Fairmont**	Cummins Cumberland, Inc. Rt 73 So. 145 Middletown Rd Fairmont, WV 26554 Telephone: (304) 367-0196 FAX: (304) 367-1077
Wisconsin	**DePere**	Cummins NPower, LLC Corporate Office 875 Lawrence Drive DePere, WI 54115-5070 Telephone: (920) 337-1991 FAX: (920) 337-9746
Wisconsin		Cummins NPower, LLC 939 Lawrence Dr DePere, Wisconsin 54115 Telephone: (920) 336-9631 FAX: (920) 7336-8984
Wisconsin	**Eau Claire**	Cummins NPower, LLC W2600 Jopke Road P. O. Box 5070 Eau Claire, Wisconsin 54701 Telephone: (715)830-0996 FAX: (715) 830-1087
Wisconsin	**Milwaukee**	Cummins NPower, LLC 840 West Ryan Road Oak Creek, WI 53154 Telephone: (414) 768-7400 FAX: (414) 768-9441
Wisconsin	**Wausau**	Cummins NPower, LLC 7815 Camp Phillips Rd Wausau, WI 54476 Telephone: (715) 359-6888 FAX: (715) 359-3744
Wyoming	**Gillette**	Cummins Rocky Mountain, LLC 2700 Hwy. 14 & 16 North P.O. Box 1207 (82717) Gillette, WY 82716 Telephone: (307) 682-9611 FAX: (307) 682-8242 Toll Free: (800) 773-9611
Wyoming	**Rock Springs**	Cummins Rocky Mountain, LLC 2000 Foothill Blvd. P.O. Box 1634 Rock Springs, WY 82901 Telephone: (307) 362-5168 FAX: (307) 362-5171

Distributors and Branches - Canada

Alberta	**Edmonton**	Cummins Western Canada 11751 - 181 Street Edmonton, AB T5S 2K5 Telephone: (780) 455-2151 FAX: (780) 454-9512
Alberta		Cummins Western Canada 4887 - 35th Street S.E. Calgary, Alberta T2B 3H6, Canada Telephone: (403) 569-1122 FAX: (403) 569-0027
Alberta	**Hinton**	Cummins Western Canada 122 Hampshire Road Hinton, Alberta T7V 1G8, Canada Telephone: (780) 865-5111 FAX: (780) 865-5714
Alberta	**Lethbridge**	Cummins Western Canada 4005 - 14th Ave N Lethbridge, Alberta T1H 6P6, Canada Telephone: (403) 329-6144 FAX: (403) 320-5383
British Columbia	**Vancouver**	Cummins Western Canada 18452 - 96th Avenue Surrey, B.C., Canada V4N 3P8 Telephone: (604) 882-5000 FAX: (604) 882-5080
British Columbia	**Kamloops**	Cummins Western Canada 976 Laval Crescent Kamloops, B.C. Canada V2C 5P5 Telephone: (250) 828-2388 FAX: (250) 828-6713
British Columbia	**Prince George**	Cummins Western Canada Prince George, B.C. V2M 6E9 Telephone: (250) 564-9111 FAX: (250) 564-5853
British Columbia	**Sparwood**	Cummins Western Canada 731 Douglas Fir Road Sparwood, B.C. VOB 2GO, Canada Telephone: (250) 425-0522 FAX: (250) 425-0323
New Brunswick	**Fredericton**	Cummins Eastern Canada, LP R.R.#1 Doak Road Fredericton, New Brunswick E3B 4X2, Canada Telephone: (506) 451-1929 FAX: (506) 451-1927
Newfoundland	**St. John's**	Cummins Eastern Canada, LP 122 Clyde Avenue Donovans Industrial Park Mount Pearl, Newfoundland A1N 2C2 Canada Telephone: (709) 747-0176 FAX: (709) 747-2283

Newfoundland	**Wabush**	Cummins Eastern Canada, LP Wabush Industrial Park Wabush, Newfoundland A0R 1B0 Telephone: (709) 282-3626 FAX: (709) 282-3108
Nova Scotia	**Halifax**	Cummins Eastern Canada, LP 50 Simmonds Drive Dartmouth, Nova Scotia B3B 1R3 Telephone: (902) 468-7938 FAX: (902) 468-5177
Ontario		
Ontario	**Kenora**	Cummins Mid-Canada Ltd. Highway 17 East P.O. Box 8 Kenora, Ontario P9N 3X1 Telephone: (807) 548-1941 FAX: (807) 548-8302
Ontario	**Ottawa**	Cummins Eastern Canada, LP 3189 Swansea Crescent Ottawa, Ontario K1G 3W5, Telephone: (613) 736-1146 FAX: (613) 736-1202
Ontario	**Thunder Bay**	Cummins Eastern Canada, LP 1400 W. Walsh Street Thunder Bay Ontario P7E 4X4 Telephone: (807) 577-7561 FAX: (807) 577-1727
Quebec	**Dorval**	Cummins, Eastern Canada, LP 580 Lepihe Dorval, Quebec H9H 1G2 Telephone: (514) 631-5000 FAX: (514) 631-0104
Quebec	**Quebec City**	Cummins Eastern Canada, LP Branch of Cummins Americas, Inc. 2400 Watt Street Ste Foy, Quebec G1P 3T3 Canada Telephone: (418) 651-2911 FAX: (418)651-0965
Quebec	**Val D'Or**	Cummins, Eastern Canada, LP Val D'Or, Quebec J9P 4P6 Telephone: (514) 695-8410 FAX: (514) 695-8917
Saskatchewan	**Lloydminster**	Cummins Western Canada 3709 - 44th Street Lloydminster, SK S9V 0Y9 Telephone: (305) 825-2062 FAX: (305) 825-6702
Saskatchewan	**Regina**	Cummins Western Canada 110 Kress Street Regina, SK S4P 2Z5 Telephone: (306) 721-9710 FAX: (306) 721-2962

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

Distributors and Branches - China, People's Republic

	Beijing	Cummins Engine (Beijing) Co., Ltd. No. 8, Wan Yuan Street, Beijing Economic and Technology Development Zone, Beijing, 100176, People's Republic of China. Telephone: (86-10) 67882258 Fax: (86-10) 67882285
	Shenyang	Cummins Engine (China) Investment Co., Ltd. ShenYang Workshop & Branch Office. No.5-2 Seventh Street, Shenyang Economic-Technological Development Area, Shenyang, Liaoning 110141, China. Telephone: (86-24) 25506611 Fax: (86-24) 25365599
	Kunming	Cummins (China) Investment Co. Ltd. Kunming Branch. Room 606, Hongta Mansion, No.155 Beijing Road, Kunming, Yunnan 650011, Telephone: (86-871) 3579471/511/579/958 Fax: (86-871) 3579210
	Shanghai	Cummins (China) Investment Co., Ltd. Shanghai Distributor Branch. No. 581, New jin Qiao Road, Pu Dong New Area, Shanghai, Shanghai 201206, China. Telephone: (86-21) 50318966 Fax: (86-21) 50318528
	Urumqi	Cummins Engine (China) Investment Co., Ltd Urumqi Branch. No.7,Shanghai Rd. Urumqi, Xinjiang 830011, China. Telephone: (86-991) 3780332/5/6/7/8/9 Fax: (86-991) 3780334
	Wuhan	Cummins Engine (China) Investment Co., Ltd. Wuhan Branch. No.2 Zhang Po Road, Dong Xi Hu District, A-Kaili Commercial Building, Wuhan, Hubei 430040, China. Telephone: (86-27) 83081677 Fax: (86-27) 83259369 / 83259370
	Guangzhou	Cummins (China) Investment Co., Ltd. Guangzhou. Branch G/F, Unit 1 & 2, Block 5, Xing Hui Yuan, NO. 46, Jinsui Road, Zhu Jiang New City, Guangzhou, Guangdong 510623, China. Telephone: (86-20) 38621009 Fax: (86-20) 38621144

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

Distributors and Branches - Australia

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

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

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

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

Distributors and Branches - New Zealand

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

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

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

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

Country Covered:	Brazil

Beijing Regional Office - China	
Cummins Corporation Bejing Branch (CCBJ) 28, Tower A, Gateway, 18, Xiaguangli North Road, East Third Ring Chaoyang District Beijing 100027 People's Republic of China Telephone: (86-10) 84548888 Fax: (86-10) 6462-0226	
Countries Covered:	China Hong Kong S.A.R Mongolia Taiwan

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

Cummins India Ltd.	
Kothrud Pune ZIP / Postal Code: 411038 India Telephone: +91-20-2538 5435 or 2538 0240 Fax: +91-20-2538 0125 www.cumminsindia.com	
Countries Covered:	Bhutan India Nepal

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

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

Country Covered:	South Korea

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

Country Covered:		
	Mexico	Costa Rica
	Guatemala	Nicaragua
	Honduras	Panama

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

Countries Covered:		
	Armenia	
	Azerbaijan	Moldova
	Belarus	Russia
	Tajikistan	
	Georgia	Turkmenistan
	Kyrgyzstan	Ukranie
	Kazakhstar	Uzbekistan

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

Countries Covered:		
	Bangladesh	Malaysia
	Brunei	
		Philippines
	Cambodia	Singapore
		Sri Lanka
	Indonesia	Thailand
	Laos	Vietnam

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

Countries Covered:		
	Argentina	
	Bolivia	
	Chile	
	Colombia	
		Paraguay
	Dominican Republic	Peru
		Uruguay
	El Salvador	Venezuela
	Eucador	
	Costa Rica	Honduras
	Dominican	Nicaragua

Distributors - International - Locations

Cummins Middle East FZE	**Cummins Middle East FZE**	P.O. Box No 17636, Units ZF 05 & 06Jebel Ali Free Zone, DubaiUnited Arab EmiratesTelephone: 00 9714 8838998Fax: 00 9714 8838997,
United Arab Emirates	**Cummins Emirates Sales & Service LLC**	P.O. Box No 54044Al Quoz Industrial Estate, DubaiUnited Arab EmiratesTelephone: 00 9714 3478184Fax: 00 9714 3478185Toll Free: 800 4184 ,
United Arab Emirates	**Cummins Emirates Sales & Service LLC**	P.O. Box No 70242, Abu DhabiUnited Arab EmiratesTelephone: 00 9712 6722980Fax: 00 9712 6722981,
ALBANIA		(Please contact the Central & Eastern European Regional Office)Cummins Diesel Deutschland GmbHGross-GerauOdenwaldstraße 23Groß-GerauZIP / Postal Code: 64521GermanyTelephone: (49-6152) 174-0Fax: (49-6152) 174-141,
ALGERIA		(Please contact) Cummins Diesel S.A.39 rue AmpèreBP 190Chassieu cédex 69680FranceTelephone: (33-4) 72 22 92 72Fax: (33-4) 78 90 19 56,
ALGERIA		-See SOUTH PACIFIC ISLANDS(Please contact) Cummins2 Caribbean DriveScoresby 3179VictoriaAUSTRALIATelephone: (61-3) 9765-3222Fax: (61-3) 9763-0079,
ANDORRA		- See European Regional Office - Mechelen ,
ANDORRA		Cummins Belgium Egide Walschaertsstraat, 2Industriepark Zuid2800 MechelenBelgiumEuropeTelephone: (32-15) 47 91 00Fax: (32-15) 27 56 86,
ANDORRA		,
ANGOLA	**(Please contact) Cummins Diesel South Africa (Pty) Ltd**	13 Eastern Service RoadKelvin (Neighbourhood), AlexandraRua Major Kahangulo, 134/140Gauteng, South AfricaZIP / Postal Code: 2054South AfricaTelephone: (27-11) 321 8700Fax: (27-11) 444 2012,
ANTIGUA		Miami (Office In U.S.A.)Cummins Power South, LLC9900 N.W. 77 Ave.Hialeah Gardens, FL 33016 Telephone: (305) 821-4200Fax: (305) 557-2992,
ARGENTINA	**Buenos Aires**	Distribuidora Cummins, S.A.Ruta Panamericana KM 32.5El Talar de Pacheco, Buenos AiresZIP / Postal Code: CP 1618Argentina Telephone: (54-11) 4736-6400Fax: (54-11) 4736-6479 / 6466 ,
ARUBA, ISLAND OF		(Please contact) Cummins Power South, LLC9900 N W 77th Ave.Hialeah Gardens, Florida 33016Telephone: (1-305) 821-4200Fax: (1-305) 557-2992,
AUSTRALIA	**Bunbury**	Cummins11 Dryanda CourtPictonBunbury, Western Australia 6229Telephone: (61-8) 9725-6777Fax: (61-8) 9725-6444,

AUSTRALIA	**Cairns**	Cummins11 Liberty Street Cairns, Queensland 4870AustraliaTelephone: (61-7) 935-2999 Fax: (61-7) 4035 2909,
AUSTRALIA	**Campbellfield**	Cummins1788-1800 Hume Highway Campbellfield, Victoria 3061AustraliaTelephone: (613) 9357-9200 Fax: (613) 9357 9916,
AUSTRALIA	**Dandenong**	Cummins46 Greens Road Dandenong, Victoria 3175 Australia Telephone: (613) 9706-8088Fax: (613) 9706 8016,
AUSTRALIA	**Darwin**	CumminsLot 1758 Graffin Crescent Winnellie, Darwin Northern Territory 0820 AustraliaTelephone: (61-8) 8947-0766 Fax: (61-8) 8984 4569,
AUSTRALIA	**Devonport**	Cummins2 Matthews Way Devonport, Tasmania 7310 AustraliaTelephone: (61-3) 6424-8800 Fax: (61-3) 6424 2200,
AUSTRALIA	**Emerald**	Cummins23 Old Sheepyard PlaceEmerald, Queensland 4720AustraliaTelephone: (61-7) 4982 4022Fax: (61-7) 4982 4159,
AUSTRALIA	**Grafton**	Cummins18 - 20 Induna StreetSouth Grafton, New South Wales 2460AustraliaTelephone: (61-2) 6641 1000Fax: (61-2) 6641 1099,
AUSTRALIA	**Hexham**	Cummins Engine Company, Pty. Ltd.21 Galleghan Street Hexham Newcastle, New South Wales, Australia 2322Telephone: (61-2) 4964-8466 Fax: (61-2) 4964-8616,
AUSTRALIA	**Kalgoorlie**	CumminsLot 62 Great Eastern HighwayCnr Hunter StreetKalgoorlie, Western AustraliaZIP / Postal Code: 6430AustraliaTelephone: (61-8) 9080 1300Fax: (61-8) 9091 7933,
AUSTRALIA	**Karratha**	Cummins1964 Anderson RoadKarratha, Western Australia 6714AustraliaTelephone: (61-8) 9144 4646 Fax: (61-8) 9143 1507,
AUSTRALIA	**Laverton**	Cummins191-195 Boundary RoadLaverton North, Victoria 3026AustraliaTelephone: (61-3) 8368 0800Fax: (61-3) 9360 0438,
AUSTRALIA	**Leeton**	Cummins29 Brady WayLeeton, NSW 2705AustraliaTelephone: (61-2) 6953-3077Fax: (61-2) 6953-3109,
AUSTRALIA	**Mackay**	Cummins46 Southgate DrivePaget, QueenslandZIP / Postal Code: 4740AustraliaTelephone: (61-7) 4952 8100Fax: (61-7) 4952 5631,
AUSTRALIA	**Mount Gambier**	Cummins2 Avey RoadMount Gambier, South Australia 5290AustraliaTelephone: (61-8) 8725 6422Fax: (61-8) 8724 9764,
AUSTRALIA	**Penrith**	CumminsTotal Truck Centre141 Coreen AvenuePenrith, New South Wales 2750AustraliaTelephone: (61-2) 4731 2188Fax: (61-2) 4731 1140,

AUSTRALIA	**Queanbeyan**	Cummins15-17 Bayldon RoadQueanbeyan, New South Wales 2620AustraliaTelephone: (61-2) 6297 3433Fax: (61-2) 6297 6709,
AUSTRALIA	**Swan Hill**	Cummins5 McAllister RoadSwan Hill, Victoria 3585AustraliaTelephone: (61-3) 5033 1511Fax: (61-3) 5032 9662,
AUSTRALIA	**Tamworth**	CumminsLot 65 Gunnedah RoadTamworth, New South Wales 2340AustraliaTelephone: (61-2) 6765 5455Fax: (61-2) 6765 5443,
AUSTRALIA	**Townsville**	Cummins704-710 Ingham RoadTownsville, Queensland 4810AustraliaTelephone: (61-7) 4774 7733 Fax: (61-7) 4774 7640,
AUSTRALIA	**Welshpool**	Cummins443 Horrie Miller DriveIndustrial ParkPerth International Airport, Western Australia 6105AustraliaTelephone: (61-7) 9475 8777Fax: (61-7) 9475 8666,
AUSTRALIA	**Wetherill Park**	Cummins492-494 Victoria StreetWetherill Park, New South Wales 2164AustraliaTelephone: (61-2) 9616 5300Fax: (61-2) 9616 5399,
AUSTRALIA	**Wodonga**	Cummins9 - 11 McKoy StreetWodonga, Victoria 3690AustraliaTelephone: (61-2) 6024 3655Fax: (61-2) 6024 3102,
AUSTRIA	**Neudörfl**	CumminsBickfordstraße 25Neudörfl, Burgenland 7201Austria Telephone: (43-2622) 77418 0Fax: (43-2622) 77418 4,
BAHAMAS	**Miami (Office in U.S.A.)**	Cummins Power South, LLC9900 N W 77th Ave.Hialeah Gardens, FL 33016 Telephone: (305) 821-4200Fax: (305) 557-2992 ,
BAHRAIN	**Bahrain**	Yusuf Bin Ahmed Kanoo W.L.L.Commercial Division832 Majlees Al Tawoon Highway, Al-Hamriya 611, SitraManamaZIP / Postal Code: Kingdom of BahrainBahrain Telephone: (973) 17 738200Fax: (973) 17 732828,
BALEARIC ISLANDS	**Madrid (Office in Spain)**	Cummins Ventas y Servicio, S.A.Torrelaguna, 56 Madrid 28027SpainTelephone: (34-91) 367-2000 376-2404Fax: (34-91) 407 6604,
BANGLADESH	**Jakson International Ltd.**	87 Suhrawardi Avenue (5th Floor) Baridhara, Dhaka-1212, Bangladesh Cell: +8801730358629 Tel: +88029893621, 9895783 Fax: +88029863307,
BARBADOS	**Miami (Office in U.S.A.)**	Cummins Power South, LLC900 N W 77th Ave.Hialeah Gardens, Florida 33016Telephone: (305) 821-821-4200Fax: (305) 557-2992,
BELGIUM	**Mechelen**	Cummins Distributor Egide Walschaertsstraat, 2Industriepark ZuidMechelenZIP / Postal Code: 2800BelgiumTelephone: (32-15) 479 100Fax: (32-15) 275 686,
BELIZE	**Tampa (Office in U.S.A.)**	Cummins Power South, LLC5421 N. 59th Street Tampa, FL 33610 Telephone: (813) 621-7202 Fax: (813) 621-8250,
BENIN		- See Togo ,

BENIN	**TOGOMAT s.a.**	Zone Industrielle CNPPMELomeTogoTelephone: (228) 2272395Fax: (228) 2270310,
BERMUDA	**Bronx (Office in U.S.A.)**	Cummins Metropower, Inc. 890 Zerega Avenue Bronx, NY 10473 Telephone: (718) 892-2400Fax: (718) 892-0055,
BHUTAN	**Pune (Office in India)**	Cummins Diesel Sales & Service (India) Ltd35A/1/2, Erandawana Pune, Maharashtra 411038IndiaTelephone: (91-20) 25431234 / 25430666 25431703Fax: (91-20) 25439490,
BOTSWANA- See Southern Africa Regional Office - Kelvin	**Cummins Diesel South Africa (Pty)**	9 Impala Road Kelvin (Neighbourhood), AlexandraGauteng, South Africa 2054South AfricaTelephone: (27-11) 321 8800Fax: (27-11) 444 3254,
BRAZIL	**Belo Horizonte**	Distribuidora Cummins Minas Ltda.Anel Rodoviario, Km 01 - Bairro Olhos D'Agua NorteBelo Horizonte, Minas Gerais 31950Brazil Telephone: (55-31) 3288-1344Fax: (55-31) 3288-1141,
BRAZIL	**Campo Grande**	Cummins Distribuidora de Motores Diesel e Equipamentos Ltda. Av. Rod. BR 163, nr. 5185Campo Grande, MATO GROSSO DO SUL 79060BrazilTelephone: (55-67) 387-8707Fax: (55-67) 387-8707,
BRAZIL	**Curitiba**	Distribuidora Parana de Motores Cummins Ltda.Abel Scuissiato 3020, Bairro AtubaCuritiba, PARANA 83408Brazil Telephone: (55-41) 3675-4500Fax: (55-41) 3675-6077,
BRAZIL	**Fortaleza**	Distribuidora Cummins Diesel do Nordeste LtdaBR 116, km.10 - nr.10.001, MessejanaFortaleza, CEARAZIP / Postal Code: 60871Brazil Telephone: (55-85) 4011-6400Fax: (55-85) 4011-6400,
BRAZIL	**Goianian**	Distribuidora Cummins Centro Oeste Ltda.Centro Oeste Ltda. Av. Caiapo , 777 Bairro Santa GenovevaGoiania, GOIAS 74672Brazil Telephone: (55-62) 269-1010 / 1011Fax: (55-62) 269-1032 / 1021,
BRAZIL	**Manaus**	Powertech Comercial Ltda.Av. Efigenio Sales 1717 - Parque 10Estrada da Ponta Negra, 6080 - SaoManaus, AMAZONAS 69060Brazil Telephone: (55-92) 642-2014Fax: (55-92) 236-6711,
BRAZIL	**Porto Alegre**	Distribuidora Meridional Motores Cummins Ltda.Av. Assis Brasil , 9000 SarandiPorto Alegre, RIO GRANDE DO SUL 91140BrazilTelephone: (55-51) 3021-2288Fax: (55-51) 3364-2288,
BRAZIL	**Rio de Janeiro**	Cummins Distribuidora de Motores Diesel e Equipamentos Ltda.Av. Brasil, 20289BotafogoRio de Janeiro, RIO DE JANEIRO 21515BrazilTelephone: (55-21) 2196-3131Fax: (55-21) 2196-3121,
BRAZIL	**Sao Paulo**	Cummins Distribuidora de Motores Diesel e Equipamentos Ltda.Rua Coronel Euclides Machado, 52Freguesia do OSao Paulo, SAO PAULO 02713BrazilTelephone: (55-11) 3931-2900Fax: (55-11) 3931-2900,

BRITISH VIRGIN ISLANDS		- See Puerto Rico ,
BRITISH VIRGIN ISLANDS	**Cummins de Puerto Rico, Inc.**	Calle 1 G1Urb. Industrial, Barrio PalmasCataño 00962Puerto RicoTelephone: (787) 275-2000Fax: (787) 275-2030,
BRUNEI		- See Malaysia ,
BRUNEI	**Scott & English (M) Sdn Bhd**	12 Jalan U1/15, Seksyen U1Hicom-Glenmarie Industrial ParkShah Alam, Selangor Darul Ehsan 40150MalaysiaTelephone: (60-3) 7805-1111Fax: (60-3) 7803-5122,
BURKINA - FASO		- See North/West/East and Central Africa Regional Office - Daventry,
BURKINA - FASO	**Cummins Engine Company Ltd**	Royal Oak Way SouthDaventry, NorthantsZIP / Postal Code: NN11 5NUUnited KingdomTelephone: (44-1327) 886000Fax: (44-1327) 886106,
BULGARIA		-See Germany Regional Office - Gross-Gerau ,
BULGARIA	**Cummins Diesel Deutschland GmbH**	Odenwaldstraße 23Groß-Gerau, Hessen 64521GermanyTelephone: (49-6152) 174-0Fax: (49-6152) 174-141,
BURMA	**Kuala Lumpur (Office In Malaysia)**	Scott & English (M) Sdn Bhd12 Jalan U1/15, Seksyen U1Hicom-Glenmarie Industrial ParkShah Alam, Selangor Darul Ehsan 40150MalaysiaTelephone: (60-3) 7805-1111Fax: (60-3) 7803-5122,
BURUNDI	**Brussels (Office in Belgium)**	Cummins Belgium N.V./S.A.Egide Walschaertsstraat, 2Industriepark ZuidMechelen 2800BelgiumTelephone: (32-15) 479 100Fax: (32-15) 275 686,
CAMBODIA		Scott & English (Cambodia) Ltd.No. 20A E0/E1 Russian BoulevardPhnom PenhCambodiaTelephone: (855-23) 723741Fax: (855-23) 723741,
CANARY ISLANDS	**Madrid (Office in Spain)**	Cummins Ventas y Servico S. A.Torrelaguna 56Madrid 28027Spain Telephone: (34-91) 367 20 00 / 367 24 04Fax: (34-91) 407 66 04,
CAPE VERDE		- See ECV PortugalElectro Central Vulcanizadora, LdaRua Conselheiro Martins de CarvalhoLote 1480 ResteloLisbonZIP / Postal Code: 1400PortugalTelephone: (351-21) 3034800Fax: (351-21) 3034801 / 2,
CENTRAL AFRICAN REPUBLIC		- See North/West Africa Regional Office - DaventryCummins Engine Company LtdRoyal Oak Way SouthDaventry, Northants NN11 5NUUnited KingdomTelephone: (44-1327) 886000Fax: (44-1327) 886106,
CHAD		- See North/West/East and Central Africa Regional Office - DaventryCummins Engine Company LtdRoyal Oak Way SouthDaventry, Northants NN11 5NUUnited KingdomTelephone: (44-1327) 886000Fax: (44-1327) 886106,

CHILE	**Santiago**	Distribuidora Cummins Chile, S.A. Avda. Americo Vespucio # 0631Santiago, QuilicuraZIP / Postal Code: 873-0596Chile Telephone: (56-2) 655-7253 / 7245Fax: (56-2) 655-7216 / 7436,
CHINA, PEOPLE'S REPUBLIC	**Beijing**	Cummins Engine (Beijing) Co., Ltd.No. 8, Wan Yuan StreetBeijing Economic and Technology Development ZoneBeijing, 100176People's Republic of ChinaTelephone: (86-10) 67882258Fax: (86-10) 67882285,
CHINA, PEOPLE'S REPUBLIC	**Shenyang**	Cummins Engine (China) Investment Co., Ltd. ShenYangWorkshop & Branch OfficeNo.5-2 Seventh StreetShenyang Economic-Technological Development AreaShenyang, Liaoning 110141ChinaTelephone: (86-24) 25506611Fax: (86-24) 25365599,
CHINA, PEOPLE'S REPUBLIC	**Kunming**	Cummins (China) Investment Co. Ltd. Kunming BranchRoom 606, Hongta MansionNo.155 Beijing RoadKunming, Yunnan 650011Telephone: (86-871) 3579471/511/579/958Fax: (86-871) 3579210,
CHINA, PEOPLE'S REPUBLIC	**Shanghai**	Cummins (China) Investment Co., Ltd. Shanghai Distributor BranchNo. 581, New jin Qiao RoadPu Dong New AreaShanghai, Shanghai 201206ChinaTelephone: (86-21) 50318966Fax: (86-21) 50318528,
CHINA, PEOPLE'S REPUBLIC	**Urumqi**	Cummins Engine (China) Investment Co., Ltd Urumqi BranchNo.7,Shanghai Rd.Urumqi, Xinjiang 830011ChinaTelephone: (86-991) 3780332/5/6/7/8/9Fax: (86-991) 3780334,
CHINA, PEOPLE'S REPUBLIC	**Wuhan**	Cummins Engine (China) Investment Co., Ltd. Wuhan BranchNo.2 Zhang Po Road, Dong Xi Hu DistrictA-Kaili Commercial BuildingWuhan, Hubei 430040ChinaTelephone: (86-27) 83081677Fax: (86-27) 83259369 / 83259370,
CHINA, PEOPLE'S REPUBLIC	**Guangzhou**	Cummins (China) Investment Co., Ltd. Guangzhou BranchG/F, Unit 1 & 2, Block 5, Xing Hui YuanNO. 46, Jinsui Road, Zhu Jiang New City,Guangzhou, Guangdong 510623ChinaTelephone: (86-20) 38621009Fax: (86-20) 38621144,
CHINA, PEOPLE'S REPUBLIC	**Shenzhen**	Shenzhen Chongfa Cummins Engine Company Ltd.Tian An Che Gong Miao Industrial Estate, Unit F2.6 - 2DShenzhen Shennan Da DaoShenzhen, Guangdong 518040ChinaTelephone: (86-755) 83415479Fax: (86-755) 83415480,
COLOMBIA	**Barranquilla**	Cummins de Colombia, S.A.Calle 65 (Avenida Murillo) #6-31Diagonal a Gran AbastosSoledad, AtlanticoColombiaTelephone: (57-53) 282600 / 282601 / 282602 / 282603 / 282604Fax: (57-53) 282640 / 282641,
COLOMBIA	**Bogota**	Cummins de los Andes S.A. Avenida Ciudad de CaliNo. 11-22Location: Bogota, CundinamarcaColombiaTelephone: (57-1) 294-8444Fax: (57-1) 2294-8431,

COLOMBIA	**Bucaramanga**	Cummins API Ltda. Kilómetro 7 Vía a Girón - Zona Industrial A.A. 1821Bucaramanga, Colombia Bucaramanga, Santander ColombiaTelephone: (57-76) 468060 / 469262 / 469263Fax: (57-76) 468065,
COLOMBIA	**Cali**	Tecnodiesel LimitadaApartado Aereo No. 6398 Carrera 8, No. 27-43Cali, ValleColombiaTelephone: (57-2) 442-2422Fax: (57-2) 442-1798,
COLOMBIA	**Medellin**	EquitelCarrera 52, # 10-184 Medellin, AntioquiaColombiaTelephone: (57-4) 255-4200Fax: (57-4) 255-4104,
COLOMBIA	**Pereira**	Tecnodiesel Limitada Carrera 16 No. 9 - 68Avenida Simon Bolivar, DosquebradasPereira, RisaraldaColombiaTelephone: (57-63) 306102Fax: (57-63) 300062,
COMOROS		- See Southern Africa Regional Office - Kelvin ,
COMOROS		Cummins Diesel South Africa (Pty) Ltd9 Impala RoadKelvin (Neighbourhood), AlexandraGauteng, South Africa 2054South AfricaTelephone: (27-11) 321 8800Fax: (27-11) 444 3254,
CONGO, PEOPLE'S REPUBLIC	**Mechelen (Office in Belgium)**	Cummins Belgium N.V./S.A.Egide Walschaertsstraat, 2Industriepark ZuidMechelen 2800BelgiumTelephone: (32-15) 479 100Fax: (32-15) 275 686,
CORSICA		- See France (Please contact) Cummins Diesel S.A. 39 rue AmpèreBP 190Chassieu cédex 69680Telephone: (33-4) 479 100Fax: (33-4) 78 90 19 56,
COSTA RICA	**San Jose**	Oficina Regional Cummins de Centro AmericaUrbanización Rincón Verde DosCasa 13ESan Pablo de HeredíaCosta RicaTelephone: (506) 238-1160Fax: (506) 238-1108,
CYPRUS	**Nicosia**	Alexander Dimitriou & Sons Limited158 Limassol AveLatsiaNicosia CY-2235CyprusTelephone: (357-22) 715 300Fax: (357-22) 715 400,
CZECH REPUBLIC		- See Central & Eastern EuropeCummins Czech Republic s.r.o.Komercni zona Pruhonice CestliceObchodni 132Praha, Prague 251 01Czech RepublicTelephone: (420-272) 680 110Fax: (420-272) 680 090,
DENMARK	**Glostrup**	Cummins Diesel Salg & Service A/SHovedvejen 233B, OstedRoskilde 4000 Denmark Telephone: (45-46) 42 35 50Fax: (45-46) 42 30 50,
DJIBOUTI		- See North/West/East and Central Africa,
DJIBOUTI		Cummins Engine Company LtdRoyal Oak Way South Daventry, NorthantsZIP / Postal Code: NN11 5NUUnited KingdomTelephone: (44-1327) 886000Fax: (44-1327) 886106,

DOMINICAN REPUBLIC	**Santo Domingo**	Argico C. por A.Calle Jose A. Soler No.3Esq. Lope de Vega Santo Domingo, Distrito NacionalDominican RepublicTelephone: (809) 562-6281Fax: (809) 562-4233 ,
DUBAI		- See United Arab Emirates ,
DUBAI		Cummins Middle East FZEP.O. Box No 17636, Units ZF 05 & 06Jebel Ali Free Zone, DubaiUnited Arab EmiratesTelephone: (00 9714) 8838998 Fax: (00 9714) 8838997,
DUBAI	**United Arab Emirates**	Cummins Emirates Sales & Service LLCP.O. Box No 54044United Arab EmiratesTelephone: (00 9714) 3478184Fax: (00 9714) 3478185Toll Free: (800) 4184 ,
ECUADOR	**Guayaquil**	Indusur S.A.Ave. Carlos Julio Arosemena Km. 4Guayaquil, GuayasEcuadorTelephone: (593-4) 220-1177 / 220-0655Fax: (593-4) 220-1052,
ECUADOR	**Quito**	Rectificadora Botar S.A. Av. 10 de Agosto # 5980Quito, PichinchaEcuadorTelephone: (593-2) 2265-177 / 2265-209 / 2265-225 / 2265-193Fax: (593-2) 2459-031,
EGYPT	**Cairo**	Egyptian International Motors CO. Ltd (EIM)Autostrade RoadAl-Mugattam, CairoEgyptTelephone: (20-2) 5061600 / 1 / 2Fax: (20-2) 5065620,
EL SALVADOR	**San Salvador**	Maquinaria Salvadoreña, S.A. de C.V.Blvd. Ejercito Nacional y 54 Ave. Norte Edificio MAQSA San SalvadorEl SalvadorEl SalvadorTelephone: (503) 2293-1666Fax: (503) 2293-1656,
ENGLAND		- See United Kingdom ,
ENGLAND		Cummins UKRutherford DrivePark Farm SouthWellingborough, NorthantsZIP / Postal Code: NN8 6ANUnited KingdomTelephone: (44-1933) 334200Fax: (44-1933) 334198,
EQUATORIAL GUINEA		- See North/West/East and Central Africa Regional Office - Daventry ,
EQUATORIAL GUINEA		Cummins Engine Company LtdRoyal Oak Way SouthDaventry, NorthantsZIP / Postal Code: NN11 5NUUnited KingdomTelephone: (44-1327) 886000Fax: (44-1327) 886106,
ESTONIA		Cummins Czech Republic s.r.o.Komercni zona Pruhonice CestliceObchodni 132Praha, Prague 251 01Czech RepublicTelephone: (420-272) 680 110Fax: (420-272) 680 090,
FAROE ISLANDS	**Wellingborough (Office in United Kingdom)**	Cummins UKRutherford Drive Park Farm SouthWellingborough, Northants NN8 6ANEngland Telephone: (44-1933) 334200Fax: (44-1933) 334198,
FERNANDO PO		- See Spain ,
FERNANDO PO		Cummins Ventas y Servico S. A.Torrelaguna 56Madrid 28027SpainTelephone: (34-91) 367 20 00 / 367 24 04Fax: (34-91) 407 66 04,

FIJI		- See Cummins New Zealand,
FIJI		Cummins9 Langley RoadManukau City Centre, Auckland 1702New ZealandTelephone: (64-3) 277 1000Fax: (64-3) 277 1001,
FINLAND	**Helsinki**	Machinery OyAnsatie 5VantaaZIP / Postal Code: FIN-01741FinlandTelephone: (358-9) 89551,
FRANCE	**Lyon**	CUMMINS DIESEL S.A.39 rue Ampère BP 190Chassieu cédex 69680 FranceTelephone: (33-4) 72 22 92 72 Fax: (33-4) 78 90 19 56,
GABON		- See North/West/East and Central Africa Regional Office - Daventry ,
GAMBIA		Matforce10 Avenue FaidherbeDakarSenegalTelephone: (221-8) 399500Fax: (221-8) 399531 / 399550,
GEORGIA		- See Moscow Regional Office - Moscow ,
GEORGIA		Cummins Engine Company, Inc.Park PlaceOffice E708, 113/1 Leninskiy ProspectMoscowZIP / Postal Code: 117198RussiaTelephone: (7-495) 956-51-22 / 23Fax: (7-495) 956-53-62,
GERMANY	**Gross-Gerau**	Cummins Diesel Deutschland GmbHOdenwaldstraße 23Groß-Gerau, Hessen 64521 GermanyTelephone: (49-6152) 174-0 Fax: (49-6152) 174-141,
GHANA	**Accra**	J&D Diesels and SystemsP.O. Box c2381CantonmentsAccra, Ghana Telephone: (233-21) 30-14-51Fax: (233-21) 301 201,
GREECE	**Athens**	ERGOTRAK Industrial Machinery & Equipment Trading Company14 km. National Road of Athens-LamiaKifissia 14510GreeceTelephone: (30-210) 6293400 / 41Fax: (30-210) 6201845,
GREENLAND		- See DenmarkCummins Diesel Salg & Service A/SHovedvejen 233B, OstedRoskilde 4000Denmark Telephone: (45-46) 42 35 50Fax: (45-46) 42 30 50,
GRENADA	**Miami (Office in U.S.A.)**	Cummins Power South, LLC 9900 N W 77th Ave. Hialeah Gardens, Florida 33016Telephone: (305) 821-4200Fax: (305) 557-2992,
GUADELOUPE	**Miami (Office in U.S.A.)**	Cummins Power South, LLC 9900 N W 77th Ave.Hialeah Gardens, Florida 33016Telephone: (305) 821-4200Fax: (305) 557-2992,
GUAM	**Barrigada**	Mid-Pac Far East, Inc. Airport Industrial Park 825 Tiyan Parkway Barrigada, Guam 96931Telephone: (671) 632-5160Fax: (671) 632-5186,
GUATEMALA	**Guatemala City**	Maquinaria y Equipos, S.A. Carretera a Amatitlan, Kilómetro 12, Zona 12, Guatemala City GuatemalaGuatemala Telephone: (502) 2477-2746 / 2477-2747 / 2477-2748 / 2477-2749 / 2477-2750Fax: (502) 2477-3929 ,

GUINEA	**Mechelen (Office in Belgium)**	Cummins Belgium N.V./S.A.Egide Walschaertsstraat, 2Industriepark ZuidMechelen 2800BelgiumTelephone: (32-15) 479 100Fax: (32-15) 275 686,
GUINEA BISSAU		- See North/West/East and Central Africa Regional Office - DaventryCummins Engine Company LtdRoyal Oak Way SouthDaventry, Northants NN11 5NUUnited KingdomTelephone: (44-1327) 886000Fax: (44-1327) 886106,
GUYANA	**Miami (Office in U.S.A.)**	Cummins Power South, LLC 9900 N.W. 77 Court Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992,
GUYANA, FRENCH	**See France**	CUMMINS DIESEL S.A.39 rue AmpèreBP 190Chassieu cédex 69680FranceTelephone: (33-4) 72 22 92 72Fax: (33-4) 78 90 19 56,
HAITI	**Miami (Office in U.S.A.)**	Cummins Power South, LLC9900 N W 77th Ave.Hialeah Gardens, FL 33016 Telephone: (305) 821-4200 Fax: (305) 557-2992,
HOLLAND	**- See Netherlands**	Cummins Holland B VGalvanistraat 35Dordrecht, Zuid-Holland 3316 GHNetherlandsTelephone: (31-78) 6181200Fax: (31-78) 6176579,
HONDURAS	**Tegucigalpa**	Comercial Laeisz Honduras, S.A.Desvio Colonia La Pradera,Blvd. ToncontinTegucigalpaHondurasTelephone: (504) 233-5615 / 234-7072Fax: (504) 233-9531 / 234-3718,
HONG KONG	**Kowloon**	Cummins Hong Kong Ltd.2/F Unison Industrial Centre27-31 Au Pui Wan Street, Fo Tan, Shatin, N.T.Hong Kong, Hong KongHong Kong S.A.R.ong Kong Telephone: (852) 2606-5678 Fax: (852) 2691-1641,
ICELAND	**Velasalan H.F.**	Ananaustrum 1Reykjavik 121 IcelandTelephone: (354) 5526122Fax: (354) 580 5301,
INDIA	**Pune**	Cummins Diesel Sales & Service (India) Ltd 35A/1/2, Erandawana Pune, Maharashtra 411038 Telephone: (91-20)25431234 , 25430666, 25431703Fax: (91-20) 25439490,
INDIA	**Kolkata**	Cummins Diesel Sales & Service (India) Ltd94, Tivoli Court, 1/C Ballygunge Circular RoadKolkata, West Bengal 700019India Telephone: (91-33) 22472481 / 22470774 / 22478065Fax: (91-33) 22473833,
INDIA	**New Delhi**	Cummins Diesel Sales & Service (India) Ltd.911-912, Hemkunt Tower,98 Nehru Place New Delhi, Delhi 110019IndiaTelephone: (91-11) 26431051 / 26445756 / 26445759 / 26416947Fax: (91-11) 26212817,
INDIA	**Raipur**	Cummins Diesel Sales & Service (India) Ltd.Vanijya Bhavan' 1st Floor, Sai Nagar FafadihDevendra Nagar RoadRaipur, Madhya Pradesh 492009IndiaTelephone: (91-771) 2521101 / 2521102Fax: (91-771) 2521103,

INDIA	**Ranchi**	Cummins Diesel Sales & Service (India) Ltd.`Shanti Kunj' C-202, Vidyalaya Marg Road No. 01, Ashok Nagar,Ranchi, Jharkhand 834002India Telephone: (91-651) 2241948 / 2241521Fax: (91-651) 2242815,
INDONESIA	**Jakarta**	P.T. Alltrak 1978 J1. R.S.C. Veteran No. 4 Bintaro, Rempoa Jakarta 12330 IndonesiaTelephone: (62-21) 736-1978 / 3301 / 5085Fax: (62-21) 736-1977 / 3302,
IRAQ		- See Middle East Regional Office or United Arab Emirates,
IRAQ		Cummins Emirates Sales & Service LLCP.O. Box No 54044Al Quoz Industrial Estate, DubaiUnited Arab EmiratesTelephone: 00 9714 3478184Fax: 00 9714 3478185Toll Free: 800 4184 ,
IRELAND	**Wellingborough (Office inEngland)**	Cummins UKRutherford DrivePark Farm SouthWellingborough, Northants NN8 6ANUnited KingdomTelephone: (44-1933) 334200Fax: (44-1933) 334198,
ISRAEL	**Tel Aviv**	Israel Engines & Trailers 33 Hahashmal StreetTel Aviv 61003IsraelTelephone: (972-3) 7106222Fax: (972-3) 5604540,
ITALY	**Milan**	Cummins Italia S.p.A.Via Einaudi, 5Peschiera Borromeo, Milano 20068ItalyTelephone: (39-02) 51 65 581Fax: (39-02) 51 65 58 56 ,
IVORY COAST		- See Cote d' IvoireSte. des Ets. Lemercier et Fils10 rue des BrasseursAbidjan 15Cote d'IvoireCote d'IvoireTelephone: (225-21) 352522 / 350687 / 350676Fax: (225-21) 358562 / 243938,
JAMAICA		Cummins Power South, LLC9900 N W 77th Ave.Hialeah Gardens, FL 33016 Telephone: (305) 821-4200Fax: (305) 557-2992,
JAPAN	**Tokyo**	Cummins Japan Ltd.2-11, Higashi-Kojiya 6-chomeOta-ku, Tokyo 144-0033Japan Telephone: (81-3) 5735-0600Fax: (81-3) 5735-0605,
JORDAN	**Amman**	SETI Jordan Ltd.Bayader Wadi AlseerIndustrial StreetAmman, JordanJordanTelephone: (962-6) 582 7300 / 4261Fax: (962-6) 585 6854,
KENYA	**Nairobi**	Simba Colt Motors LtdCummins Engine Division, PO Box 48296, Code 00100Shimo-La-Tewa Road,NairobiKenyaTelephone: (254-20) 650029Fax: (254-20) 534870 ,
KOREA - SOUTH KOREA	**Seoul**	Cummins Diesel Sales & Service Co., Ltd. 354-4, Chonheung-ri, Songgo-eupChonan-city, Choongchungnam-do 330-836South Korea Telephone: (82-41) 620-9202/3Fax: (82-41) 621-9121 to 2,
KOREA - SOUTH KOREA		Cummins Korea Ltd2nd Floor, Choyang Bldg.113 Samsung Dong, Kangnam-kuSeoul, KoreaTelephone: (82-2) 3420-0901Fax: (82-2) 3452-4113 / 539-6569,

KUWAIT	**Kuwait**	General Transportation & Equipment Co. (GTE)(Sales Department) Safat 13011KuwaitTelephone: (965) 483 3380/1/2Fax: (965) 481 2860,
LAOS		Diethelm & Co. LtdBan Phonsinouan, Unit 18,New Road Sisattanak District,VientianeLaos P.D.R.Telephone: (856-21) 453 100Fax: (856-21) 453-103,
LATVIA	**Please contact the Central & Eastern European Regional Office**	Cummins Diesel Deutschland GmbHOdenwaldstraße 23Groß-GerauZIP / Postal Code: 64521GermanyTelephone: (49-6152) 174-0Fax: (49-6152) 174-141,
LEBANON	**Beirut**	S.E.T.I. Charles Keller SALCorniche du Fleuve BeirutLebanonLebanonTelephone: (961-1) 425040 / 425041 / 426042Fax: (961-1) 425637 / 425389,
LESOTHO	**- See South Africa**	Cummins Diesel South Africa (Pty) Ltd13 Eastern Service RoadKelvin (Neighbourhood), AlexandraGauteng, South Africa 2054South AfricaTelephone: (27-11) 321 8700Fax: (27-11) 444 2012,
LIBYA	**- See North/West Africa Regional Office - Daventry**	Cummins Engine Company LtdRoyal Oak Way SouthDaventry, Northants NN11 5NUUnited KingdomTelephone: (44-1327) 886000Fax: (44-1327) 886106,
LIECHTENSTEIN	**- See Switzerland**	AKSA Wurenlos AGGrosszelgstrasse 15Wuerenlos CH-5436SwitzerlandTelephone: (41-56) 436 77 00Fax: (41-56) 436 77 19,
LUXEMBOURG		Cummins Diesel Deutschland GmbH Odenwaldstraße 23Groß-Gerau, Hessen 64521GermanyTelephone: (49-6152) 174-0Fax: (49-6152) 174-141,
MACAU	**- See Hong Kong**	Cummins Hong Kong Ltd.2/F Unison Industrial Centre27-31 Au Pui Wan Street, Fo Tan, Shatin, N.T.ccccHong Kong, Hong KongHong Kong S.A.R.Telephone: (852) 2606-5678Fax: (852) 2691-1641,
MADAGASCAR	**- See Southern Africa Regional Office**	Cummins Diesel South Africa (Pty) Ltd13 Eastern Service RoadKelvin (Neighbourhood), AlexandraGauteng, South Africa 2054ZIP South AfricaTelephone: (27-11) 321 8700Fax: (27-11) 444 2012,
MADEIRA ISLANDS	**- See Portugal**	Electro Central Vulcanizadora, LdaRua Conselheiro Martins de CarvalhoLote 1480 Restelo Lisbon 1400PortugalTelephone: (351-21) 3034800Fax: (351-21) 3034801 / 2,
MALAYSIA	**Kuala Lumpur**	Scott & English (M) Sdn Bhd 12 Jalan U1/15, Seksyen U1 Hicom-Glenmarie Industrial ParkShah Alam, Selangor Darul Ehsan 40150MalaysiaTelephone: (60-3) 7805-1111Fax: (60-3) 7803-5122,
MALI	**- See Senegal (Matforce)**	Matforce10 Avenue FaidherbeDakarSenegalTelephone: (221-8) 399500Fax: (221-8) 399531 / 399550,

MALTA	**Valletta**	International Machinery LtdRegency House254 Republic Street Valletta, MaltaMaltaTelephone: (356-21) 232620 / 233343Fax: (356-21) 235484 / 247571,
MARTINIQUE		Cummins Power South, LLC9900 N.W. 77 Ave.Hialeah Gardens, FL 33016 Telephone: (305) 821-4200Fax: (305) 557-2992,
MEXICO	**Guadalajara**	Distribuidora Megamak de OccidenteMetalurgia No. 2980 Fracc. Alamo IndustrialGuadalajara, Jalisco 45560MexicoTelephone: (52-3) 666-0329 / 666-0383Fax: (52-3) 666-0333,
MEXICO	**Monterrey**	Converto Dexel Monterrey Privada Nazry Hasbun #2, Carr. Migue Aleman 14.8Parque Industrial HasnaApodaca, Nuevo León 66473MexicoTelephone: (52-81) 81310200Fax: (52-81) 81310200,
MEXICO	**Merida**	Distribuidora Megamak del SuresteAv. Aviacion Civil No. 647Col. Sambula Merida, Yucatan 97259MexicoTelephone: (52-9) 930-1300Fax: (52-9) 930-1315,
MEXICO	**Puebla**	Cummins De Oriente, S.A. de C.V. Km. 10+400 Carr. Fed. Puegla-TlaxcalaPuebla, Puebla 72100Mexico Telephone: (52-2) 248-7674 / 5 / 30-5083 / 6Fax: (52-2) 249-7679,
MEXICO	**Queretaro**	Converto Dexel QueretaroBlvd. Bernardo Quintana No. 518, Col. ArboledasQueretaro, Queretaro ZIP / Postal Code: 76140Mexico Telephone: (52-442) 211-8700Fax: (52-442) 211-8700,
MOROCCO	**Casablanca**	Groupe Auto Hall44 avenue Lalla YacoutCasablancaMoroccoTelephone: (212-22) 442121 / 317044 / 317052Fax: (212-22) 318915 / 315633,
MOZAMBIQUE	**- See Southern Africa Regional Office - Kelvin**	Cummins Diesel South Africa (Pty) Ltd13 Eastern Service RoadKelvin (Neighbourhood), AlexandraGauteng, South Africa 2054South AfricaTelephone: (27-11) 321 8700Fax: (27-11) 444 2012,
NEPAL	**Pune (Office in India)**	Cummins Diesel Sales &Service (India) Ltd. 35A/1/2, Erandawana Pune, Maharashtra 411038IndiaTelephone: (91-20) 25431234 / 25430666 / 25431703Fax: (91-20) 25439490,
NETHERLANDS	**Dordrecht**	Cummins Holland B V Galvanistraat 35 Dordrecht, Zuid-Holland 3316 GHNetherlandsTelephone: (31-78) 6181200Fax: (31-78) 6176579,
NETHERLANDS ANTILLES		Cummins Power South, LLC 9900 N W 77th Ave.Hialeah Gardens, FL 33016 Telephone: (305) 821-4200Fax: (305) 557-2992,
NEW GUINEA	**- See Papua New Guinea**	CumminsMacdhui StreetLaePapua New GuineaTelephone: (675) 472 3699Fax: (675) 472 3803,

NEW GUINEA	**- See Papua New Guinea**	CumminsMacdhui StreetLaePapua New GuineaTelephone: (675) 472 3699Fax: (675) 472 3803,
New Zealand	**Auckland**	Cummins9 Langley RoadManukau City Centre, South Auckland 1702 New Zealand Telephone: (64-9) 277 1000Fax: (64-9) 277 1001,
New Zealand	**Christchurch**	Cummins33 Parkhouse RoadChristchurchNew ZealandTelephone: (64-3) 348 8170Fax: (64-3) 348 8007,
New Zealand	**Dunedin**	Cummins8 Devon StreetDunedinNew ZealandTelephone: (64-3) 477 8818Fax: (64-3) 477 8061,
New Zealand	**Palmerston North**	Cummins852 - 860 Tremaine AvenuePalmerston North, Wanganui-Manawatu 5301New ZealandTelephone: (64-3) 356 2209Fax: (64-3) 356 9130,
New Zealand	**Rotorua**	Cummins328 Te Ngae RoadBay of PlentyRotoruaNew ZealandTelephone: (64-7) 345 6699Fax: (64-7) 345 6694,
NICARAGUA	**Managua**	F. Alf. Pellas, S.A.Gadala Maria Cuatro Cuadras OesteBarrio AcahualincaManagua, NicaraguaNicaraguaTelephone: (505) 268-2244Fax: (505) 266-1060,
NIGERIA	**Lagos**	Scoa Power (A Division of Scoa Nigeria Plc) 15, Creek RoadApapaLagosNigeriaTelephone: (234-1) 5873623 / 5877322Fax: (234-1) 5450646,
NIGERIA	**Paris (Office in France)**	SCOA InterImmeublearie JosepheRue du Marechal de Lattre de Tassigny78990 Elancourt, FranceFrance Telephone: (33-1) 30 688 268Fax: (33-1) 30 688 269,
NORTHERN IRELAND	**- See United Kingdom**	Cummins Engine Company LtdRoyal Oak Way SouthDaventry, NorthantsZIP / Postal Code: NN11 5NUUnited Kingdom Telephone: (44-1327) 886000Fax: (44-1327) 886106,
NORWAY	**Oslo**	Cummins Norway A SHestehagen 3 Postboks 151 Drobak 1441Norway Telephone: (47) 64 90 70 80Fax: (47) 64 90 70 90,
OMAN	**Ruwi**	Universal Engineering Services LLCPO Box 2688Ruwi 112OmanTelephone: (968) 597531 / 597537Fax: (968) 597514,
PAKISTAN	**Karachi**	Cummins Sales & Service Pakistan2 Bangalore Town Main Shahrah-e-Faisal Karachi 75350 Pakistan Telephone: +92-21-4539603 / 4539604/ 4539605Fax: +92-21-4532519,
PANAMA	**Panama City**	Grupo Tiesa, S.A. Via Transistmica Milla 8 Frente a BacardiPartilloPanama Panama Telephone: (507) 231-0266Fax: (507) 231-2535,
PARAGUAY	**Asuncion**	De La Sobera S.A.Eusebio Ayala 1947P.O. Box 1160 AsuncionParaguay Telephone: (595) 21 202 913,

PERU	**Lima**	Mitsui Maquinarias Peru, S.A.Av. Nicolas Ayllon 2648Parcela Rustica Sta. Angelica AteLima ZIP / Postal Code: 03PeruTelephone: (51-1) 326-4957Fax: (51-1) 326-4954,
PHILIPPINES	**EDSA**	Cummins Sales & Service Philippines, Inc.Lot 1 & 2, Block 15, LIIP Avenue,Laguna International Industrial Park, Mamplasan, BinanLagunaPhilippinesTelephone: (63-2) 843-0630 Fax: (63-2) 539-0290,
POLAND		Cummins Engine Company Limited Sp. z.o.o. Oddzial w Polsceul. Stawowa 119Krakow 31-346Poland Telephone: (48-12) 661 53 05 & (48-12) 661 53 25Fax: (48-12) 661 53 15,
PORTUGAL	**Lisbon**	Electro Central Vulcanizadora, Lda Rua Conselheiro Martins de CarvalhoLisbonZIP / Postal Code: 1400PortugalTelephone: (351-21) 3034800Fax: (351-21) 3034801 / 2,
QATAR	**Doha**	Jaidah Motors & Trading Co. P.O. Box 150 Doha, Qatar (Arabian Gulf) Telephone: (974) 4466888Fax: (974) 441 4100 / 441 5400,
REUNION	**- See Lyon Regional Office - Lyon**	CUMMINS DIESEL S.A.39 rue AmpèreBP 190Chassieu cédex 69680FranceTelephone: (33-4) 72 22 92 72Fax: (33-4) 78 90 19 56,
RIO DE ORO	**- See Spain**	Cummins Ventas y Servico S. A.Torrelaguna 56Madrid 28027SpainTelephone: (34-91) 367 20 00 / 367 24 04Fax: (34-91) 407 66 04,
ROMANIA	**- See Germany Regional Office - Gross-Gerau**	Cummins Diesel Deutschland GmbHOdenwaldstraße 23Groß-Gerau, Hessen 64521GermanyTelephone: (49-6152) 174-0Fax: (49-6152) 174-141,
RUSSIA		OOO CumminsKlyazma 1GKhimki Disctrict, Moscow Region 141400RussiaTelephone: (7-495) 540 86 24 / 25Fax: (7-495) 540 86 99,
RWANDA	**Mechelen**	Cummins Belgium N.V./S.A. Egide Walschaertsstraat, 2Industriepark ZuidMechelen 2800BelgiumTelephone: (32-15) 479 100Fax: (32-15)275 686,
ST. LUCIA		Cummins Power South, LLC9900 N W 77th Ave.Hialeah Gardens, FL 33016 Telephone: (305) 821-4200Fax: (305) 557-2992,
ST. LUCIA	**Miami (Office in U.S.A.)**	Cummins Power South, LLC 9900 N W 77th Ave.Hialeah Gardens, FL 33016 Telephone: (305) 821-4200Fax: (305) 557-2992,
SAN MARINO	**- See Italy**	Cummins Italia S.p.A.ItalyVia Einaudi, 5Peschiera Borromeo, Milano 20068Telephone: (39-02) 51 65 581Fax: (39-02) 51 65 58 56 ,
SAO TOME AND PRINCIPE	**- See North/West/East and Central Africa Regional Office - Daventry, England**	Cummins Engine Company LtdRoyal Oak Way SouthDaventry, NorthantsZIP / Postal Code: NN11 5NUUnited KingdomTelephone: (44-1327) 886000Fax: (44-1327) 886106,

SAUDI ARABIA	**Al-Khobar**	General Contracting Company - OLAYANP.O. Box 356 King Abdul Aziz Road Al-KhobarSaudi Arabia Telephone: (966-3) 882-0888Fax: (966-3) 8828560 / 8827914,
SCOTLAND	**- See United Kingdom**	Cummins UKRutherford DrivePark Farm SouthWellingborough, NorthantsZIP / Postal Code: NN8 6ANUnited KingdomTelephone: (44-1933) 334200Fax: (44-1933) 334198,
SENEGAL	**Dakar**	Matforce 10 Avenue FaidherbeDakarSenegal Telephone: (221-8) 399500 Fax: (221-8) 399531/399550 Equipements et Services (Mining Only) BP 15372-Fann Dakar Senegal Contacts: Mr. Jean Smets Tel: (221-8) 60 77 76 & 24 73 62 Fax: (221-8) 60 95 98,
SEYCHELLES	**- See North/West/East & Central Africa Regional Office - Daventry, England**	Cummins Engine Company LtdRoyal Oak Way SouthDaventry, NorthantsZIP / Postal Code: NN11 5NUUnited KingdomTelephone: (44-1327) 886000Fax: (44-1327) 886106,
SIERRA LEONE	**- See North/West/East and Central Africa Regional Office - Daventry**	Cummins Engine Company LtdRoyal Oak Way SouthDaventry, NorthantsZIP / Postal Code: NN11 5NUUnited KingdomTelephone: (44-1327) 886000Fax: (44-1327) 886106,
SINGAPORE	**Singapore**	Cummins Engine (Singapore) Pte Ltd8 Tanjong Penjuru Singapore 609019SingaporeTelephone: (65) 6261-3555Fax: (65) 6261-2405,
SLOVAKIA		- See European Regional Office - Gross-Gerau,
SOLOMON ISLANDS	**The Czech branch covers sales and service for the Czech Republic and Slovakia**	Cummins Czech Republic s.r.o.Komercni zona Pruhonice CestliceObchodni 132Praha, Prague 251 01Czech RepublicTelephone: (420-272) 680 110Fax: (420-272) 680 090,
SOLOMON ISLANDS	**-See SOUTH PACIFIC ISLANDS**	(Please contact) Cummins2 Caribbean DriveScoresby 3179VictoriaTelephone: (61-3) 9765-3222Fax: (61-3) 9763-0079,
SOMALIA	**- see Southern Africa Regional Office**	(Please contact) Cummins Diesel South Africa (Pty) Ltd13 Eastern Service RoadKelvin (Neighbourhood), AlexandraGauteng, South Africa 2054South AfricaTelephone: (27-11) 321 8700Fax: (27-11) 444 2012,
SOUTH AFRICA	**Johannesburg**	Cummins Diesel South Africa (Pty) Ltd 13 Eastern Service Road Kelvin (Neighbourhood), AlexandraGauteng, South Africa 2054South Africa Telephone: (27-11) 321 8700Fax: (27-11) 444 2012 ,
SOUTHWEST AFRICA	**- see Southern Africa Regional Office**	(Please contact) Cummins Diesel South Africa (Pty) Ltd13 Eastern Service RoadKelvin (Neighbourhood), AlexandraGauteng, South Africa 2054South AfricaTelephone: (27-11) 321 8700Fax: (27-11) 444 2012 ,
SPAIN	**Madrid**	Cummins Ventas y Servico S. A.Torrelaguna, 56 Madrid 28027Spain Telephone: (34-91) 367 20 00 / 367 24 04Fax: (34-91) 407 66 04,

SPANISH GUINEA	**- See Spain**	Cummins Ventas y Servico S. A.Torrelaguna, 56 Madrid 28027Spain Telephone: (34-91) 367 20 00 / 367 24 04Fax: (34-91) 407 66 04,
SRI LANKA	**Colombo**	Trade Promoters Ltd 272/25, Sudharshana MawathaMalabe Sri Lanka Telephone: (94-11) 2413002Fax: (94-11) 5550034,
SUDAN	**- See Middle East Regional Office - United Arab Emirates**	United Arab EmiratesCummins Middle East FZEUnits ZF 5/6Jebel Ali Free ZoneP.O.Box No 17636DubaiUnited Arab EmiratesTelephone: (971-4) 883 8998Fax: (971-4) 883 7971,
SURINAM		Cummins Power South, LLC9900 N W 77th Ave.Hialeah Gardens, FL 33016 Telephone: (305) 821-4200Fax: (305) 557-2992,
SWAZILAND	**- See South Africa**	Cummins Diesel South Africa (Pty) Ltd13 Eastern Service RoadKelvin (Neighbourhood), AlexandraGauteng, South AfricaZIP / Postal Code: 2054South AfricaTelephone: (27-11) 321 8700Fax: (27-11) 444 2012,
SWEDEN	**Stockholm**	Cummins Sweden Maskingata 17CBrista IndustriomadeMärsta, Stockholm 195 60Sweden Telephone: (46-8) 595 133 90Fax: (46-8) 595 133 99,
SWITZERLAND	**Regensdorf**	AKSA Wurenlos AGGrosszelgstrasse 15Wuerenlos CH-5436Switzerland Telephone: (41-1) 436 77 00Fax: (41-56) 436 77 19,
SYRIA	**Damascus**	Puzant Yacoubian & Sons Yacoubian BuildingAbou Baker El Saddik StreetDamascusSyriaTelephone: (963-11) 212 8600Fax: (963-11) 212 8611,
TAHITI, ISLAND OF	**- See French Polynesia**	Cummins MerCruiser Diesel245 Brisbane RoadBiggera Waters, Queensland 4216AustraliaTelephone: (61-7) 5500 9060Fax: (61-7) 5500 9070,
TAIWAN		Cummins Taiwan Pte. Ltd.No.49 Ting Hu RoadTkuei Shan HsiangTaoyuan, Taiwan 104TaiwanTelephone: (886-3) 211-5160Fax: (886-2) 211-4158,
TANZANIA	**- See South African Regional Office - Kelvin, South Africa**	Cummins Diesel South Africa (Pty) Ltd13 Eastern Service RoadKelvin (Neighbourhood), AlexandraGauteng, South AfricaZIP / Postal Code: 2054South AfricaTelephone: (27-11) 321 8700Fax: (27-11) 444 2012,
THAILAND	**Bangkok**	DKSH (Thailand) Ltd1696 New Petchburi Road Bangkok 10310Thailand Telephone: (66-2) 254-4900 / 454-2173Fax: (66-2) 253-5560 / 652-9417 / 8 / 9,
TOGO (and BENIN)	**Lome**	TOGOMAT s.a.Zone Industrielle CNPPMELomeTogo Telephone: (228) 2272395Fax: (228) 2270310,
TONGA, ISLAND OF	**-See SOUTH PACIFIC ISLANDS**	(Please contact) Cummins2 Caribbean DriveScoresby 3179VictoriaAUSTRALIATelephone: (61-3) 9765-3222Fax: (61-3) 9763-0079,
TRINIDAD and TOBAGO		Cummins Power South, LLC 9900 N W 77th Ave.Hialeah Gardens, FL 33016 Telephone: (305) 821-4200Fax: (305) 557-2992,

TURKEY	**Istanbul**	Hamamcioglu Muesseseleri Ticaret T.A.S. Okul Cad. No. 1334956 Orhanli - P.K. 62 TuzlaIstanbulTurkey Telephone: (90-216) 394 3210Fax: (90-216) 394 3208 / 9,
UKRAINE	**- See Moscow Regional Office - Moscow**	Cummins Engine Company, Inc.Park PlaceOffice E708, 113/1 Leninskiy ProspectMoscow 117198RussiaTelephone: (7-495) 956-51-22 / 23 Fax: (7-495) 956-53-62 ,
UNITED ARAB EMIRATES	**Dhabi**	Cummins Middle East FZE Units ZF 05&06Jebel Ali Free ZoneDhabiUnited Arab Emirates Telephone: (971-4) 883 8998Fax: (971-4) 883 7971,
UNITED KINGDOM	**Wellingborough**	Cummins UKRutherford DrivePark Farm SouthWellingborough, Northants NN8 6ANUnited Kingdom Telephone: (44-1933) 334200Fax: (44-1933) 334198,
VATICAN CITY	**- See Italy**	Cummins Italia S.p.A.Via Einaudi, 5Peschiera Borromeo, Milano 20068ItalyTelephone: (39-02) 51 65 581Fax: (39-02) 51 65 58 56 ,
VENEZUELA	**Caracas**	Dieselval, C.A.Ave. Lisandro Alvarado, Sector La FloridaEdificio DieselvalValencia, CaraboboVenezuela ZIP / Postal Code: VenezuelaVenezuelaTelephone: (58-241) 8353074 / 8355265Fax: (58-241) 8314553 / 8314818,
VIETNAM	**Hanoi**	Diethelm & Co. Ltd., Engrg.94, Tran Quoc Toan Street,Hoan Kiem DistrictHanoiVietnam Telephone: (84-4) 9424-725Fax: (84-4) 9424-730,
VIETNAM	**Ho Chi Minh City**	Diethelm & Co. Ltd., Engrg.189 Dien Bien Phu Street, Ward 15Binh Thanh DistrictHo Chi Minh City, S.R. Vietnam Telephone: (84-8) 5121-334Fax: (84-8) 5121-335,
WESTERN SAMOA	**-See SOUTH PACIFIC ISLANDS**	(Please contact) Cummins2 Caribbean DriveScoresby 3179VictoriaAUSTRALIATelephone: (61-3) 9765-3222Fax: (61-3) 9763-0079,
YEMEN	**Sana'a**	Zubieri Trading CompanyAl Qiyadah StreetSana'aRepublic of YemenTelephone: (967-1) 223943 / 224051Fax: (967-1) 221611 / 245838,
SERBIA & MONTENEGRO		Cummins Dizel Motori Prodaja i ServisAutoput, 2211080 ZemumBeograd, Serbia & MontenegroSerbia & MontenegroTelephone: (381-11) 314 90 71Fax: (381-11) 314 91 27,
ZAMBIA	**Ndola**	Cummins Zambia LtdLufunza AvenueNdola, ZambiaZambiaTelephone: (260-2) 610 729Fax: (260-2) 612 756,
ZIMBABWE	**Harare**	Cummins Zimbabwe (Pvt) Ltd. 72 Birmingham RoadSoutherton, ZimbabweZimbabwe Telephones: (263-4) 621871 / 2 / 3 / 4 / 5Fax: (263-4) 621880,

Section TS - Troubleshooting Symptoms

Section Contents

This Page Left Intentionally Blank

Troubleshooting Procedures and Techniques

General Information

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

⚠ WARNING ⚠

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

Follow the suggestions below for troubleshooting:

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

Troubleshooting Symptoms Charts

General Information

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

⚠WARNING⚠

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

Air Compressor Air Pressure Rises Slowly

Cause	Correction
STEP 1 Air intake system restriction to air compressor is excessive	Replace the air compressor air cleaner (if installed). Check the air intake piping. Check engine air intake restriction if the air compressor inlet is plumbed to the vehicle or equipment intake system. Refer to Procedure 012-014 (Air Compressor) in Section 5.
OK Go To Next Step	
STEP 2 Air system leaks	Block the vehicle wheels and check the air system for leaks with spring brakes applied and released. Check for leaks from the air compressor gaskets and the air system hoses, fittings, tanks, and valves. Refer to the OEM service manuals.
OK Go To Next Step	
STEP 3 Carbon buildup is excessive in the air discharge line, downstream air valves, or cylinder head	Check for carbon buildup. Replace the air compressor discharge line and cylinder head assembly if necessary. Refer to the OEM service manuals.
OK Go To Next Step	
STEP 4 Contact a Cummins® Authorized Repair Facility	

Air Compressor Cycles Frequently

Cause	Correction
STEP 1 Air system leaks	Block the vehicle wheels and check the air system for leaks with spring brakes applied and released. Check for leaks from the air compressor gaskets and the air system hoses, fittings, tanks, and valves. Refer to the OEM service manuals.
OK Go To Next Step	
STEP 2 Carbon buildup is excessive in the air discharge line, check valve, or cylinder head	Check for carbon buildup. Replace the air compressor discharge line, if necessary. Refer to Procedure 012-015 (Air Compressor Discharge Lines) in Section 7.
OK Go To Next Step	
STEP 3 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 an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 4 Contact a Cummins® Authorized Repair Facility	

Air Compressor Noise is Excessive

Cause	Correction
STEP 1 Carbon buildup is excessive in the air discharge line, downstream air valves, or cylinder head	Check for carbon buildup. Replace the air compressor discharge line and cylinder head assembly if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 2 Air compressor is sending air pulses into the air tanks	Install a ping tank between the air dryer and the wet tank. Refer to the manufacturer's instructions.
OK Go To Next Step	
STEP 3 Ice buildup in the air system components	For all models, check for ice in low spots of the air discharge line, dryer inlet, and elbow fittings. On Holset® models, also check the Econ valve (if equipped). Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Contact a Cummins® Authorized Repair Facility	

Air Compressor Pumping Excess Lubricating Oil into the Air System

Cause	Correction
STEP 1 Lubricating oil drain interval is excessive	Verify the correct lubricating oil drain interval. Refer to Procedure 102-002 (Maintenance Schedule) in Section 2.
OK Go To Next Step	
STEP 2 Air intake system restriction to air compressor is excessive	Replace the air compressor air cleaner (if installed). Check the air intake piping. Check engine air intake restriction if the air compressor inlet is plumbed to the vehicle or equipment intake system. Refer to Procedure 010-059 (Air Cleaner Restriction) in Section 4.
OK Go To Next Step	
STEP 3 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 an Authorized Cummins Repair Facility.
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 the OEM service manual.
OK Go To Next Step	
STEP 5 Contact a Cummins® Authorized Repair Facility	

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

Cause	Correction
STEP 1 Air system leaks	Block the vehicle wheels and check the air system for leaks with spring brakes applied and released. Check for leaks from the air compressor gaskets and the air system hoses, fittings, tanks, and valves. Refer to the OEM service manual.

OK
Go To Next Step

STEP 2
Contact a Cummins® Authorized Repair Facility

Air Compressor Will Not Stop Pumping

Cause	Correction
STEP 1 Air system leaks	Block the vehicle wheels and check the air system for leaks with spring brakes applied and released. Check for leaks from the air compressor gaskets and the air system hoses, fittings, tanks, and valves. Refer to the OEM service manual.

OK
Go To Next Step

STEP 2
Contact a Cummins® Authorized Repair Facility

Alternator Not Charging or Insufficient Charging

Cause		Correction
STEP 1 Alternator pulley is loose on the shaft	.....	Tighten the pulley. Refer to OEM service manual.

OK
Go To Next Step

STEP 2 Batteries have malfunctioned	.....	Check the condition of the batteries. Replace the batteries, if necessary. Refer to Procedure 013-007 (Batteries) in Section 4 .

OK
Go To Next Step

STEP 3 Battery cables or connections are loose, broken, or corroded (excessive resistance)	.....	Check the battery cables and connections.

OK
Go To Next Step

STEP 4 Alternator is overloaded, or alternator capacity is below specification	.....	Install an alternator with a higher capacity. Refer to the OEM service manual.

OK
Go To Next Step

STEP 5 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 6 Battery temperature is above specification	.....	Position the batteries away from heat sources. Refer to the OEM service manual.

OK
Go To Next Step

STEP 7 Electrical system is "open" (blown fuses, broken wires, or loose connections)	.....	Check the fuses, wires, and connections. Refer to the OEM service manual and the manufacturer's wiring diagram.

OK
Go To Next Step

STEP 8 Vehicle gauge is malfunctioning	.....	Check the vehicle gauge. Refer to the OEM service manual.

OK
Go To Next Step

STEP 9
Contact a Cummins® Authorized Repair Facility

Alternator Overcharging

Cause	Correction
STEP 1 Batteries have failed	Check the condition of the batteries. Replace the batteries, if necessary. Refer to Procedure 013-007 (Batteries) in Section 4.
OK Go To Next Step	
STEP 2 Voltage regulator is malfunctioning	Check the voltage regulator. Replace the voltage regulator, if necessary. Refer to an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 3 Contact a Cummins® Authorized Repair Facility	

Coolant Contamination

Cause	Correction
STEP 1 Coolant is rusty and has debris	Drain and flush the cooling system. Fill with correct mixture of antifreeze and water. Refer to Procedures 008-046 (Supplemental Coolant Additive (SCA) and Antifreeze Concentration) in Section 7.
OK Go To Next Step	
STEP 2 Transmission oil cooler or torque converter cooler is leaking	Check the transmission oil cooler and torque converter cooler for coolant leaks. Refer to the OEM service manual.
OK Go To Next Step	
STEP 3 Lubricating oil cooler is leaking	Check the lubricating oil cooler for coolant leaks and cracks. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Cylinder head gasket is leaking	Check the cylinder head gasket. Refer to the OEM service manual.
OK Go To Next Step	
STEP 5 Contact a Cummins® Authorized Repair Facility	

Coolant Loss - External

Cause	Correction
STEP 1 Coolant level is below specification	Inspect the engine and cooling system for external coolant leaks. Repair if necessary. Add coolant. Refer to the OEM service manual.
OK Go To Next Step	
STEP 2 External coolant leak	Inspect the engine for coolant leaking from hoses, draincocks, water manifold, jumper tubes, expansion and pipe plugs, fittings, radiator core, air compressor and cylinder head gaskets, lubricating oil cooler, water pump seal, cylinder block, and OEM-mounted components that have coolant flow. Refer to Procedure 008-066 (Coolant Level) in Section 3.
OK Go To Next Step	
STEP 3 Radiator cap is **not** correct, is malfunctioning, or has low-pressure rating	Check the radiator pressure cap. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Cooling system hose is collapsed, restricted, or leaking	Inspect the hoses. Refer to Procedure 008-086 (Cooling System Hoses) in Section 4.
OK Go To Next Step	
STEP 5 Coolant fill line is restricted or obstructed	Check the coolant fill line for restrictions or obstructions. Refer to Procedure 008-066 (Coolant Level) in Section 3.
OK Go To Next Step	
STEP 6 Coolant is rusty and has debris	Drain and flush the cooling system. Fill with correct mixture of antifreeze and water. Refer to Procedure 008-046 (Supplemental Coolant Additive (SCA) and Antifreeze Concentration) in Section 7.
OK Go To Next Step	
STEP 7 Engine is overheating	Refer to the Coolant Temperature Above Normal symptom tree.
OK Go To Next Step	
STEP 8 Contact a Cummins® Authorized Repair Facility	

Coolant Temperature Above Normal - Gradual Overheat

Cause	Correction
STEP 1 Charge air cooler fins, radiator fins, or air conditioner condenser fins are damaged or obstructed with debris	Inspect the charge air cooler, air conditioner condenser, and radiator fins. Clean, if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 2 Cold weather radiator cover or winterfront is closed	Open the cold weather radiator cover or the winterfront. Maintain a minimum of 784 cm^2 [122 in^2] or approximately 28 x 28 cm [11 x 11 in] of opening at all times. Refer to Procedure 101-004 (Cold Weather Starting) in Section 1.
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 Procedure 008-066 (Coolant Level) in Section 3.
OK Go To Next Step	
STEP 4 Fan shroud is damaged or missing or the air recirculation baffles are damaged or missing	Inspect the shroud and the recirculation baffles. Repair, replace, or install, if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 5 Lubricating oil is contaminated with coolant or fuel	Contact a Cummins Authorized Repair Facility.
OK Go To Next Step	
STEP 6 Cooling system hose is collapsed, restricted, or leaking	Inspect the hoses. Refer to Procedure 008-086 (Cooling System Hoses) in Section 4.
OK Go To Next Step	
STEP 7 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 Procedure 008-046 (Supplemental Coolant Additive (SCA and Antifreeze Concentration)) in Section 6.
OK Go To Next Step	
STEP 8 Lubricating oil level is above or below specification	Check the oil level. Add or drain oil, if necessary. Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3.
OK Go To Next Step	

Coolant Temperature Above Normal - Gradual Overheat

Cause	Correction
STEP 9 Radiator fins are damaged or obstructed with debris	Inspect the radiator fins. Clean and repair the fins as necessary. Refer to the manufacturer's instructions.

OK
Go To Next Step

STEP 10 Coolant temperature gauge is malfunctioning	Test the temperature gauge. Repair or replace the gauge, if necessary.

OK
Go To Next Step

STEP 11 Fan drive belt is loose, tight, or **not** in alignment	Check the fan drive belt. Refer to Procedure 103-002 (Drive Belts) in Section 3.

OK
Go To Next Step

STEP 12 Vehicle cooling system is **not** adequate	Verify that the engine and vehicle cooling systems are using the correct components. Refer to the OEM specifications.

OK
Go To Next Step

STEP 13
Contact a Cummins® Authorized Repair Facility

Coolant Temperature Above Normal - Sea Water Cooling System

Cause	Correction
STEP 1 Sea water inlet valve is **not** open or is partially open	Check sea water inlet valve. Refer to Procedure 008-057 (Sea Water Pump) in Section 6.
OK Go To Next Step	
STEP 2 Sea water strainer clogged	Clean sea water strainer. Refer to Procedure 008-067 (Sea Water Strainer) in Section 3.
OK Go To Next Step	
STEP 3 Sea water hose(s) collapsed	Check sea water system hose(s). Refer to Procedure 008-104 (Sea Water Hoses) in Section 4.
OK Go To Next Step	
STEP 4 Sea water pump outlet pressure is excessive	Determine cause of sea water system blockage. Refer to OEM service manual.
OK Go To Next Step	
STEP 5 Sea water pump is **not** pumping water	Inspect the sea water pump impeller. Refer to Procedure 008-057 (Sea Water Pump) in Section 6.
OK Go To Next Step	
STEP 6 Contact a Cummins® Authorized Repair Facility	

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 008-066 (Coolant Level) in Section 3.
OK Go To Next Step	
STEP 2 Air in the cooling system	Inspect and vent the cooling system. Refer to the OEM service manual.
OK Go To Next Step	
STEP 3 Fan drive belt is broken	Check the fan drive belt. Replace the belt, if necessary. Refer to Procedure 103-002 (Drive Belts) in Section 3.
OK Go To Next Step	
STEP 4 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 5 Cooling system hose is collapsed, restricted, or leaking	Inspect the hoses. Refer to Procedure 008-086 (Cooling System Hoses) in Section 4.
OK Go To Next Step	
STEP 6 Coolant temperature gauge is malfunctioning	Test the temperature gauge. Repair or replace the gauge, if necessary.
OK Go To Next Step	
STEP 7 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 8 Cold weather radiator cover or winterfront is closed	Open the cold weather radiator cover or the winterfront. Maintain a minimum of 784 cm^2 [122 in^2] or approximately 28 x 28 cm [11 x 11 in] of opening at all times. Refer to Procedure 101-004 (Cold Weather Starting) in Section 1.
OK Go To Next Step	
STEP 9 Contact a Cummins® Authorized Repair Facility	

Coolant Temperature Below Normal

Cause	Correction
STEP 1 Coolant temperature gauge or sensor is malfunctioning	Test the gauge and the sensor. Repair or replace, if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 2 Engine is operating at low ambient temperature	Check the winterfront, shutters, and under-the-hood air. Use under-the-hood intake air in cold weather. Refer to Procedure 101-004 (Cold Weather Starting) in Section 1.
OK Go To Next Step	
STEP 3 Fan drive or fan controls are malfunctioning	Check the fan drive and controls. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Coolant temperature gauge is malfunctioning	Test the temperature gauge. Repair or replace the gauge, if necessary.
OK Go To Next Step	
STEP 5 Thermostat is **not** correct or is malfunctioning	Check the thermostat for the correct part number and for correct operation. Contact a Cummins Authorized Repair Facility.
OK Go To Next Step	
STEP 6 Contact a Cummins® Authorized Repair Facility	

Engine Acceleration or Response Poor

Cause	Correction
STEP 1 Operator technique is **not** correct	Refer to Procedure 101-015 (Operating the Engine) in Section 1.
OK Go To Next Step	
STEP 2 Fuel level is low in the tank	Fill the supply tank. Refer to the OEM service manual.
OK Go To Next Step	
STEP 3 Vehicle parasitics are excessive	Check the vehicle brakes for dragging, transmission malfunction, cooling fan operation cycle time, and engine-driven units. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Clutch is malfunctioning or is **not** correct	Compare the drivetrain specifications to Cummins recommendations. Check the clutch for correct operation. Refer to the OEM service manual.
OK Go To Next Step	
STEP 5 Drivetrain is **not** correctly matched to the engine	Check for correct gearing and drivetrain components. Refer to the OEM vehicle specifications.
OK Go To Next Step	
STEP 6 Fuel leak	Check the fuel lines, fuel connections, and fuel filters for leaks. Check the fuel lines to the supply tanks. Refer to Procedure 006-024 (Fuel Supply Lines) in Section A.
OK Go To Next Step	
STEP 7 Intake manifold air temperature is above specification	Refer to the Intake Manifold Air Temperature Above Specification symptom tree.
OK Go To Next Step	
STEP 8 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. Procedure 006-024 (Fuel Supply Lines) in Section A
OK Go To Next Step	
STEP 9 Charge air cooler is restricted or leaking	Inspect the charge air cooler for air restrictions or leaks. Refer to Procedure 010-027 (Charge-Air Cooler) in Section 5.
OK Go To Next Step	

Engine Acceleration or Response Poor

Cause	Correction
STEP 10 Air intake or exhaust leaks	Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to the OEM service manual.

OK
Go To Next Step

STEP 11 Air intake system restriction is above specification	Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-058 (Air Intake Piping) in Section 6.

OK
Go To Next Step

STEP 12 Fuel grade is **not** correct for the application or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.

OK
Go To Next Step

STEP 13
Contact a Cummins® Authorized Repair Facility

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

Cause	Correction
STEP 1 Starting procedure is **not** correct	Verify the correct starting procedure. Refer to Procedure 101-014 (Normal Starting Procedure) in Section 1.
OK Go To Next Step	
STEP 2 Fuel level is low in the tank	Fill the supply tank. Refer to the OEM service manual.
OK Go To Next Step	
STEP 3 Starting aid, if necessary for cold weather, is malfunctioning	Check for correct operation of the cold weather starting aid. Refer to Procedure 101-004 (Cold Weather Starting) in Section 1.
OK Go To Next Step	
STEP 4 Engine block heater is malfunctioning (if equipped)	Check the electrical sources and wiring to the cylinder block heater. Replace the block heater, if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 5 Fuel heater is malfunctioning (if equipped)	Check the fuel heater and replace, if necessary. Refer to the manufacturer's instructions.
OK Go To Next Step	
STEP 6 Battery voltage is low	Check the batteries and the unswitched battery supply circuit. Refer to Procedure 013-007 (Batteries) in Section 4.
OK Go To Next Step	
STEP 7 Keyswitch circuit is malfunctioning	Check the vehicle, equipment, or vessel keyswitch circuit. Refer to the OEM service manual.
OK Go To Next Step	
STEP 8 Engine cranking speed is too slow	If the cranking speed is slower than 150 rpm, refer to the Engine Will Not Crank or Cranks Slowly symptom tree.
OK Go To Next Step	
STEP 9 Vehicle parasitics are excessive	Check the vehicle brakes for dragging, transmission malfunction, cooling fan operation cycle time, and engine-driven units. Refer to the OEM service manual.
OK Go To Next Step	

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

Cause	Correction
STEP 10 Fuel leak	Check the fuel lines, fuel connections, and fuel filters for leaks. Check the fuel lines to the supply tanks. Refer to the OEM service manual and Procedure 006-024 (Fuel Supply Lines) in Section A.
OK Go To Next Step	
STEP 11 Fuel pump overflow valve is malfunctioning	Check the overflow valve. Replace if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 12 Fuel transfer pump malfunctioning	Inspect the fuel transfer pump. Replace if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 13 Throttle linkage adjustment is **not** correct	Check the fuel pump throttle linkage adjustment. Refer to the OEM service manual.
OK Go To Next Step	
STEP 14 Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 15 Air intake system restriction is above specification	Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-058 (Air Intake Piping) in Section 6.
OK Go To Next Step	
STEP 16 Fuel grade is **not** correct for the application or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 17 Contact a Cummins® Authorized Repair Facility	

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

Cause	Correction
STEP 1 Starting procedure is **not** correct	Verify the correct starting procedure. Refer to Procedure 101-014 (Normal Starting Procedure) in Section 1.

OK
Go To Next Step

STEP 2 Fuel level is low in the tank	Fill the supply tank. Refer to the OEM service manual.

OK
Go To Next Step

STEP 3 Fuel shutoff valve is malfunctioning	Check for loose wires and verify that the fuel shutoff valve is functioning. Check to be sure manual shutoff lever is in the run position. Refer to the OEM service manual.

OK
Go To Next Step

STEP 4 OEM engine protection system is malfunctioning	Isolate the OEM engine protection system. Follow the OEM service manuals to check for a malfunction.

OK
Go To Next Step

STEP 5 Battery voltage is low	Check the batteries and the unswitched battery supply circuit. Refer to the OEM service manual .

OK
Go To Next Step

STEP 6 Keyswitch circuit is malfunctioning	Check the vehicle, equipment, or vessel keyswitch circuit. Refer to the OEM service manual.

OK
Go To Next Step

STEP 7 Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section A.

OK
Go To Next Step

STEP 8 Fuel transfer pump malfunctioning	Inspect the fuel transfer pump. Replace if necessary. Refer to the OEM service manual.

OK
Go To Next Step

STEP 9 Fuel drain backup	Verify the fuel return line is plumbed to the bottom of the fuel tank.

OK
Go To Next Step

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

Cause	Correction
STEP 10 Fuel pump overflow valve is malfunctioning	Check or replace the return overflow valve. Refer to the OEM service manual.

OK
Go To Next Step

STEP 11 Throttle linkage misadjusted or damaged	Adjust or repair the linkage. Refer to the OEM service manual.

OK
Go To Next Step

STEP 12 Contact a Cummins® Authorized Repair Facility

Engine Noise Excessive

Cause	Correction
STEP 1 Fan drive belt is loose, tight, or **not** in alignment	Check the fan drive belt. Refer to Procedure 103-002 (Drive Belts) in Section 4.
OK Go To Next Step	
STEP 2 Lubricating oil is thin or diluted	Refer to the Lubricating Oil Pressure Low symptom tree.
OK Go To Next Step	
STEP 3 Vibration damper is damaged	Inspect the vibration damper. Refer to Procedures 001-051 (Vibration Damper, Rubber) or 001-052 (Vibration Damper, Viscous) in Section 10.
OK Go To Next Step	
STEP 4 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 010-058 (Air Intake Piping) in Section 6.
OK Go To Next Step	
STEP 5 Air intake or exhaust leaks	Inspect the air intake and exhaust systems for air leaks. Refer to the OEM service manual.
OK Go To Next Step	
STEP 6 Air intake or exhaust piping is contacting the chassis or cab	Inspect the air piping, chassis, and cab for contact points. Refer to the OEM service manual.
OK Go To Next Step	
STEP 7 Air intake system restriction is above specification	Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-058 (Air Intake Piping) in Section 6.
OK Go To Next Step	
STEP 8 Coolant temperature is above specification	Refer to the Coolant Temperature is Above Normal - Sudden Overheat or the Coolant Temperature is Above Normal - Gradual Overheat symptom tree.
OK Go To Next Step	
STEP 9 Engine mounts are worn, damaged, or **not** correct	Check the engine mounts. Refer to Procedure 016-010 (Engine Mounts) in Section A.
OK Go To Next Step	

Engine Noise Excessive

Cause	Correction
STEP 10 Fan clutch, hydraulic pump, or refrigerant compressor noise is excessive	Isolate each component and check for noise. Refer to the OEM service manual.
OK Go To Next Step	
STEP 11 Fan is loose, damaged, or has excessive hub bearing end play	Check the fan. Refer to Procedure 008-040 (Cooling Fan) in Section 3.
OK Go To Next Step	
STEP 12 Contact a Cummins® Authorized Repair Facility	

Engine Noise Excessive — Combustion Knocks

Cause	Correction
STEP 1 Engine is operating at low ambient temperature	Check the winterfront, shutters, and under-the-hood air. Use under-the-hood intake air in cold weather. Refer to Procedure 101-004 (Cold Weather Starting) in Section 1.
OK Go To Next Step	
STEP 2 Fuel grade is **not** correct for the application or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 3 Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 4 Coolant temperature is below specification	Refer to the Coolant Temperature Below Normal symptom tree.
OK Go To Next Step	
STEP 5 Contact a Cummins® Authorized Repair Facility	

Engine Power Output Low

Cause	Correction
STEP 1 Fuel level is low in the tank	Fill the supply tank. Refer to the OEM service manual.
OK Go To Next Step	
STEP 2 Engine is operating above recommended altitude	Engine power decreases above recommended altitude. Refer to the Engine Data Sheet for specifications.
OK Go To Next Step	
STEP 3 Throttle linkage adjustment is **not** correct	Check the fuel pump throttle linkage adjustment. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Fuel shutoff lever (mechanical) partially engaged	Check or replace shutoff lever in run position.
OK Go To Next Step	
STEP 5 Intake and exhaust system restricted	Check the intake and exhaust systems for restrictions. Inspect the intake air filter and replace as necessary.
OK Go To Next Step	
STEP 6 Air intake system restriction is above specification	Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-058 (Air Intake Piping) in Section 6.
OK Go To Next Step	
STEP 7 Air intake or exhaust leaks	Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to the OEM service manual.
OK Go To Next Step	
STEP 8 Air leak between the turbocharger and the intake manifold	Check for leaks in the air crossover tube, charge air cooler connections, hoses, or through holes in the manifold cover and repair or replace if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 9 Fuel leak	Check the fuel lines, fuel connections, and fuel filters for leaks. Check the fuel lines to the supply tanks. Refer to the OEM service manual.
OK Go To Next Step	

Engine Power Output Low

Cause	Correction
STEP 10 Fuel quality is poor	Operate the engine from a temporary tank of number 2 diesel fuel. Refer to the OEM service manual.
OK Go To Next Step	
STEP 11 Fuel supply is **not** adequate	Check the flow through the filter to locate the source of the restriction. Refer to the OEM service manual.
OK Go To Next Step	
STEP 12 Fuel return restriction excessive	Inspect the fuel return lines for restrictions. Refer to the OEM service manual.
OK Go To Next Step	
STEP 13 Fuel pump overflow valve is malfunctioning	Check the overflow valve. Replace if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 14 Fuel lift pump is malfunctioning	Check the fuel lift pump for correct operation. Check the pump output pressure. Replace the fuel lift pump if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 15 Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 16 Vehicle parasitics are excessive	Check the vehicle brakes for dragging, transmission malfunction, cooling fan operation cycle time, and engine-driven units. Refer to the OEM service manual.
OK Go To Next Step	
STEP 17 Charge air cooler is restricted or leaking	Inspect the charge air cooler for air restrictions or leaks. Refer to Procedure 010-027 (Charge-Air Cooler) in Section A.
OK Go To Next Step	

Engine Power Output Low

Cause	Correction
STEP 18 Lubricating oil level is above specification	Check the oil level. Verify the dipstick calibration and oil pan capacity. Fill the system to the specified level. Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3.

OK
Go To Next Step

STEP 19
Contact a Cummins® Authorized Repair Facility

Engine Runs Rough at Idle

Cause	Correction
STEP 1 Engine is cold	Allow the engine to warm to operating temperature. If the engine will **not** reach operating temperature, refer to the Coolant Temperature Below Normal symptom tree.
OK Go To Next Step	
STEP 2 Idle speed is set too low for accessories	Check and adjust the low-idle screw. Refer to the OEM service manual.
OK Go To Next Step	
STEP 3 Fuel pump overflow valve is malfunctioning	Check the overflow valve. Replace if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Fuel transfer pump malfunctioning	Inspect the fuel transfer pump. Replace if necessary. Refer to The OEM service manual.
OK Go To Next Step	
STEP 5 Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 6 Fuel supply line or passage restriction between the fuel pump and the injectors	Check the fuel supply line or passage for sharp bends or restriction. Procedure 006-024 (Fuel Supply Lines) in Section A
OK Go To Next Step	
STEP 7 Engine mounts are worn, damaged, or **not** correct	Check the engine mounts. Refer to the OEM service manual.
OK Go To Next Step	
STEP 8 Fuel grade is **not** correct for the application or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 9 Contact a Cummins® Authorized Repair Facility	

Engine Runs Rough or Misfires

Cause	Correction
STEP 1 Engine is cold	Allow the engine to warm to operating temperature. If the engine will **not** reach operating temperature, refer to the Coolant Temperature Below Normal symptom tree.
OK Go To Next Step	
STEP 2 Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 3 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. the OEM service manual
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 Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 5 Fuel leak	Check the fuel lines, fuel connections, and fuel filters for leaks. Refer to the OEM service manual.
OK Go To Next Step	
STEP 6 Fuel pump overflow valve is malfunctioning	Check the overflow valve. Replace if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 7 Fuel lift pump is malfunctioning	Check the fuel lift pump for correct operation. Check the pump output pressure. Replace the fuel lift pump if necessary. Refer to An Authorized Cummins Repair Location.
OK Go To Next Step	
STEP 8 Engine mounts are worn, damaged, or **not** correct	Check the engine mounts. Refer to Procedure 016-010 (Engine Mounts) in Section A.
OK Go To Next Step	
STEP 9 Contact a Cummins® Authorized Repair Facility	

Engine Shuts Off Unexpectedly or Dies During Deceleration

Cause	Correction
STEP 1 Engine will **not** restart	Refer to the Engine Difficult to Start or Will Not Start symptom tree.
OK Go To Next Step	
STEP 2 Fuel level is low in the tank	Fill the supply tank. Refer to the OEM service manual.
OK Go To Next Step	
STEP 3 Electronic fault codes are active	For instructions on how to read active fault codes, refer to Procedure 101-007 (Electronic Controlled Fuel System) in Section 1. If fault codes are active, contact a Cummins Authorized Repair Facility.
OK Go To Next Step	
STEP 4 Moisture in the wiring harness connectors	Dry the connectors with Cummins electronic cleaner, Part Number 3824510.
OK Go To Next Step	
STEP 5 Battery voltage supply to the electronic control module (ECM) is low, interrupted, or open	Check the battery connections, the fuses, and the unswitched battery supply circuit. Refer to the OEM service manual or a Cummins Authorized Repair Facility.
OK Go To Next Step	
STEP 6 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 7 Contact a Cummins® Authorized Repair Facility	

Engine Speed Surges at Low or High Idle

Cause	Correction
STEP 1 Fuel level is low in the tank	Fill the supply tank. Refer to the OEM service manual.
OK Go To Next Step	
STEP 2 Engine idle speed is set too low	Adjust the idle speed. Refer to the OEM service manual.
OK Go To Next Step	
STEP 3 Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 4 Fuel supply line or passage restriction between the fuel pump and the injectors	Check the fuel supply line or passage for sharp bends or restriction. Procedure 006-024 (FuelSupply Lines) in Section A
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 Procedure 018-002 (Fuel Recomendations and Specifications) in Section V.
OK Go To Next Step	
STEP 6 Contact a Cummins® Authorized Repair Facility	

Engine Speed Surges Under Load or in Operating Range

Cause	Correction
STEP 1 Fuel level is low in the tank	Fill the supply tank. Refer to the OEM service manual.
OK Go To Next Step	
STEP 2 Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 3 Idling with excessive load	Use the PTO feature for loaded conditions at low engine speeds. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 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 5 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 6 Fuel grade is **not** correct for the application or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 7 Contact a Cummins® Authorized Repair Facility	

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 Idle speed is set too low for accessories	Check and adjust the low-idle screw. Refer to the OEM service manual.
OK Go To Next Step	
STEP 3 Engine-driven units are engaged	Disengage engine-driven units.
OK Go To Next Step	
STEP 4 Fuel shutoff lever (mechanical) partially engaged	Check for correct solenoid operation. Refer to the OEM service manual.
OK Go To Next Step	
STEP 5 Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 6 Fuel filter or fuel suction line is restricted	Replace the fuel filter. Refer to Procedure 006-015 (Fuel Filter (Spin on Type)) in Section 6.
OK Go To Next Step	
STEP 7 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. Procedure 006-024 (Fuel Supply Lines) in Section A
OK Go To Next Step	
STEP 8 Fuel grade is **not** correct for the application or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 9 Contact a Cummins® Authorized Repair Facility	

Engine Vibration Excessive

Cause	Correction
STEP 1 Engine **not** running smoothly	Refer to the Engine Runs Rough or Misfires symptom tree.
OK Go To Next Step	
STEP 2 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 the OEM service manual.
OK Go To Next Step	
STEP 3 Air compressor pumping time is excessive	Refer to the Air Compressor Cycles Frequently symptom tree.
OK Go To Next Step	
STEP 4 Engine mounts are worn, damaged, or **not** correct	Check the engine mounts. Refer to Procedure 016-010 (Engine Mounts) in Section A.
OK Go To Next Step	
STEP 5 Fan is loose, damaged, or has excessive hub bearing end play	Check the fan. Refer to Procedure 008-040 (Cooling Fan) in Section 3.
OK Go To Next Step	
STEP 6 Engine is misfiring	Refer to the Engine Runs Rough or Misfires symptom tree.
OK Go To Next Step	
STEP 7 Vibration damper is damaged	Inspect the vibration damper. Refer to Procedures 001-051 (Vibration Damper, Rubber) or 001-052 (Vibration Damper, Viscous) in Section 10.
OK Go To Next Step	
STEP 8 Alternator bearing worn or damaged	Clean and replace the alternator. Refer to the OEM service manual.
OK Go To Next Step	
STEP 9 Contact a Cummins® Authorized Repair Facility	

Engine Will Not Crank or Cranks Slowly (Air Starter)

Cause	Correction
STEP 1 Air pressure is low in the air tanks	Increase air pressure with an external air source. Refer to the OEM service manual.
OK Go To Next Step	
STEP 2 Engine-driven units are engaged	Disengage engine-driven units.
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 Procedure 007-043 (Lubricating Oil Level) in Section 3.
OK Go To Next Step	
STEP 4 Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 5. Use the oil recommended in Section V.
OK Go To Next Step	
STEP 5 Electrical system is "open" (blown fuses, broken wires, or loose connections)	Check the fuses, wires, and connections. Refer to the OEM service manual and manufacturer's wiring diagram.
OK Go To Next Step	
STEP 6 Battery charge is low	Check battery. If the battery is low, check the alternator for proper charging. Charge the battery, and replace if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 7 Keyswitch circuit is malfunctioning	Check the vehicle, equipment, or vessel keyswitch circuit. Refer to the OEM service manual.
OK Go To Next Step	
STEP 8 Starter solenoid is **not** receiving voltage	Check the battery supply to the starter solenoid. Refer to the OEM service manual.
OK Go To Next Step	
STEP 9 Starting motor is malfunctioning or starting motor is **not** correct	Check the starting motor operation. Compare the starting motor with the engine and vehicle specifications. Refer to the OEM service manual.
OK Go To Next Step	

Engine Will Not Crank or Cranks Slowly (Air Starter)

Cause	Correction
STEP 10	
Contact a Cummins® Authorized Repair Facility	

Engine Will Not Crank or Cranks Slowly (Electric Starter)

Cause	Correction
STEP 1 Batteries are cold	Check the battery heater. Refer to the manufacturer's instructions .
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 Electrical system is "open" (blown fuses, broken wires, or loose connections)	Check the fuses, wires, and connections. Refer to the OEM service manual and manufacturer's wiring diagram.
OK Go To Next Step	
STEP 4 Battery charge is low	Check battery. If the battery is low, check the alternator for proper charging. Charge the battery, and replace if necessary. Refer to Procedure 013-007 (Batteries) in Section 4.
OK Go To Next Step	
STEP 5 Keyswitch circuit is malfunctioning	Check the vehicle, equipment, or vessel keyswitch circuit. Refer to the OEM service manual.
OK Go To Next Step	
STEP 6 Starter solenoid is **not** receiving voltage	Check the battery supply to the starter solenoid. Refer to the OEM service manual.
OK Go To Next Step	
STEP 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 Procedure 007-043 (Lubricating Oil Level) in Section 3.
OK Go To Next Step	
STEP 9 Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 6. Use the oil recommended in Section V.
OK Go To Next Step	

Engine Will Not Crank or Cranks Slowly (Electric Starter)

Cause	Correction
STEP 10	
Contact a Cummins® Authorized Repair Facility	

Engine Will Not Reach Rated Speed (RPM)

Cause	Correction
STEP 1 Vehicle speed is too low for adequate cooling with high engine load	Reduce the engine load. Increase the engine (fan) rpm by downshifting.
OK Go To Next Step	
STEP 2 Throttle linkage adjustment is **not** correct	Check throttle linkage adjustment. Refer to the OEM service manual.
OK Go To Next Step	
STEP 3 Tachometer is **not** calibrated or is malfunctioning	Compare the tachometer reading with a handheld tachometer or an electronic service tool reading. Calibrate or replace the tachometer as necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Air-fuel tube leaking, wastegate diaphragm ruptured, or wastegate plumbing damaged	Tighten the fittings, repair plumbing, replace wastegate diaphragm. Refer to the OEM service manual or an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 5 Charge air cooler restricted (if equipped)	Inspect the air cooler for internal and external restrictions. Replace the restricted cooler if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 6 Fuel supply is **not** adequate	Check the flow through the filter to locate the source of the restriction. Refer to the OEM service manual.
OK Go To Next Step	
STEP 7 Fuel shutoff lever (mechanical) partially engaged	Make sure fuel shutoff lever is in the RUN position. Replace if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 8 Exhaust back pressure too high	Measure and correct if above specification. Refer to an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 9 Fuel transfer pump malfunctioning	Inspect the fuel transfer pump. Replace if necessary. Refer to the OEM service manual.
OK Go To Next Step	

Engine Will Not Reach Rated Speed (RPM)

Cause	Correction
STEP 10 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 11 Engine power output is low	Refer to the Engine Power Outlet Low symptom tree.
OK Go To Next Step	
STEP 12 Contact a Cummins® Authorized Repair Facility	

Engine Will Not Shut Off

Cause	Correction
STEP 1 Fuel shutoff valve is malfunctioning	Check for loose wires and verify that the fuel shutoff valve is functioning. Check to be sure manual shutoff lever is in the run position. Refer to Procedure 005-043 (Fuel Shutoff Valve) in Section A.
OK Go To Next Step	
STEP 2 Engine running on fumes drawn into the air intake	Inspect the air intake ducts. Locate and isolate the source of the fumes. Make repairs as needed. Refer to the OEM service manual.
OK Go To Next Step	
STEP 3 Fuel leak	Check the fuel lines, fuel connections, and fuel filters for leaks using the combustible gas detector service tool. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Contact a Cummins® Authorized Repair Facility	

Exhaust Smoke Excessive Under Load

Cause	Correction
STEP 1 Engine is being lugged down	Use lower gear.
OK Go To Next Step	
STEP 2 Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank standpipe and fuel filters as necessary. Vent air from the system. Refer to Procedure 006-003 (Air in Fuel) in Section A.
OK Go To Next Step	
STEP 3 Air filter is restricted	Check the air filter for restrictions. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Intake or exhaust leak	Check intake and exhaust systems for loose or damaged piping connections and/or missing pipe plugs. Check turbocharger and exhaust manifold mounting. Refer to the OEM service manual.
OK Go To Next Step	
STEP 5 Turbocharger is malfunctioning	Monitor the turbocharger boost pressure with an electronic service tool. Refer to the OEM service manual or an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 6 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 7 Air-fuel (AFC) control is leaking or obstructed	Check the AFC for leaks. Repair any leaks found, if necessary. Check and clean AFC tubing and fittings for obstructions. Refer to the OEM service manual or an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 8 Contact a Cummins® Authorized Repair Facility	

Fault Code Warning Lamps Stay On (No Apparent Reason)

Cause	Correction
STEP 1 Diagnostic shorting plug is installed	Remove the diagnostic shorting plug.

OK
Go To Next Step

STEP 2 Diagnostic switch is in the ON position	Turn off the diagnostic switch.

OK
Go To Next Step

STEP 3 Electronic fault codes are active	For instructions on how to read active fault codes, refer to Procedure 101-007 (Electronic Controlled Fuel System) in Section 1. If fault codes are active, contact a Cummins Authorized Repair Facility.

OK
Go To Next Step

STEP 4
Contact a Cummins® Authorized Repair Facility

Fault Code Warning Lamps Do Not Illuminate

Cause	Correction
STEP 1 Keyswitch is in the OFF position	Turn the keyswitch to the ON position.

OK
Go To Next Step

STEP 2 Battery voltage supply to the electronic control module (ECM) is low, interrupted, or open	Check the battery connections, the fuses, and the unswitched battery supply circuit. Refer to the OEM service manual.

OK
Go To Next Step

STEP 3 Idle shutdown or PTO shutdown features are activated	Check the time limit on idle and PTO shutdowns with an electronic service tool. Refer to Procedure 101-007 (Electronic Controlled Fuel System) in Section 1.

OK
Go To Next Step

STEP 4
Contact a Cummins® Authorized Repair Facility

Fuel Consumption Excessive

Cause	Correction
STEP 1 Operator technique is **not** correct	Refer to Procedure 101-015 (Normal Operating Procedure) in Section 1.
OK Go To Next Step	
STEP 2 Fuel leak	Check the fuel lines, fuel connections, and fuel filters for leaks. Check the fuel lines to the supply tanks. Refer to the OEM service manual.
OK Go To Next Step	
STEP 3 Hubometer or odometer is miscalibrated	Check the hubometer and odometer calibrations. Calibrate or replace the hubometer or odometer, if necessary. Calculate fuel consumption with new mileage figures.
OK Go To Next Step	
STEP 4 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 the OEM service manual.
OK Go To Next Step	
STEP 5 Air intake or exhaust leaks	Inspect the air intake and exhaust systems for air leaks. Refer to the OEM service manual.
OK Go To Next Step	
STEP 6 Air intake system restriction is above specification	Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-058 (Air Intake Piping) in Section 6.
OK Go To Next Step	
STEP 7 Equipment and environmental factors are affecting fuel consumption	Consider ambient temperatures, wind, tire size, axle alignment, routes, and use of aerodynamic aids when evaluating fuel consumption.
OK Go To Next Step	
STEP 8 Lubricating oil level is above specification	Check the oil level. Verify the dipstick calibration and oil pan capacity. Fill the system to the specified level. Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3.
OK Go To Next Step	
STEP 9 Contact a Cummins® Authorized Repair Facility	

Fuel in Coolant

Cause	Correction
STEP 1 Bulk coolant supply is contaminated	Check the bulk coolant supply. Drain the coolant and replace with noncontaminated coolant. Replace the coolant filters. Refer to Procedure 008-006 (Coolant Filters) in Section 7.

OK
Go To Next Step

STEP 2 Contact a Cummins® Authorized Repair Facility

Fuel in the Lubricating Oil

Cause	Correction
STEP 1 Engine idle time is excessive	Low oil and coolant temperatures can be caused by long idle time (greater than 10 minutes). Shut off the engine rather than idle for long periods. If idle time is necessary, raise the idle speed.
OK Go To Next Step	
STEP 2 Bulk oil supply is contaminated	Check the bulk oil supply. Drain the oil and replace with noncontaminated oil. Replace the oil filter(s). Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 6.
OK Go To Next Step	
STEP 3 Contact a Cummins® Authorized Repair Facility	

Fuel or Lubricating Oil Leaking From Exhaust Manifold

Cause	Correction
STEP 1 Intake air restriction is high	Check the air intake system for restriction. Refer to the OEM service manual.
OK Go To Next Step	
STEP 2 Turbocharger oil drain line is restricted	Remove the turbocharger oil drain line and check for restriction. Clean or replace the oil drain line. Refer to the OEM service manual or an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 3 Turbocharger oil seal is leaking	Check the turbocharger for oil seals and for leaks. Refer to the OEM service manual or an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 4 Contact a Cummins® Authorized Repair Facility	

Intake Manifold Air Temperature Above Specification

Cause	Correction
STEP 1 Charge air cooler fins, radiator fins, or air conditioner condenser fins are damaged or obstructed with debris	Inspect the charge air cooler, air conditioner condenser, and radiator fins. Clean, if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 2 Cold weather radiator cover or winterfront is closed	Open the cold weather radiator cover or the winterfront. Maintain a minimum of 784 cm^2 [122 in^2] or approximately 28 x 28 cm [11 x 11 in] of opening at all times. Refer to Procedure 101-004 (Cold Weather Starting) in Section 1.
OK Go To Next Step	
STEP 3 Fan drive belt or water pump belt is broken	Check the fan drive belt and water pump belt. Replace the belts if necessary. Refer to Procedure 103-002 (Drive Belts) in Section 3.
OK Go To Next Step	
STEP 4 Fan shroud is damaged or missing or the air recirculation baffles are damaged or missing	Inspect the shroud and the recirculation baffles. Repair, replace, or install, if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 5 Radiator shutters are **not** opening completely or the shutterstat setting is wrong	Inspect the radiator shutters. Repair or replace if necessary. Refer to the manufacturer's instructions. Check the shutterstat setting. Refer to the OEM service manual.
OK Go To Next Step	
STEP 6 Vehicle speed is too low for adequate cooling with high engine load	Reduce the engine load. Increase the engine (fan) rpm by downshifting.
OK Go To Next Step	
STEP 7 Vehicle cooling system is **not** adequate	Verify that the engine and vehicle cooling systems are using the correct components. Refer to the OEM vehicle specifications.
OK Go To Next Step	
STEP 8 Intake manifold temperature gauge is malfunctioning, if equipped	Test the temperature gauge. Refer to the OEM service manual.
OK Go To Next Step	

Intake Manifold Air Temperature Above Specification

Cause

STEP 9
Fan is **not** an adequate size for the application

Correction

Verify that the fan is the correct size. Refer to the engine and OEM vehicle specifications.

OK
Go To Next Step

STEP 10
Contact a Cummins® Authorized Repair Facility

Intake Manifold Pressure (Boost) is Below Normal

Cause	Correction
STEP 1 Air intake or exhaust leaks	Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to OEM service manual.
OK Go To Next Step	
STEP 2 Air intake or exhaust leaks	Inspect the air intake and exhaust systems for air leaks. Refer to teh OEM service manual.
OK Go To Next Step	
STEP 3 Air intake system restriction is above specification	Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 010-058 (Air Intake Piping) in Section 6.
OK Go To Next Step	
STEP 4 Charge air cooler is restricted or leaking	Inspect the charge air cooler for air restrictions or leaks. Refer to Procedure 010-027 (Charge-Air Cooler) in Section A.
OK Go To Next Step	
STEP 5 Engine power output is low	Refer to the Engine Power Output Low symptom tree.
OK Go To Next Step	
STEP 6 Contact a Cummins® Authorized Repair Facility	

Lubricating Oil Consumption Excessive

Cause	Correction
STEP 1 Crankcase ventilation system is plugged	Check and clean the crankcase breather and vent tube. Refer to Procedure 003-018 (Crankcase Breather Tube) in Section 3.
OK Go To Next Step	
STEP 2 Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 5 and 018-003 (Lubricating Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 3 Lubricating oil drain interval is excessive	Verify the correct lubricating oil drain interval. Refer to Procedure 102-002 (Maintenance Schedule) in Section 2.
OK Go To Next Step	
STEP 4 Lubricating oil leak (external)	Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to Procedure 018-003 (Lubricating Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 5 Verify the oil consumption rate	Check the amount of oil added versus the mileage.
OK Go To Next Step	
STEP 6 Air compressor is pumping lubricating oil into the air system	Check the air lines for carbon buildup and lubricating oil. Refer to OEM service manual.
OK Go To Next Step	
STEP 7 Contact a Cummins® Authorized Repair Facility	

Lubricating Oil Contaminated

Cause	Correction
STEP 1 Lubricating oil sludge is excessive	Change the oil and filters. Refer to the Lubricating Oil Sludge in the Crankcase Excessive symptom tree.
OK Go To Next Step	
STEP 2 Lubricating oil is contaminated with coolant or fuel	Change the oil and filters. Refer to Procedures 007-002 (Lubricating Oil and Filters) in Section 5 and 018-003 (Lubricating Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 3 Fuel lift pump is malfunctioning	Check the fuel lift pump for correct operation. Check the pump output pressure. Replace the fuel lift pump if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Bulk oil supply is contaminated	Check the bulk oil supply. Drain the oil and replace with noncontaminated oil. Replace the oil filter(s). Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 5.
OK Go To Next Step	
STEP 5 Contact a Cummins® Authorized Repair Facility	

Lubricating Oil Loss

Cause	Correction
STEP 1 Lubricating oil leak (external)	Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to the OEM service manual.
OK Go To Next Step	
STEP 2 Lubricating oil level is below specification	Check the oil level. Verify the dipstick calibration and the oil pan capacity. Fill the system to the specified level. Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3.
OK Go To Next Step	
STEP 3 Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Procedures 007-002 (Lubricating Oil and Filters) in Section 5 and 018-003 (Lubricating Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 4 Lubricating oil cooler is leaking	Check the lubricating oil cooler for coolant leaks and cracks. Refer to the OEM service manual or an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 5 Air compressor is pumping lubricating oil into the air system	Check the air lines for carbon buildup and lubricating oil. Refer to the OEM service manual or an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 6 Blowby excessive	Check for excessive blowby. Refer to the OEM service manual or an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 7 Turbocharger oil seal is leaking	Check the turbocharger for oil seals and for leaks. Refer to the OEM service manual or an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 8 Contact a Cummins® Authorized Repair Facility	

Lubricating Oil Pressure High

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 Coolant temperature is below specification	Refer to the Coolant Temperature Below Normal symptom tree.
OK Go To Next Step	
STEP 3 Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Procedures 007-002 (Lubricating Oil and Filters) in Section 5 .
OK Go To Next Step	
STEP 4 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 5 Contact a Cummins® Authorized Repair Facility	

Lubricating Oil Pressure Low

Cause	Correction
STEP 1 Engine angularity during operation exceeds specification	Refer to the Engine Data Sheet.
OK Go To Next Step	
STEP 2 Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Procedures 007-002 (Lubricating Oil and Filters) in Section 5 .
OK Go To Next Step	
STEP 3 Lubricating oil is diluted with water	Check for a missing dipstick, rain caps, or oil fill caps. Change the oil. Refer to the OEM service manual.
OK Go To Next Step	
STEP 4 Lubricating oil viscosity **not** correct	Make sure the correct lubricating oil is being used. Refer to Procedure 018-003 (Lubricating Oil Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 5 Lubricating oil filter is plugged	Change the oil and filter. Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 5.
OK Go To Next Step	
STEP 6 Lubricating oil is contaminated with coolant or fuel	Change the oil and filters. Refer to the Lubricating Oil Contaminated symptom tree.
OK Go To Next Step	
STEP 7 Lubricating oil leak (external)	Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to OEM service manual.
OK Go To Next Step	
STEP 8 Lubricating oil level is above or below specification	Check the oil level. Add or drain oil, if necessary. Refer to Procedure 007-043 (Lubricating Oil Level) in Section 3.
OK Go To Next Step	
STEP 9 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	

Lubricating Oil Pressure Low

Cause	Correction
STEP 10 Contact a Cummins® Authorized Repair Facility	

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 filter(s). Refer to Procedure 007-002 (Lubricating Oil and Filters) in Section 5.
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 (Crankcase Breather Tube) in Section 3.
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 Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 5 Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Procedures 007-002 (Lubricating OIl and Filters) in Section 5.
OK Go To Next Step	
STEP 6 Contact a Cummins® Authorized Repair Facility	

Smoke, Black — Excessive

Cause	Correction
STEP 1 Air intake system restriction is above specification	Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Procedure 018-019 (Air Intake System) in Section V.

OK
Go To Next Step

STEP 2 Air intake or exhaust leaks	Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to OEM service manual.

OK
Go To Next Step

STEP 3 Air intake or exhaust leaks	Inspect the air intake and exhaust systems for air leaks. Refer to OEM service manual.

OK
Go To Next Step

STEP 4 Charge air cooler is restricted or leaking	Inspect the charge air cooler for air restrictions or leaks. Refer to Procedure 010-027 (Charge-Air Cooler) in Section A.

OK
Go To Next Step

STEP 5
Contact a Cummins® Authorized Repair Facility

Smoke, White — Excessive

Cause	Correction
STEP 1 Starting procedure is **not** correct	Verify the correct starting procedure. Refer to Procedure 101-014 (Normal Starting Procedure) in Section 1.
OK Go To Next Step	
STEP 2 Engine is cold	Allow the engine to warm to operating temperature. If the engine will **not** reach operating temperature, refer to the Coolant Temperature Below Normal symptom tree.
OK Go To Next Step	
STEP 3 Engine is operating at low ambient temperature	Check the winterfront, shutters, and under-the-hood air. Use under-the-hood intake air in cold weather. Refer to Procedure 101-004 (Cold Weather Starting) in Section 1.
OK Go To Next Step	
STEP 4 Starting aid is malfunctioning	Check for correct operation of cold-starting aid. Refer to OEM service manual.
OK Go To Next Step	
STEP 5 Coolant temperature is below specification	Refer to the Coolant Temperature is Below Normal symptom tree.
OK Go To Next Step	
STEP 6 Fuel grade is **not** correct for the application or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Procedure 018-002 (Fuel Recommendations and Specifications) in Section V.
OK Go To Next Step	
STEP 7 Air intake or exhaust leaks	Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to OEM service manual.
OK Go To Next Step	
STEP 8 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 OEM service manual.
OK Go To Next Step	

Smoke, White — Excessive

Cause	Correction
STEP 9 Air intake system restriction is above specification	Inspect the air intake system for restriction. Replace the air filter. Refer to Procedure 010-058 (Air Intake Piping) in Section 6.

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 (Charge-Air Cooler) in Section A.

OK
Go To Next Step

STEP 11
Contact a Cummins® Authorized Repair Facility

Turbocharger Leaks Engine Oil or Fuel

Cause	Correction
STEP 1 Engine is operating for extended periods under light or no-load conditions (slobbering)	Review the engine operating instructions. Refer to Procedure 101-015 (Operating the Engine) in Section 1.
OK Go To Next Step	
STEP 2 Lubricating oil or fuel is entering the turbocharger	Remove the intake and exhaust piping, and check for oil or fuel.
OK Go To Next Step	
STEP 3 Turbocharger oil drain line is restricted	Remove the turbocharger oil drain line and check for restriction. Clean or replace the oil drain line. Refer to an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 4 Turbocharger oil supply line loose or leaking	Check and tighten oil supply line fitting(s), if necessary. Refer to an Authorized Cummins Repair Facility.
OK Go To Next Step	
STEP 5 Contact a Cummins® Authorized Repair Facility	

Section V - Maintenance Specifications

Section Contents

General Engine

Specifications

Industrial

Bore.....114 mm [4.49 in]
Stroke.....135 mm [5.32 in]
Displacement.....8.27 liters [504.7 C.I.D.]
Engine Weight (dry) with Standard Accessories.....603 to 612 kg [1330 to 1350 lb]
Wet Weight.....635 to 658 kg [1400 to 1450 lb]
Firing Order.....1-5-3-6-2-4
Valve Clearances:
- Intake.....0.30 mm [0.012 in]
- Exhaust.....0.61 mm [0.024 in]

Rotation, Viewed from the Front of the Engine..... **Clockwise**
Compression Ratio:
- Naturally Aspirated.....16.4:1
- Turbocharged.....17.3:1
- Turbocharged/Aftercooled.....16.5:1
- Charge Air Cooled.....18.0:1

Marine

Type..... Four cycle, in-line, six cylinder
Bore and Stroke.....114 mm [4.49 in] x 135 mm [5.32 in]
Displacement.....8.3 liters [504.5 C.I.D.]
Engine Mounting:
- Maximum Allowable Bending Moment at Rear Face of Block.....1356 N•m [1000 ft-lb]
- Minimum/Maximum Static Installation Angle for In-line Drives (front up).....0 degrees/12 degrees
- Minimum/Maximum Static Installation Angle for V-Drives (front up).....3 degrees/12 degrees

NOTE: “Front up” refers to front of engines. In V-drives it faces the back of the boat.

Fuel System

Specifications

Industrial

Maximum Fuel Filter Pressure Drop across Filters.....34 kPa [5 psi]
Maximum Inlet Restriction to Fuel Transfer Pump.....100 mm Hg [4 in Hg]
Maximum Allowable Return Line Restriction.....518 mm Hg [20.4 in Hg]

Marine

Maximum Allowable Restriction to Fuel Pump - with Clean Filter.....63.5 mm Hg [2.5 in Hg]
Maximum Allowable Restriction to Fuel Pump - with Dirty Filter.....100 mm Hg [4 in Hg]
Maximum Allowable Return Line Pressure.....518 mm Hg [20.4 in Hg]

Lubricating Oil System

Specifications

Industrial Applications

Oil Pressure
- At Idle Speed - Minimum.....69 kPa [10 psi]
- Normal Operating Speed.....205 kPa to 517 kPa [30 psi to 75 psi]

Regulated Pressure.....517 kPa [75 psi]
Maximum Allowable Temperature.....120°C [250°F]

Maximum Operational Angularity of Oil Pan (see engine mounting)
- Front Down.....45 degrees
- Front Up.....35 degrees
- Side to Side.....45 degrees

Oil Capacity of Standard Engine:
- Standard Oil Pan (Pan **Only**).....18.9 liters [20 qt]
- Standard Oil Pan with Cylinder Block Stiffener Plate (Pan **Only**).....19.9 liters [21 qt]

Oil Pan Low to High:
- 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.....19.9 liters [21 qt]
Total System Capacity (excluding bypass Filter).....21.9 liters [23.2 qt]

NOTE: Some applications have a slightly different oil pan capacity. Contact the local Cummins Distributor if there are any questions.

Marine Applications

Oil Pressure
- At Idle Speed - Minimum.....55 kPa [8 psi]
- Normal Operating Range.....205 to 517 kPa [30 to 75 psi]

Maximum Allowable Oil Temperature.....120°C [250°F]
Oil Pan Capacity High/Low.....17/13 liters [18/14 qt]
Total System Capacity (excluding bypass filter).....21.9 liters [23.2 qt]

Cooling System

Specifications

Industrial

Coolant Capacity (engine **only**).....10.9 liters [11.5 qt]
Standard Modulating Thermostat - Range.....84 to 91°C [184 to 195°F]
Maximum Allowable Operating Temperature.....100°C [212°F]
Minimum Recommended Operating Temperature.....70°C [158°F]
Minimum Recommended Pressure Cap.....50 kPa [7 psi]

Marine

Coolant Capacity — Engine **Only** .....12.3 liters [13 qt]
Coolant Capacity - Engine with Heat Exchanger.....28.9 liters [30.5 qt]
Maximum External Pressure Loss in Cooling System.....35 kPa [5 psi]
Maximum Static Pressure of Coolant (exclusive of pressure cap).....103 kPa [15 psi]
Standard Thermostat (modulating) Range.....71 to 83°C [160 to 181°F]
Maximum Coolant Temperature.....96°C [205°F]
Minimum Allowable Coolant Expansion Space.....5 percent of System Capacity
Minimum Coolant Makeup Capacity.....2.5 liters [2.6 qt]
Maximum Sea Water Pressure.....172 kPa [25 psi]
Maximum Sea Water Inlet Restriction..... − 127 mm Hg [− 5 in Hg]

Air Intake System

Specifications

Industrial

Maximum Intake Restriction

Clean Air Filter Element.....254 mm H_2O [10.0 in H_2O]
Dirty Air Filter Element.....635 mm H_2O [25.0 in H_2O]

Marine

Maximum Allowable Intake Restriction

Clean Air Filter Element.....380 mm H_2O [15.0 in H_2O]
Dirty Air Filter Element.....635 mm H_2O [25.0 in H_2O]

Maximum Air Cleaner Inlet Temperature Rise over Ambient.....17°C [30°F]

Exhaust System

Specifications

Industrial

Maximum Exhaust Back Pressure.....76 mm Hg [3 in Hg]

Marine

Maximum Allowable Exhaust Back Pressure.....75 mm Hg [3 in Hg]

Electrical System

Specifications

Recommended Battery Capacity

System Voltage	Ambient Temperature			
	-18°C [0°F]		-29°C [-20°F]	
	Cold Cranking Amperes	Reserve Capacity (Minutes) (1)	Cold Cranking Amperes	Reserve Capacity (Minutes) (1)
12 VDC	1250	360	1875	360
24 VDC (2)	625	180	900	180

- 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.

12-VDC System

Minimum Recommended Battery Capacity:
Cold Cranking Amperes (CCA) Rating.....1250 CCA
Marine Cranking Amperes (MCA) Rating.....1563 MCA
Reserve Capacity (discharging 25 amps at 27°C [80°F]).....320 minutes
Maximum Allowable Resistance of Starting Circuit.....0.00075 ohms
Maximum Allowable Voltage Drop of Starting Circuit.....0.075 VDC
Wiring Diagram Number.....3920281

24-VDC System

Minimum Recommended Battery Capacity:
Cold Cranking Amperes (CCA) Rating.....625 CCA
Marine Cranking Amperes (MCA) Rating.....781 MCA
Reserve Capacity (discharging 25 amps at 27°C [80°F]).....320 minutes
Maximum Allowable Voltage Drop of Starting Circuit.....0.2 VDC
Maximum Allowable Resistance of Starting Circuit.....0.002 ohms
Wiring Diagram Number.....3920281

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

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

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

Fuel Filters

Fuel Filter:

- Cummins Part Number 3931063
- Fleetguard® Part Number FF5052.

Fuel-Water Separator:

- Cummins Part Number 3930942
- Fleetguard® Part Number FS1280.

Lubricating Oil Filter

- Cummins Part Number 3401544
- Fleetguard® Part Number LF9009.

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.

CAUTION

Lighter fuels can reduce fuel economy and can possibly damage the fuel injection pump.

Cummins recommends the use of ASTM Number 2D fuel. The use of Number 2D 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.

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

The following chart lists acceptable alternate fuels for C8.3 Series engines.

Acceptable Substitute Fuels - Cummins C8.3 Fuel System									
Number 1D Diesel(1)(2)	Number 2D Diesel	Number 1K Kerosene	Jet-A	Jet-A1	JP-5	JP-8	Jet-B	JP-4	CITE
OK	OK	OK	OK	OK	OK	OK	**NOT** OK	**NOT** OK	**NOT** OK
Any adjustment to compensate for reduced performance with a fuel system using alternate fuel is **not** warrantable.									
Winter blend fuels, such as those found at commercial fuel dispensing outlets, are combinations of Number 1D and Number 2D diesel fuel and are acceptable.									

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

Lubricating Oil Recommendations and Specifications

New Engine Break-in Oils

⚠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.

⚠CAUTION⚠

The use of a synthetic-based 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.

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 used in normal operation.

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

Precautions and Instructions for Proper Kit Use

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 CE/SF 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 specification represented with its product.

General Information

Midrange engines with 1999 U.S.A. certification will have 500-hour maximum oil drain intervals using CES20071 (CH-4) or better lubricating oil.

Non-U.S.A. certified engines will have 500-hour oil drain intervals using CES20071 (CH-4) or better lubricating oil.

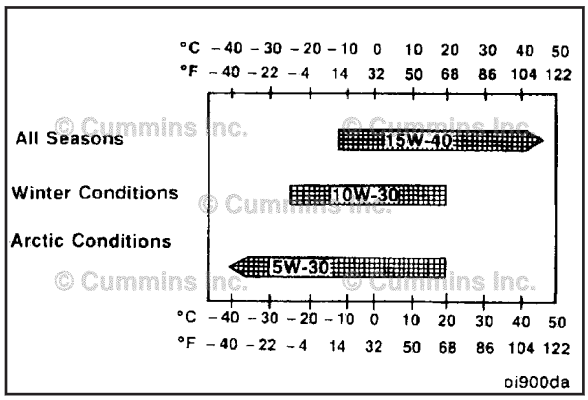
The use of quality engine lubricating oils, combined with appropriate oil drain and filter change intervals, are critical factors in maintaining engine performance and durability.

Cummins recommends the use of a high-quality SAE 15W-40 multiviscosity heavy-duty engine oil, such as Cummins Premium Blue®, that meets the requirements of Cummins Engineering Specification CES20071 or CES20076, or the American Petroleum Institute (API) performance classification CG-4 or CH-4.

NOTE: In areas where CG-4 or CH-4 lubricating oils are **not** available, CES20075 can be used but the lubricating oil change interval **must** be reduced to 12,070 km [7500 mi], or 250 hours.

A sulfated ash limit of 1.0 mass percent is suggested for optimum valve and piston deposit and oil consumption control. The sulfated ash **must not** exceed 1.85 mass percent.

For further details and discussion of engine lubricating oils for Cummins engines, refer to Cummins Engine Oil Recommendations, Bulletin Number 3810340, or a Cummins Authorized Repair Facility.

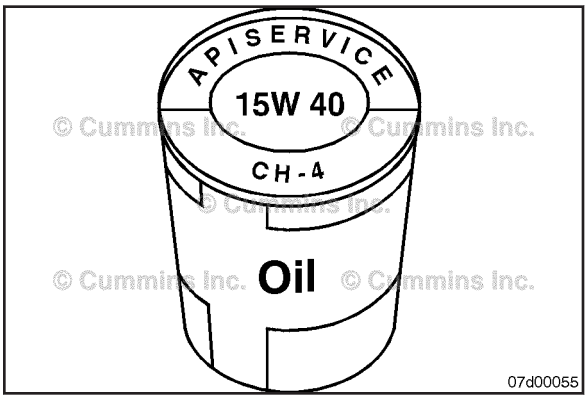


The use of low-viscosity oils, such as 10W or 10W-30, can be used to aid in starting the engine and in providing sufficient oil flow at ambient temperatures below -5°C [23°F]. However, continuous use of low-viscosity oils can decrease engine life due to wear. Refer to the accompanying chart.

The API service symbols are shown in the accompanying illustration. The upper half of the symbol displays the appropriate oil categories.

The lower half can contain a description of oil energy conserving features.

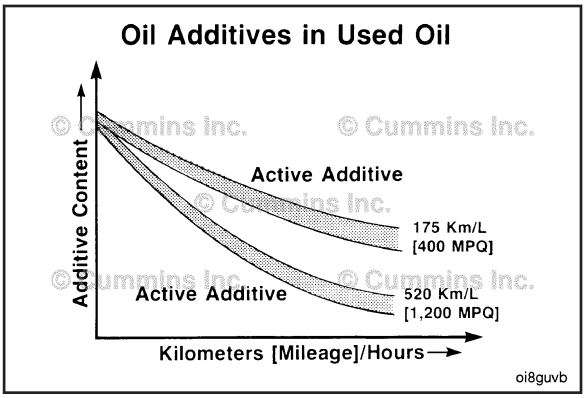
The center section identifies the SAE oil viscosity grade.

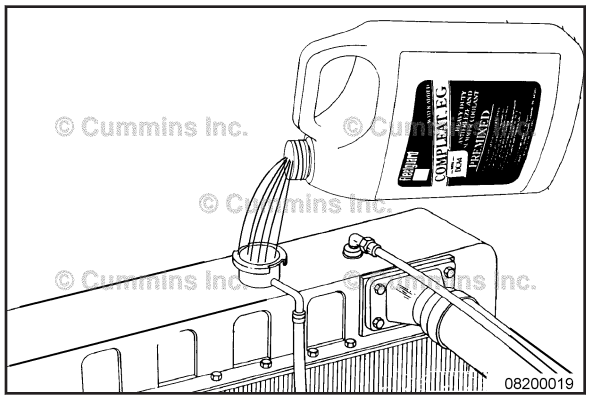


As the engine oil becomes contaminated, essential oil additives are depleted. Lubricating oils protect the engine as long as these additives are functioning properly. Progressive contamination between oil and filter change intervals is normal. The amount of contamination will vary depending on the operation 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 Interval Chart in this section to determine which oil drain interval to use for an application.





Coolant Recommendations and Specifications

Fully Formulated Coolant/Antifreeze

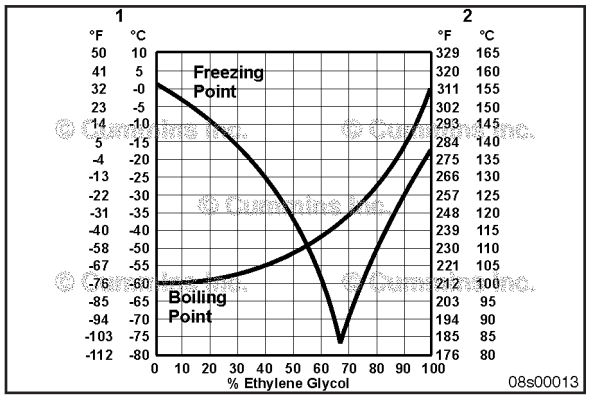
Cummins, Inc. recommends using either a 50/50 mixture of high-quality water and fully formulated antifreeze or fully formulated coolant when filling the cooling system. The fully formulated antifreeze or coolant **must** meet TMC RP 329 or TMC RP 330 specifications.

Water Quality	
Calcium Magnesium (Hardness)	Maximum 170 ppm as ($CaCO_3$ + $MgCO_3$)
Chloride	40 ppm as(Cl)
Sulfur	100 ppm as (SO_4)

18200001

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

Cummins, Inc. recommends using Fleetguard® Compleat. It is available in both glycol forms (ethylene and propylene) and complies with TMC standards.



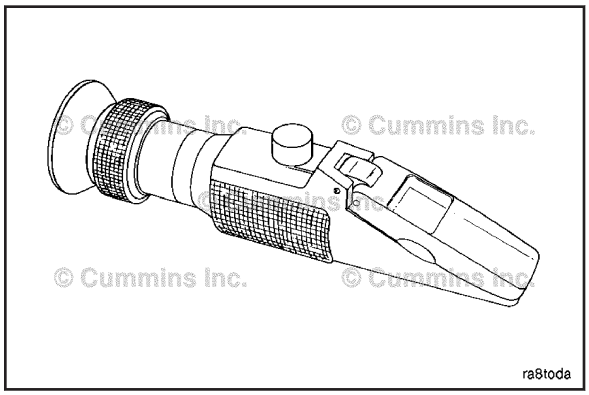
Fully formulated antifreeze **must** be mixed with high-quality water at a 50/50 ratio (40- to 60-percent working range). A 50/50 mixture of antifreeze and water has a -36°C [-33°F] freezing point and a 108°C [226°F] boiling point, which is adequate for North America. The actual lowest freezing point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

Legend

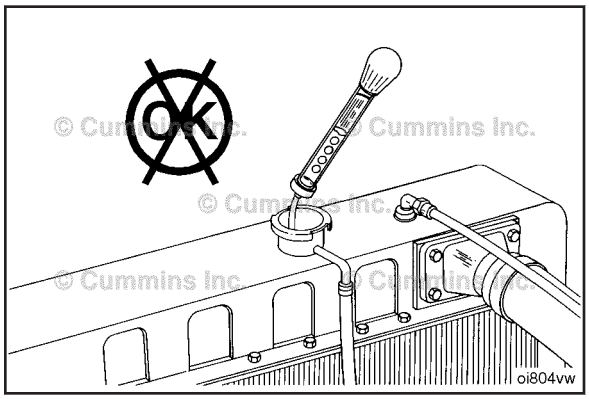
1 Freezing Point Temperature Scale

2 Boiling Point Temperature Scale

A refractometer **must** be used to measure the freezing point of the coolant accurately.



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



Specifications

Use a low-silicate antifreeze that meets ASTM4985 test (GM6038M specification) criteria.

Concentration

Antifreeze **must** be used in any climate for both freezing- and boiling-point protection. Cummins Inc. recommends a 50-percent concentration level (40- to 60-percent range) of ethylene glycol or propylene glycol in most climates. Antifreeze at 68-percent concentration provides the maximum freeze protection and **must never** be exceeded under any condition. Antifreeze protection decreases above 68 percent.

Ethylene Glycol	Propylene Glycol
40% equals -23°C [-9°F]	40% equals -21°C [-6°F]
50% equals -37°C [-35°F]	50% equals -33°C [-27°F]
60% equals -54°C [-65°F]	60% equals -49°C [-56°F]
68% equals -71°C [-96°F]	68% equals -63°C [-81°F]

Concentration Testing

Antifreeze concentration **must** be checked using a refractometer (such as Fleetguard® Part No. CC2800). "Floating-Ball"-type density testers or hydrometers are **not** accurate enough for use with heavy-duty diesel cooling systems.

Coolant Change Recommendation

The coolant **must** be drained and replaced every 2 years or 385,000 km [239,227 mi] to eliminate buildup of harmful chemicals.

Cooling System Additives

Supplemental Coolant Additive (SCA)

Supplemental coolant additives (SCA) are recommended for all Cummins Inc. cooling systems. Antifreeze alone does **not** provide sufficient protection for heavy-duty diesel engines.

DCA4

DCA4 is the recommended SCA for all Cummins Inc. engines. Other brands can be used if they provide adequate engine protection and do **not** cause seal or gasket degradation or corrosion/fouling.

SCA Concentration

The recommended concentration level of DCA4 is 1.5 units for every 3.7 liters [1 gal]. The DCA4 concentration **must never** exceed 3.0 units for every 3.7 liters [1 gal] nor fall below 1.2 units for every 3.7 liters [1 gal].

DCA4 Filter Change Interval

Supplemental coolant additives deplete during normal engine operation. Cummins Inc. recommends that the level be maintained by installation of a service coolant filter on the engine at every 10,000-km [6214 mi], 250-hours, or 3-month interval.

DCA4 Concentration Test

As noted above, the primary method is to maintain proper DCA4 concentration levels by changing the service coolant filter at every 10,000 km [6214 mi], 250 hours, or 3 months. Fleetguard® DCA4 “dipstick” test kit, Part No. CC2626, or Fleetguard® Monitor C™, Part No. CC2700, **must** be used if testing is deemed necessary due to one of the following reasons:

- Addition of untreated make-up coolant in excess of 5.7 liters [6 qt] between maintenance intervals
- Troubleshooting of cooling system problems in the fleet (such as corrosion or seal leakage)
- An optional program in some fleets to monitor SCA levels to determine if maintenance intervals are acceptable.

NOTE: The practice of using a test kit to determine when to add or change the coolant filter is specifically **not** recommended. No other test kit (such as Fleetguard® titration test kit, Part No. 3300846-S or 3825379-S) can be used on Cummins engines with DCA4.

DCA4 Unit Maintenance Guide

Fleetguard® Part No.	Cummins Part No.	DCA4 Units
DCA4 Liquid		
DCA 60L	3315459	4*
DCA4 Filter		
WF-2070	3318157	2

WF-2071	3315116	4
WF-2072	3318201	6
WF-2073	3315115	8
WF-2074	3316053	12
WF-2077	None	0
*If DCA 60L is used, do **not** use a coolant filter that contains coolant additives. The combination of liquid and filter coolant additives will result in overconcentration.		

DCA4 Maintenance Guide

Maintenance Intervals		
Total Cooling System Capacity	Initial Charge (B)	10,000 km [6000 mi], 250 Hours, or 3 Months
30 to 57 liters [8 to 15 gal]	WF-2074	WF-2070

Notes:

A Consult the vehicle equipment manufacturer's maintenance information for the total cooling system capacity.

B After draining and replacing the coolant, install the initial per-charge coolant filter to provide the recommended level of DCA4 concentration.

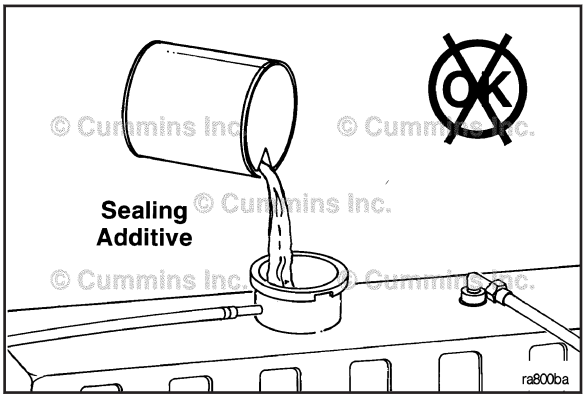
C Change the coolant filter at regular intervals to protect the cooling system.

D Check the coolant additive concentration regularly. Check the cooling system using Fleetguard® DCA4 **only** with DCA4 coolant test kit, Part No.CC-2626.

Cooling System Sealing Additives

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

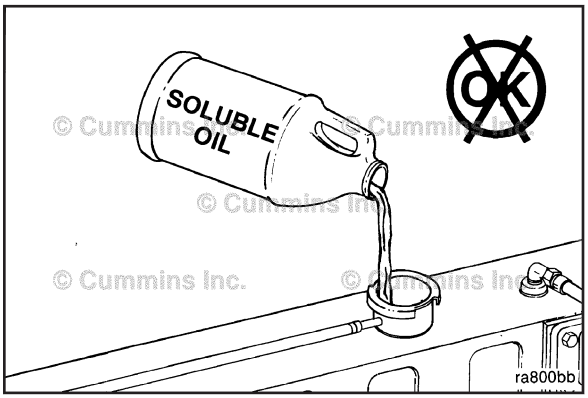
- Build up in coolant low-flow areas
- Clog coolant filters
- Plug radiator and oil cooler
- Possibly damage water pump seal.



Cooling System Soluble Oils

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

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



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
31 rib	-	3164750	1668	375	1330 to 1560	300 to 350

NOTE: This chart does not apply to automatic belt tensioners.

* A belt is considered used if it has been in service for ten minutes or longer.

* If used belt tension is less than the minimum value, tighten the belt to the maximum used belt value.

Engine Component Torque Values

Torque Table

Component	Wrench Size	Torque Value		
		N•m	ft-lb	in-lb
Aftercooler mounting	10 mm	24	18	
Aftercooler water hose clamp	8 mm	5		44
Alternator link (Delco 10-15 SI)	13 mm	24	18	
Alternator link (Delco 20-27 SI)	3/4 in	43	32	
Alternator mounting bolt 10-15 SI	15 mm	43	32	
Alternator mounting 27 SI	18 mm	77	57	
Alternator support (upper)	10 mm	24	18	
Belt tensioner flat bracket	Allen 5 mm	24	18	
Belt tensioner mounting	15 mm	43	32	
Crankshaft damper and pulley	15 mm	137	101	
Crossover clamp	5/16 in	5		44
Tee bolt type clamp	11 mm	8		71
Exhaust outlet pipe, v-band clamp	7/16 in	8		71
Fan bracket mounting	10 mm	24	18	
Fan pulley	10 mm	24	18	
Fan pulley	13 mm	43	32	
Fuel filter	75 to 85 mm	Install as specified by filter manufacturer.		
Fuel filter adapter nut	24 mm	32	24	
Lubricating oil filter	75 to 85 mm	3/4 of a turn after contact		
Lubricating oil cooler assembly	10 mm	24	18	
Lubricating oil pan drain plug	17 mm	80	59	
Lubricating oil pan heater plug	27 mm	80	59	
Lubricating oil pressure regulator plug	19 mm	80	59	
Starter mounting	10 mm	43	32	
Thermostat housing	10 mm	24	18	
Water inlet connection	15 mm	43	32	
Water pump mounting	13 mm	24	18	
Rocker lever (valve) cover	15 mm	12		106
Water-in-fuel (WIF) sensor	19 mm	Hand-tighten		

Sealants

General Information

Use either the sealants listed below or sealants containing equivalent properties.

Item Description	Sealing Method
Pipe plugs	Pre-coated Teflon™ or pipe sealer
Cups plugs	Loctite® 271 or Cummins® sealant, Part Number 3375068
O-rings	Lubriplate™ 105
Rear camshaft expansion plug	Loctite® 271 or Cummins® sealant, Part Number 3375068
Fuel pump studs	Loctite® 242
Turbocharger drain (in block)	Loctite 271 or Cummins® sealant, Part Number 3375068
Dipstick tube (in block)	Loctite® 271 or Cummins® sealant, Part Number 3375068
Wet flywheel housing to block	Three-Bond™ sealant, Part Number 3823494
Side oil fill	Loctite® 271 or Cummins® sealant, Part Number 3375068
Oil pan at gear housing joint	Three-Bond™ sealant, Part Number 3823494

Capscrew Markings and Torque Values

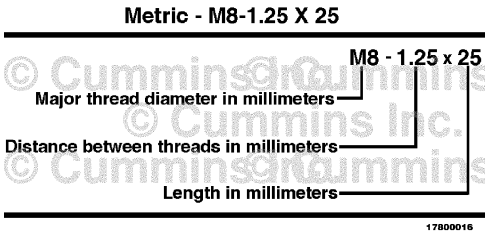
General Information

⚠CAUTION⚠

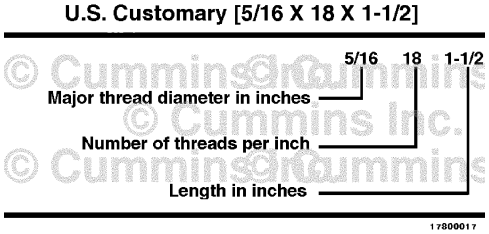
When replacing capscrews, always use a capscrew of the same measurement and strength as the capscrew being replaced. Using the wrong capscrews can result in engine damage.

Metric capscrews and nuts are identified by the grade number stamped on the head of the capscrew or on the surface of the nuts. U.S. Customary capscrews are identified by radial lines stamped on the head of the capscrew.

The following examples indicate how capscrews are identified:

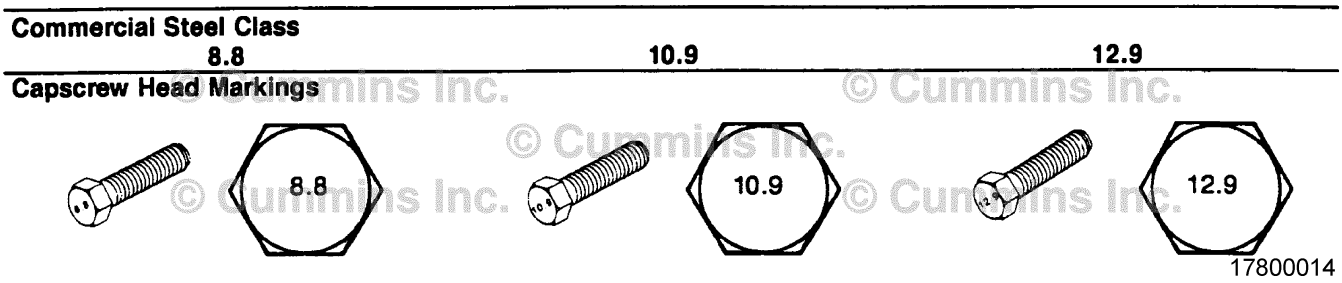


- **Always** use the torque values listed in the following tables when specific torque values are **not** available.
- Do **not** use the torque values in place of those specified in other sections of this manual.
- The torque values in the table are based on the use of lubricated threads.
- When the 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.



- **Always** use the torque values listed in the following tables when specific torque values are **not** available.
- Do **not** use the torque values in place of those specified in other sections of this manual.
- The torque values in the table are based on the use of lubricated threads.
- 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.

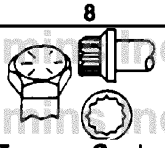
Capscrew Markings and Torque Values - Metric



Body Size	Torque				Torque				Torque			
Diameter	Cast Iron		Aluminium		Cast Iron		Aluminium		Cast Iron		Aluminium	
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

Body Size	Torque				Torque				Torque			
Diameter	Cast Iron		Aluminium		Cast Iron		Aluminium		Cast Iron		Aluminium	
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
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

17800015

Capscrew Body Size	Cast Iron		Aluminium		Cast Iron		Aluminium	
	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

Fraction, Decimal, Millimeter Conversions

Conversion Chart

Fraction	inch	mm	Fraction	inch	mm
1/64	0.0156	0.397	33/64	0.5156	13.097
1/32	0.0313	0.794	17/32	0.5313	13.494
3/64	0.0469	1.191	35/64	0.5469	13.891
1/16	0.0625	1.588	9/16	0.5625	14.288
5/64	0.0781	1.984	37/64	0.5781	14.684
3/32	0.0938	2.381	19/32	0.5938	15.081
7/64	0.1094	2.778	39/64	0.6094	15.478
1/8	0.1250	3.175	5/8	0.6250	15.875
9/64	0.1406	3.572	41/64	0.6406	16.272
5/32	0.1563	3.969	21/32	0.6563	16.669
11/64	0.1719	4.366	43/64	0.6719	17.066
3/16	0.1875	4.763	11/16	0.6875	17.463
13/64	0.2031	5.159	45/64	0.7031	17.859
7/32	0.2188	5.556	23/32	0.7188	18.256
15/64	0.2344	5.953	47/64	0.7344	18.653
1/4	0.2500	6.350	3/4	0.7500	19.050
17/64	0.2656	6.747	49/64	0.7656	19.447
9/32	0.2813	7.144	25/32	0.7813	19.844
19/64	0.2969	7.541	51/64	0.7969	20.241
5/16	0.3125	7.938	13/16	0.8125	20.638
21/64	0.3281	8.334	53/64	0.8281	21.034
11/32	0.3438	8.731	27/32	0.8438	21.431
23/64	0.3594	9.128	55/64	0.8594	21.828
3/8	0.3750	9.525	7/8	0.8750	22.225
25/64	0.3906	9.922	57/64	0.8906	22.622
13/32	0.4063	10.319	29/32	0.9063	23.019
27/64	0.4219	10.716	59/64	0.9219	23.416
7/16	0.4375	11.113	15/16	0.9375	23.813
29/64	0.4531	11.509	61/64	0.9531	24.209
15/32	0.4688	11.906	31/32	0.9688	24.606
31/64	0.4844	12.303	63/64	0.9844	25.003
1/2	0.5000	12.700	1	1.0000	25.400

Conversion Factor: 1 inch = 25.4 mm

Newton-Meter to Foot-Pound Conversions

Conversion Chart

N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1	9 in-lb	55	41	155	114
5	44 in-lb	60	44	160	118
6	53 in-lb	65	48	165	122
7	62 in-lb	70	52	170	125
8	71 in-lb	75	55	175	129
9	80 in-lb	80	59	180	133
10	89 in-lb	85	63	185	136
11	97 in-lb	90	66	190	140
12	106 in-lb	95	70	195	144
14	124 in-lb	100	74	200	148
15	133 in-lb	105	77	205	151
16	142 in-lb	110	81	210	155
18	159 in-lb	115	85	215	159
20	15 ft-lb	120	89	220	162
25	18	125	92	225	165
30	22	130	96	230	170
35	26	135	100	235	173
40	30	140	103	240	177
45	33	145	107	245	180
50	37	150	111	250	184
NOTE: To convert from Newton-Meters to Kilogram-Meters divide Newton-Meters by 9.803.					

Pipe Plug Torque Values

Torque Table

Size		Torque		Torque	
Thread	Actual Thread O.D.	In Aluminum Components		In Cast Iron or Steel Components	
in	**in**	**N•m**	**ft-lb**	**N•m**	**ft-lb**
1/16	0.32	5	45 in-lb	15	10
1/8	0.41	15	10	20	15
1/4	0.54	20	15	25	20
3/8	0.68	25	20	35	25
1/2	0.85	35	25	55	40
3/4	1.05	45	35	75	55
1	1.32	60	45	95	70
1-1/4	1.66	75	55	115	85
1-1/2	1.90	85	65	135	100

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

General Information

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

Tap Size		Drill
60%	75%	Size
		48
		1.95mm
		5/64
	3-48	47
		2.00mm
	M2.5x.45	2.05mm
		46
3-48	3056	45
		2.10mm
M2.5x.45	M2.6x.45	2.15mm
3-56	4-36	44
		2.20mm
M2.6x.45		2.25mm
4-36	4-40	43
		2.30mm
		2.35mm
4-40	4-48	42
		3/32
	M3x.6	2.40mm
4-48		41
		2.45mm
		40
M3x.6	M3x.5	2.50mm
		39
	5-40	38
M3x.5		2.60mm
5-40	5-44	37
		2.70mm
5-44	6-32	36
		2.75mm
		7/64
		35
		2.80mm
		34
6-32	6-40	33
	M3.5x6	2.90mm
		32
M3.5x6		3.00mm
6-40		31
		3.10mm
		1/8
		3.20mm
	M4x.75	3.25mm
		30
	M4x.7	3.30mm
M4x.75		3.40mm
M4x.7	8-32	29
		3.50mm
	8-36	28
8-32		9/64
		3.60mm
8-36		27
		3.70mm
		26
	M4.5x.75	3.75mm
	10-24	25
		3.80mm
		24
M4.5x.75		3.90mm
		23
		5/32
10-24		22
	M5x1	4.00mm
	10-32	21
		20
	M5x.9	4.10mm
M5x1	M5x.8	4.20mm
10-32		19
M5x.9		4.25mm
M5x.8		4.30mm
		18
		11/64
		17

Tap Size		Drill
60%	75%	Size
		4.40mm
	12-24	16
		4.50mm
		15
	M5.5x.9	4.60mm
12-24	12-28	14
		13
		4.70mm
M5.5x.9		4.75mm
12-28		3/16
		12
		4.80mm
		11
		4.90mm
		10
		9
	M6x1	5.00mm
		8
		5.10mm
	1/4-20	7
		13/64
		6
M6x1		5.20mm
		5
	M6x.75	5.25mm
		5.30mm
1/4-20		4
M6x.75		5.40mm
	1/4-28	3
		5.50mm
		7/32
		5.60mm
1/4-28		2
		5.70mm
		5.75mm
		1
		5.80mm
		5.90mm
		A
		15/64
	M7x1	6.00mm
		B
		6.10mm
		C
M7x1		6.20mm
		D
	M7x.75	6.25mm
		6.30mm
		E
		1/4
M7x.75		6.40mm
		6.50mm
	5/16-18	F
		6.60mm
		G
		6.70mm
		17/64
	M8x1.25	6.75mm
5/16-18		H
		6.80mm
		6.90mm
	5.16-24	I
M8x1.25	M8x1	7.00mm
		J
		7.10mm
5/16-24		K
		9/32
M8x1		7.20mm
		7.25mm
		7.30mm
		L
		7.40mm
		M

Tap Size		Drill
60%	75%	Size
		7.50mm
		19/64
		7.60mm
		N
		7.70mm
	M9x1.25	7.75mm
		7.80mm
		7.90mm
	3/8-16	5/16
M9x1.25	M9x1	8.00mm
		O
		8.10mm
M9x1		8.20mm
		P
		8.25mm
		8.30mm
3/8-16	1/8-27NPT	21/64
		8.40mm
	3/8-24	Q
	M10x1.5	8.50mm
		8.60mm
		R
3/8-24		8.70mm
1/8-27NPT		11/32
	M10x1.25	8.75mm
M10x1.5		8.80mm
		S
		8.90mm
M10x1.25	M10x1	9.00mm
		T
		9.10mm
		23/64
M10x1		9.20mm
		9.30mm
	7/16-14	U
		9.40mm
	M11x1.5	9.50mm
		3/8
		V
		9.60mm
		9.70mm
		9.75mm
M11x1.5		9.80mm
7/16-14		W
		9.90mm
	7/16-20	25/64
		10.00mm
7/16-20		X
	M12x1.75	10.20mm
		Y
		13/32
		Z
M12x1.75	M12x1.5	10.50mm
	1/2-13	27/64
M12x1.5	M12x1.25	10.75mm
M12x1.25		11.00mm
1/2-13		7/16
1/4-18NPT		
		11.25mm
		11.50mm
		29/64
		11.75mm
		11.50mm
	1/2-20	29/64
	9/16-12	15/32
	M14x2	12.00m
		12.25mm
9/16-12		31/64
M14x2	M14x1.5	12.50mm
	9/16-18	1/2
M14x1.5	M14x1.25	12.75mm
M14x1.25		13.00mm
9/16-18		33/64

Tap Size		Drill
60%	75%	Size
		13.25mm
	5/8-11	17/32
	M15x1.5	13.50mm
M15x1.5		13.75mm
5/8-11		35/64
	M16x2	14.00mm
		14.25mm
	5/8-18	9/16
M16x2	M16x1.5	14.50mm
5/8-18		37/64
		14.75mm
M16x1.5		15.00mm
		19.32
		15.25mm
		39/64
	M17x1.5	15.50mm
M17x1.5	M18x2.5	15.75mm
		5/8
M18x2.5	M18x2	16.00mm
M18x2		16.25mm
	3/4-10	41/64
	M18x1.5	16.50mm
3/4-10	M19x2.5	21/32
M18x1.5		16.75mm
M19x2.5		17.00mm
		43/64
		17.25mm
3/4-16	3/4-16	11/16
	M20x2.5	17.50mm
		17.75mm
		45/64
M20x2.5	M20x2	18.00mm
M20x2		18.25mm
		23/32
	M20x1.5	18.50mm
		47/64
M20x1.5		18.75mm
		19.00mm
		3/4
		19.25mm
	7/8-9	49/64
	M22x2.5	19.50mm
7/8-9		25/32
		19.75mm
M22x2.5	M22x2	20.00mm
	7/8-14	51/64
M22x2		20.25mm
	M22x1.5	20.50mm
7/8-14		13/16
		20.75mm
M22x1.5	M24x3	21.00mm
		53/64
		21/25mm
		27/32
M24x3		21.50mm
		21.75mm
		55/64
	M24x2	22.00mm
	1"-8	7/8
M24x2		22.25mm
	M24x1.5	22.50mm
1"-8		57/64
M24x1.5		22.75mm
	M25x2	23.00mm
	1"-12	29/32
M25x2		23.25mm
1"x12	1"-14	59/64
	M25x1.5	23.50mm
M20x1.5		23.75mm
1"-14		15/16

17800013

Weights and Measures - Conversion Factors

Conversion Chart

Quantity	U.S. Customary		Metric		From U.S. Customary To Metric Multiply By	From Metric To U.S. Customary Multiply By
	Unit Name	Abbreviation	Unit Name	Abbreviation		
Area	sq. inch	in^2	sq. millimeters	mm^2	645.16	0.001550
			sq. centimeters	cm^2	6.452	0.155
	sq. foot	ft^2	sq. meter	m^2	0.0929	10.764
Fuel Consumption	pounds per horsepower hour	lb/hp-hr	grams per kilowatt hour	g/kW-hr	608.277	0.001645
Fuel Performance	miles per gallon	mpg	kilometers per liter	km/l	0.4251	2.352
	gallons per mile	gpm	liters per kilometer	l/km	2.352	0.4251
Force	pounds force	lbf	Newton	N	4.4482	0.224809
Length	inch	in	millimeters	mm	25.40	0.039370
	foot	ft	millimeters	mm	304.801	0.00328
Power	horsepower	hp	kilowatt	kW	0.746	1.341
Pressure	pounds force per sq. inch	psi	kilopascal	kPa	6.8948	0.145037
	inches of mercury	in Hg	kilopascal	kPa	3.3769	0.29613
	inches of water	in H_2O	kilopascal	kPa	0.2488	4.019299
	inches of mercury	in Hg	millimeters of mercury	mm Hg	25.40	0.039370
	inches of water	in H_2O	millimeters of water	mm H_2O	25.40	0.039370
	bars	bars	kilopascals	kPa	100.001	0.00999
	bars	bars	millimeters of mercury	mm Hg	750.06	0.001333
Temperature	fahrenheit	°F	centigrade	°C	(°F-32) ÷1.8	(1.8 x °C) +32
Torque	pound force per foot	ft-lb	Newton-meter	N•m	1.35582	0.737562
	pound force per inch	in-lb	Newton-meter	N•m	0.113	8.850756
Velocity	miles/hour	mph	kilometers/hour	kph	1.6093	0.6214
Volume: liquid displacement	gallon (U.S.)	gal.	liter	l	3.7853	0.264179
	gallon (Imp*)	gal.	liter	l	4.546	0.219976
	cubic inch	in^3	liter	l	0.01639	61.02545
	cubic inch	in^3	cubic centimeter	cm^3	16.387	0.06102
Weight (mass)	pounds (avoir.)	lb	kilograms	kg	0.4536	2.204623
Work	British Thermal Unit	BTU	joules	J	1054.5	0.000948
	British Thermal Unit	BTU	kilowatt-hour	kW-hr	0.000293	3414
	horsepower hours	hp-hr	kilowatt-hour	kW-hr	0.746	1.341

Notes

Section W - Warranty

Section Contents

This Page Left Intentionally Blank

All Engines Less Than 10L Worldwide New Engine Parts

Coverage

Products Warranted

This Warranty applies to new Parts sold by Cummins when used on or with its Engines less than 10L which are purchased by the first user on or after January 1, 2013. It applies anywhere in the world where Cummins approved service is available through a Cummins distributor.

Coverage

This Warranty covers any failures of the Parts, under normal use and service, which result from defects in material or factory workmanship (Warrantable Failures). The Coverage is for the duration specified within the warranty or specified maintenance interval, whichever occurs first, after the date of first installation.

This Warranty is made to all Owners in the chain of distribution and Coverage continues to all subsequent Owners until the end of the periods of Coverage.

Cummins Responsibilities

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

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

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

Owner Responsibilities

At the time when the Parts are installed, Owner is responsible for the preparation of a written record containing the following: (1) the date of installation of the Parts; (2) the Engine serial number; (3) the Engine miles, hours or kilometers of operation; (4) the Parts installed; and (5) the location of the Parts in the Engine. The purpose of this record is to protect Owner's interests and support any claim for a Warrantable Failure.

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

Before 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. Owner must also deliver the Engine to the repair facility. Locations in the United States and Canada are listed in the United States 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 provided during Warranty repairs unless such items are not reusable due to a Warrantable Failure.

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

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

Limitations

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

Except for fuel pumps, Cummins does not warrant parts supplied by Cummins which bear the name of another company. This category of parts includes, but is not limited to: hydraulic pumps, alternators, starters, fans, air conditioning compressors, clutches, filters, power steering pumps, transmissions, torque converters, marine gears, air cleaners, non-Cummins air compressors and Engine compression brakes.

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

Parts used to repair a Warrantable Failure may be new Cummins parts, Cummins ReCon® 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 ReCon® part used to repair a Warrantable Failure assumes the identity of the part it replaced and is entitled to the remaining Coverage hereunder.

This Warranty does not apply to parts furnished by Cummins at no charge to the Owner.

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

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGE.

THIS WARRANTY IS THE SOLE WARRANTY MADE BY CUMMINS IN REGARD TO THESE PARTS. CUMMINS MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

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

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.

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

Additional Coverage is outlined in the Emission Warranty section.

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 (3,000 hours for A Series Engines) 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.

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

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

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

Limitations

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

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:	
EPA 2007/2010/2013	max. 15 parts per million
EPA Tier 4 Interim / Final	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

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

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.

For all other Industrial engines (except those previously mentioned), 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.

For all A Series Applications, including Industrial, travel reimbursement for non-transportable equipment will be limited to 4.0 hours, $0.25/mile and 250 miles maximum. Any costs beyond this limit are the customer's responsibility.

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* and Canada 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 and 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 for industrial applications, five years or 3,500 hours of operation for industrial spark-ignited Engines (GTA855, G855, G5.9C, G8.3-C, GTA8.9E, QSK19G) and five years or 2,500 hours of operation for industrial spark-ignited Engines (GKTA19-GC), whichever occurs first, as measured from the date of delivery of the Engine to the ultimate purchaser, or (B) The Base Engine Warranty.

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

Limitations

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

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:	
EPA 2007/2010/2013	max. 15 parts per million
EPA Tier 4 Interim / Final	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

Failures, other than those resulting from defects in 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 oil, fuel or diesel exhaust fluid or by water, dirt or other contaminants in the fuel, oil or diesel exhaust fluid.

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

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

** Alternators, starters, and fans ARE covered for the duration of the Base Engine Warranty on A Series and B3.3 Engines.

** Alternators and starters are covered for the duration of the Base Engine Warranty on QSK23 Engines.

*** Emissions Warranty for BLPG Industrial Off-Highway Engines is 5 years / 3,500 hours.

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.

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

Extended Major Components Warranty

The Extended Major Components Warranty 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 (3,000 hours for A Series Engines) of operation, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first.

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

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

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

Limitations

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

Maximum sulfur levels by emissions certification level as listed on the Engine's dataplate are:	
EPA 2007/2010/2013	max. 15 parts per million
EPA Tier 4 Interim / Final	max. 15 parts per million
EU Stage IIIB 2011	max. 15 parts per million
Euro 4/5	max. 50 parts per million
Euro 6	max. 10 parts per million

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

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.

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.

For all A Series Applications, including Industrial, travel reimbursement for non-transportable equipment will be limited to 4.0 hours, $0.25/mile and 250 miles maximum. Any costs beyond this limit are the customer's responsibility.

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 the 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.

* Alternators and starters are covered for the duration of the Base Engine Warranty on QSK23 Engines.

US Marine (division of Brunswick Corp.) Worldwide Propulsion Products Coverage

Products Warranted

This warranty applies to new B and C Series Engines and Marine Gears sold by Cummins Inc., herein after 'Cummins', that are installed in Marine (division of Brunswick Corp.) hulls and used in Marine propulsion applications anywhere in the world where Cummins approved service is available* and delivered to the first user on or after May 1, 1995. The 'Product' consists of a new Cummins Engine, as well as accessories approved and installed by Cummins. These Products have the following designation:

High Output Rating

This power rating is for use in variable load applications where full power is limited to one (1) hour out of every eight (8) 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 pleasure/non-revenue generating applications that operate less than 300 hours per year.

Base Engine Warranty

This warranty covers any failures of the Product, under normal use and service, which result from a defect in Cummins material or factory workmanship (Warrantable Failure). Coverage begins with the sale of the Engine by Cummins and ends at the time or mileage stated below. The duration commences on either 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.

Extended Major Components Warranty

The Extended Major Components Warranty covers Warrantable Failures of the following Engine parts or castings (Covered Parts):

- Engine Cylinder Block Casting
- Engine Cylinder Head Casting
- Engine Camshaft Forging
- Engine Crankshaft Forging
- Engine Connecting Rods
- Engine Gear Train Gears:
  - Crankshaft Gear
  - Camshaft Gear
  - Camshaft Idler Gear
  - Accessory Drive Gear
  - Fuel Pump Gear
- Engine Gear Cover and Housing
- Flywheel Housing

Bushing and bearing failures are NOT covered.

Extended Major Components Warranty continues beyond the expiration of the Base Engine Warranty and continues for the Duration stated below. The Duration commences on either 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.

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.

Warranty Coverage		
	Coverage Duration*	
Coverage Category	Months	Hours
Base Engine Warranty	24	600
Extended Major Components	72	1800
*Whichever occurs first.		

Warranty Coverage				
	Repair Charge Paid by Cummins			
Coverage Category	Parts	Labor	Removal & Installation Labor	Travel
Base Engine Warranty	Yes	Yes	Yes	Yes - Up to 6 hours
Extended Major Components	Yes**	Yes	Yes	No
**Covered Parts as listed above.				

Cummins Responsibilities

During the Base Engine Warranty

Cummins 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, Cummins will pay up to six (6) hours total travel expenses, including meals, mileage and lodging, for mechanics to travel to and from the repair dock.

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 for 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 of any Covered Part damaged by a Warrantable Failure of the defective Covered Part.

Owner Responsibilities

During the Extended Major Components Warranty

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

During Both the Base Engine and the Extended Major Components Warranties

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 the operation and maintenance of the Product 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 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.

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

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.

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 cooling, lubricating or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications to the Engine. Cummins is also not responsible for failures caused by incorrect oil or fuel or by water, dirt or other contaminants in the fuel or oil.

Cummins is not responsible for failures resulting from:

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 Cummins published standards.

Failure of belts and hoses supplied by Cummins 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 Cummins parts, Cummins approved rebuilt parts, or repaired parts. Cummins is not responsible for failures resulting from the use of parts not supplied by Cummins.

A new Cummins or Cummins-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.

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

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

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.

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

CMD Commercial Application Marine Propulsion(B/C/N14) Coverage

Engines Included in this Coverage

Marine Propulsion
4B
6B
6C
N14

Products Warranted

This Warranty applies to new Cummins Engines sold by Cummins MerCruiser Diesel, herein after “CMD”, that are used in Marine propulsion applications anywhere in the world where CMD approved service is available*, and delivered to the first user on or after April 29, 2002. The 'Product' consists of a new Cummins 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 or the maximum rated RPM. This rating is an ISO3046 Fuel Stop Power Rating and is for applications that operate less than 1,500 hours per year.

MARINE PROPULSION - 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 3,000 hours per year.

MARINE PROPULSION - 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.

MARINE PROPULSION - 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.

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 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.

	Duration Whichever Occurs First	
Rating	**Years**	**Hours**
Intermittent	1	1,500
Medium Continuous	1	3,000
Heavy Duty	1	5,000
Continuous	1	Unlimited

Extended Major Components Warranty

The Extended Major Components Warranty applies to Engines other than B and C Series. It 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 after three years or 10,800 hours of operation, whichever occurs first, from the date of delivery 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.

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. 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 MerCruiser Diesel Responsibilities

During the Base 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 CMD published Standard Repair Time guidelines.

When it is necessary for mechanics to make on-site Warranty repairs, CMD will pay up to six hours total 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.

During the Extended Major Components Warranty

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

Owner Responsibilities

During the Base Engine Warranty

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

During the Extended Major Components Warranty

Owner is responsible for the cost of all labor needed to repair the Engines, including the labor cost for Engine removal and reinstallation. When CMD elects to repair a part instead of replacing it, the Owner is not responsible for the labor needed to repair the part.

Owner is responsible for the cost of all parts required for the repair except for the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered Part. Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items replaced during repair of a Warrantable Failure.

During the Base Engine and Extended Major Components Warranties

Owner is responsible for the operation and maintenance of the 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.

Before the expiration of the applicable Warranty, Owner must notify a CMD distributor, authorized dealer or other repair location approved by CMD of any Warrantable Failure and make the Engine available for repair by such facility.

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

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 CMD material or factory workmanship.

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

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 also not responsible for failures caused by incorrect oil or fuel, or by water, dirt or other contaminants in the fuel or oil.

CMD is not responsible for failure 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.

Except for the accessories noted previously, CMD does not warrant accessories which bear the name of another company.

Parts used in Warranty repairs may be new Cummins parts, Cummins approved rebuilt parts or repaired parts. CMD is not responsible for failures resulting from the use of parts not supplied by Cummins.

A new Cummins or Cummins 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.

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 the 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.

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

California Emission Control System Warranty, Off-Highway

Products Warranted

This Emission Control System Warranty applies to off-road diesel engines certified with the California Air Resources Board beginning with the year 1996 for engines up to 750 horsepower, beginning with the year 2000 for 751 horsepower and over, marketed by Cummins, and registered in California for use in industrial off-highway applications.

Your Warranty Rights and Obligations

The California Air Resources Board and Cummins Engine Company, Inc., are pleased to explain the emission control system warranty on your engine. In California, new off-road diesel engines must be designed, built and equipped to meet the State's stringent anti-smog standards. Cummins must warrant the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

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

Where a warrantable condition exists, Cummins will repair your off-road diesel engine at no cost to you including diagnosis, parts and labor.

Manufacturer's Warranty Coverage

This warranty coverage is provided for 5 years or 3,000 hours of engine operation, whichever first occurs from the date of delivery of the engine to the first user. If any emission-related part on your engine is defective, the part will be repaired or replaced by Cummins.

Coverage

This emission control system warranty applies only to the following A series, B3.3, B3.9, B4.5^{S}, B5.9, B6.7^{S}, QSB3.9-30, QSB4.5-30, QSB5.9-30, QSB5.9-44, C8.3, QSC8.3, and QSL9 emission control parts:

Fuel Pump	Intake Manifold
Static Timing	Charge Air Cooler
Delivery Valve	Aftercooler
Injection Control Valve Module	
	Exhaust Manifold
Injectors	
Calibration	Oxidation Catalyst
Needle	
Nozzle	Electronic Control System
Spring	Control Module
	Boost Pressure Sensor
Turbocharger	Coolant Temperature Sensor
Compressor Wheel	Fuel Pressure Sensor
Turbine Wheel	
Turbine Oil Seal	
Wastegate Valve	

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.

Notes

CALIFORNIA
Proposition 65 Warning

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

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

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

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

Bulletin 4021330
Printed in U.S.A. 26-AUGUST-2013