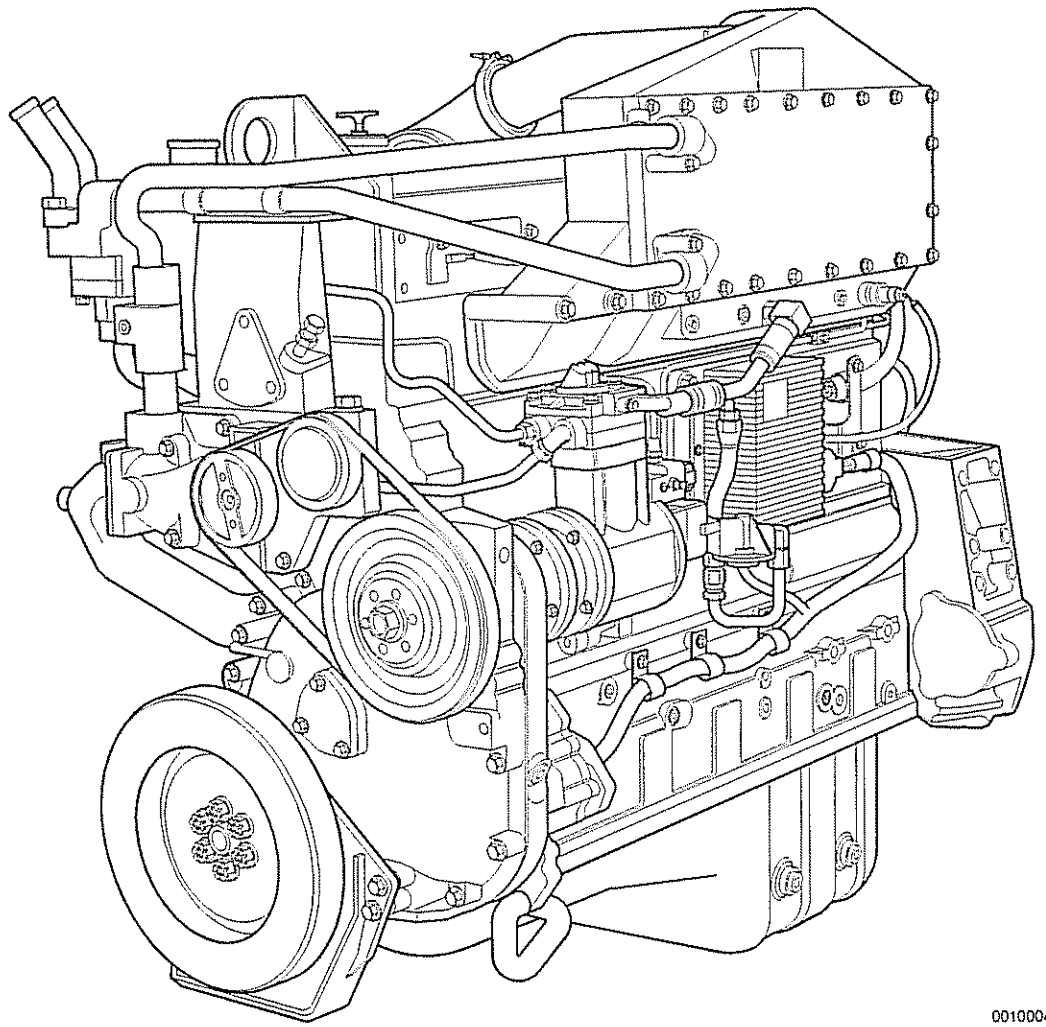
Operation and Maintenance Manual
Industrial
N14 Engines



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Foreword

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

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

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

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

The latest technology and the highest quality components were used to produce this engine. When replacement parts are needed, we recommend using only genuine Cummins or ReCon® exchange parts. These parts can be identified by the following trademarks:

Note: 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.

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

Section i - Introduction

Section Contents

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To the Owner and Operator

Preventative 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, oil, and coolant in your engine as specified in Engine Specifications (Section V).

Cummins uses the latest technology and the highest quality components to produce its engines. Cummins recommends using **only** genuine Cummins 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 Service Assistance (Section S).

About the Manual

This manual contains information needed to operate and maintain your engine correctly as recommended by Cummins Engine Company, Inc. Additional service literature can be ordered from your Cummins Distributor. For problems with literature orders, contact 1-800-DIESELS (1-800-343-7357) (for U.S.A. and Canada).

This manual does **not** cover vehicle or equipment maintenance procedures. Consult the vehicle 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 the complete listing of symbols and their definitions in this section.

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

How to Use the Manual

This manual is organized according to intervals at which engine maintenance is to be performed. A maintenance chart (table) that gives required intervals and checks to be made is located in Section 2. Locate the interval at which you are performing maintenance, then follow the steps given in that section for all of the procedures to be performed. In addition, the procedures completed under previous maintenance intervals **must** also be performed.

Keep a record of all the checks and inspections made. A record form for recording date and hours at which maintenance checks were made is located in Section 2.

Refer to Section TS for a guide to troubleshooting your engine. Follow the directions given in that section to locate and correct engine problems.

Refer to Section V for specifications and torque values recommended by Cummins Engine Company, Inc. for your engine.

Symbols

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

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

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

Indicates a **REMOVAL or DISASSEMBLY** step.

Indicates an **INSTALLATION or ASSEMBLY** step.

INSPECTION is required.

CLEAN the part or assembly.

PERFORM a mechanical or time **MEASUREMENT**.

LUBRICATE the part or assembly.

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

TIGHTEN to a specific torque.

PERFORM an electrical **MEASUREMENT**.

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

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

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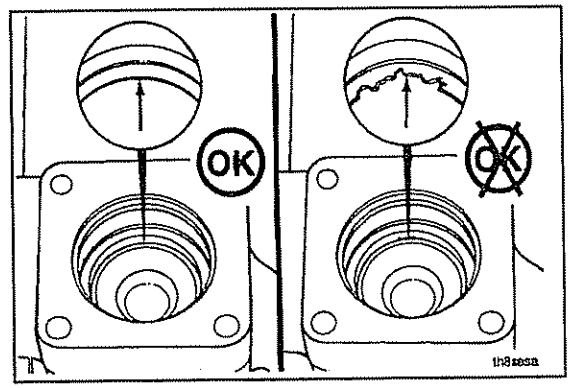
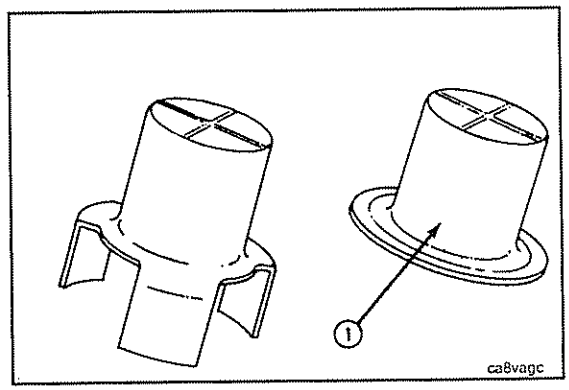
Illustrations

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 or carelessness can cause burns, cuts, mutilation, asphyxiation or other bodily 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.

- Make sure the work area surrounding the product 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 you slowly loosen the filler cap and relieve the pressure from the cooling system.
- Do **not** work on anything that is supported ONLY by lifting jacks or a hoist. **Always** use blocks or proper stands to support the product before performing any service work.
- Relieve all pressure in the air, oil, fuel and the 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 prevent suffocation and frostbite, wear protective clothing and ONLY disconnect fuel and 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 avoid 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 your 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 avoid burns, be alert for hot parts on products that have just been turned off, and hot fluids in lines, tubes, and compartments.
- **Always** use tools that are in good condition. Make sure you understand how to use them before performing any service work. Use ONLY genuine Cummins or Cummins ReCon® replacement parts.
- **Always** use the same fastener part number (or equivalent) when replacing fasteners. Do **not** use a fastener of lesser quality if replacements are necessary.
- Do **not** perform any repair when fatigued or after consuming alcohol or drugs that can impair your functioning.
- Some state and federal agencies in the United States of America have determined that used engine oil can be carcinogenic and can cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil.
- Coolant is toxic. If **not** reused, dispose of in accordance with local environmental regulations.

General Repair Instructions

General Information

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

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

Air Compressor
Air Controls
Air Shutoff Assemblies
Balance Weights
Cooling Fan
Fan Hub Assembly
Fan Mounting Bracket(s)
Fan Mounting Capscrews
Fan Hub Spindle
Flywheel
Flywheel Crankshaft Adapter
Flywheel Mounting Capscrews
Fuel Shutoff Assemblies
Fuel Supply Tubes
Lifting Brackets
Throttle Controls
Turbocharger Compressor Casing
Turbocharger Oil Drain Line(s)
Turbocharger Oil Supply Line(s)
Turbocharger Turbine Casing
Vibration Damper Mounting Capscrews

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

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

Welding on a Vehicle with an Electronic Controlled Fuel System

⚠ CAUTION ⚠

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

General Cleaning Instructions

Solvent and Acid Cleaning

Several solvent and acid-type cleaners can be used to clean the engine parts. Experience has shown that the best results can be obtained using a cleaner that can be heated to 90 to 95 degrees Celsius [180 to 200 degrees Fahrenheit]. A cleaning tank that provides a constant mixing and filtering of the cleaning solution will give the best results. **Cummins Engine Company, 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 ⚠

Acid is extremely dangerous and can cause personal injury and damage the machinery. Always provide a tank of strong soda water as a neutralizing agent.

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

If the parts are **not** to be used immediately after cleaning, dip them in a suitable rustproofing compound. The rustproofing compound **must** be removed from the parts before 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 way to clean the oil drillings.

⚠ WARNING ⚠

Wear protective clothing to prevent personal injury from the high pressure and extreme heat.

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

1. Electrical Components
2. Wiring
3. Injectors
4. Fuel Pump
5. Belts and Hoses
6. Bearings
7. Electronic Control Module (ECM)
8. ECM Connectors

Glass or Plastic Bead Cleaning

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

⚠ CAUTION ⚠

Do not use glass or plastic bead cleaning on aluminum piston skirts. Do not use glass bead cleaning on aluminum ring grooves. Small particles of glass or plastic will embed in the aluminum and result in premature wear. Valves, turbocharger shafts, etc., can also be damaged. Follow the cleaning directions listed in the procedures.

NOTE: Plastic bead blasting media, Part No. 3822735, can be used to clean aluminum ring grooves. Do **not** use any bead blasting media on pin bores or aluminum skirts.

Follow the equipment manufacturer's cleaning instructions. The following guidelines can be used to adapt to manufacturer's instructions:

1. Bead size:
   a. Use U.S. size No. 16-20 for piston cleaning with plastic bead media, Part No. 3822735.
   b. Use U.S. size No. 70 for piston domes with glass media.
   c. Use U.S. size No. 60 for general purpose cleaning with glass media.
2. Operating Pressure:
   a. Glass: Use 620 kPa [90 psi] for general purpose cleaning.
   b. Plastic: Use 270 kPa [40 psi] for piston cleaning.
3. Steam clean or wash the parts with solvent to remove all of the foreign material and glass or plastic beads after cleaning. Rinse with hot water. Dry with compressed air.
4. Do **not** contaminate the wash tanks with glass or plastic beads.

Acronyms and Abbreviations

AFC	Air Fuel Control
API	American Petroleum Institute
ASA	Air Signal Attenuator
ASTM	American Society of Testing and Materials
°C	Celsius
CARB	California Air Resources Board
C.I.D.	Cubic Inch Displacement
CNG	Compressed Natural Gas
CPL	Control Parts List
cSt	Centistokes
ECM	Electronic Control Module
ECS	Emission Control System
EPA	Environmental Protection Agency
EPS	Engine Position Sensor
°F	Fahrenheit
GVW	Gross Vehicle Weight
Hg	Mercury
hp	Horsepower
H_2O	Water
ICM	Ignition Control Module
km/l	Kilometers per Liter
kPa	Kilopascal
LNG	Liquid Natural Gas
LTA	Low Temperature Aftercooling
MIP	Mixer Inlet Pressure
MPa	Megapascal
mph	Miles Per Hour
mpq	Miles Per Quart
N•m	Newton-meter
NG	Natural Gas
OEM	Original Equipment Manufacturer
ppm	Parts Per Million
psi	Pounds Per Square Inch
PTO	Power Takeoff
rpm	Revolutions Per Minute
SAE	Society of Automotive Engineers
SCA	Supplemental Coolant Additive
STC	Step Timing Control
VS	Variable Speed
VSS	Vehicle Speed Sensor

NOTES

Section E - Engine Identification

Section Contents

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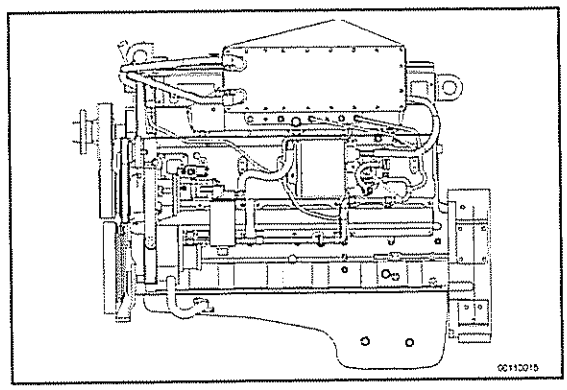
Engine Identification

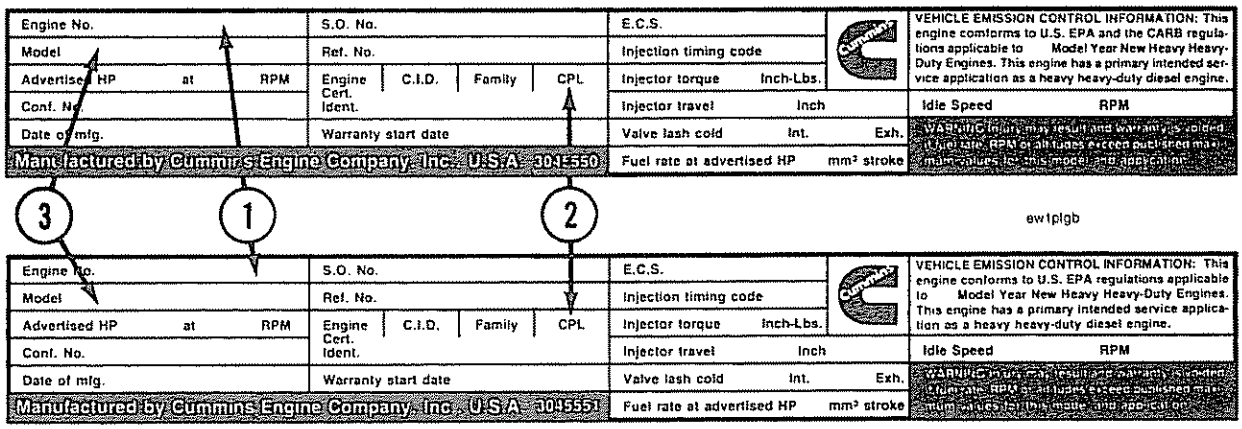
Engine Dataplate

The engine dataplate provides the model identification and other important information about the engine.

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

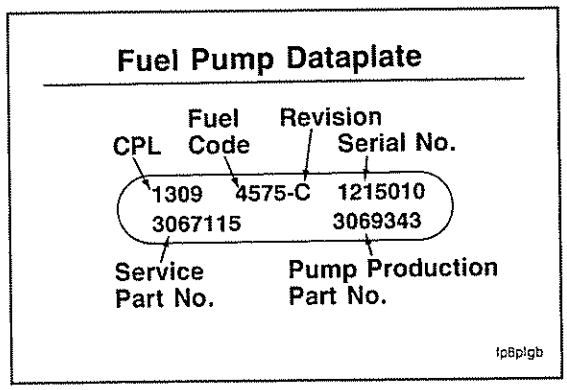
1. Engine Serial Number
2. Control Parts List
3. Model.

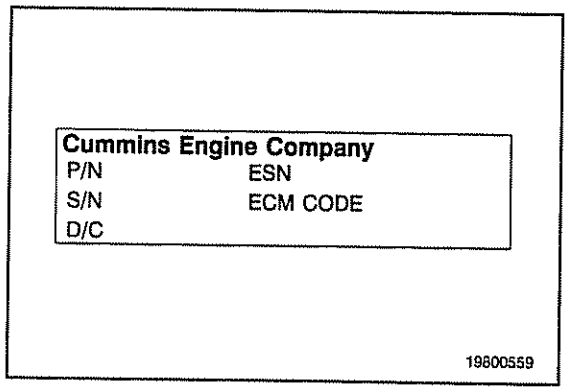




Fuel Pump Dataplate

On step timing control (STC) engines, the fuel pump dataplate is located on the top of the fuel pump. It provides information for fuel pump calibration.

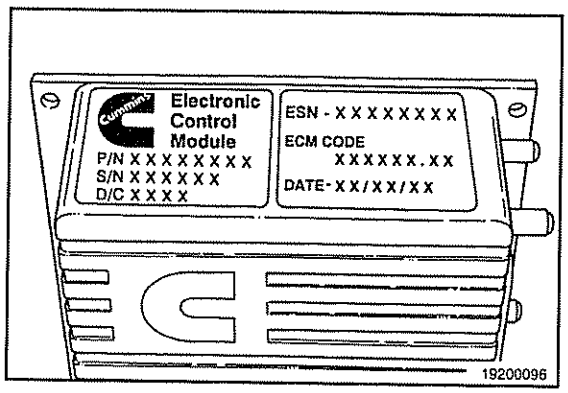




ECM Dataplate

The CENTRY™ System electronic control module (ECM) dataplate is located on the front of the ECM and contains the following information:

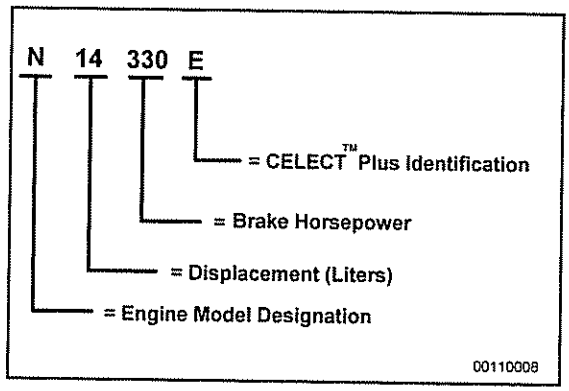
1. P/N — ECM Part Number
2. S/N — ECM Serial Number
3. D/C — Date Code (the date the ECM was manufactured)
4. ESN — Engine Serial Number
5. ECM CODE — The ECM calibration identifier



On CELECT™ Plus engines, the electronic control module (ECM) dataplate is located on top of the ECM.

The abbreviations in the accompanying illustration are explained as follows:

P/N = part number
S/N = serial number
D/C = date code.



Cummins Engine Nomenclature

The Cummins engine nomenclature provides the data as illustrated in the graphic.

NOTE: The following letters designate some of the different market applications for a Cummins engine.

- A = Agriculture
- C = Construction
- G = Generator drive
- M = Marine.

Specifications

General Specifications

NOTE: Listed below are general specifications for this engine.

Horsepower ..... Refer to the engine dataplate

Engine Speed ..... Refer to the engine dataplate

Displacement ..... 14 liters [855 C.I.D.]

Bore and Stroke ..... 140 mm [5.5 in] x 152 mm [6.0 in]

Compression Ratio:
- 310, 320, 335, 345, 350, 360 ..... 18.5:1
- 400, 410, 425, 430, 440, 460, 475, 480, 485, 525E 16.5:1

Dry Engine Weight ..... 1316 kg [2901 lb]

Wet Engine Weight ..... 1371 kg [3022 lb]

Firing Order 1-5-3-6-2-4

Crankshaft Rotation (viewed from front of engine) ..... **Clockwise**

Valve and Injector Settings:
- Intake Valve Adjustment ..... 0.35 mm [0.014 in]
- Exhaust Valve Adjustment ..... 0.68 mm [0.027 in]
- Injector Lash Adjustment ..... 0.56 mm [0.022 in]
- Engine Brake Settings ..... 0.58 mm [0.023 in]

Fuel System

NOTE: For performance and fuel rate values, consult the engine data sheet or the fuel pump code for the particular model involved.

Maximum Allowable Restriction toPump with or without Fuel Cooler:
- STC
  - With Clean Filter ..... 102 mm Hg [4 in Hg]
  - With Dirty Filter ..... 204 mm Hg [8 in Hg]
- CELECT™ Plus
  - With Clean Filter ..... 152 mm Hg [6 in Hg]
  - With Dirty Filter ..... 254 mm Hg [10 in Hg]

Maximum Allowable Return Line Restriction with Check Valves and/or Overhead Tanks ... 165 mm Hg [6.5 in Hg]

Maximum Allowable Fuel Return Line Restriction without Check Valves ..... 89 mm Hg [3.5 in Hg]

Minimum Allowable Fuel Tank Vent Capability ..... 0.85 m^3/hr [30 ft^3/hr]

Maximum Allowable Fuel Inlet Temperature ..... 71°C [160°F]

Lubricating Oil System

Oil Pressure at Idle (minimum allowable at 93°C [200°F] oil temperature) ..... 70 kPa [10 psi]

Oil Pressure at 1200 rpm or Torque Peak (minimum allowable) ..... 172 kPa [25 psi]

Oil Capacity of Standard Engine
- Combination Full-Flow/Bypass Filter Capacity ..... 2.7 liters [0.7 U.S. gal]
- Oil Pan Capacity (high-low) ..... 36 to 30 liters [9.5 to 8 U.S. gal]
- Oil Change Capacity (oil pan and filter filled to capacity) ..... 37.7 to 32.9 liters [10.2 to 8.7 U.S. gal]

Total Lubricating Oil System Capacity Including Filter ..... 42 liters [11.0 U.S. gal]

Cooling System

Coolant Capacity (engine **only**) ..... 20.81 liters [21 qt]

Standard Modulating Thermostat Range ..... 82 to 93°C [180 to 200°F]

Maximum Coolant Cylinder Block Pressure (pressure cap removed):
- At 2300 rpm ..... 317 kPa [46 psi]
- At 1700 rpm ..... 165 kPa [24 psi]

Maximum Allowable Coolant Temperature Engine Outlet:
- CELECT™ Plus ..... 100°C [212°F]
- STC ..... 100°C [212°F]

Coolant Alarm Activation Temperature:
- CELECT™ Plus ..... 101°C [215°F]
- STC ..... 102 ±2°C [215 ±2°F]

Maximum External Resistance in Aftercooler Circuit (CELECT™ Plus **only**) ..... 35 kPa [5 psi]

Minimum Coolant Flow Through Aftercooler Circuit (open thermostat CELECT™ Plus **only**)
Liters per Minute [U.S. gallons per minute] ..... 83 [22]

Coolant Temperature at Aftercooler Radiator Inlet at Maximum Engine Coolant Out Temperature (CELECT™ Plus **only**) ..... 93°C [199°F]

Maximum Water Temperature into Aftercooler at Maximum Engine Coolant Out Temperature (CELECT™ Plus **only**) ..... 72°C [162°F]

Minimum Recommended Top Tank Temperature ..... 70°C [158°F]

Minimum Recommended Pressure Cap Pressure ..... 50 kPa [7 psi]

Air Intake System

△ CAUTION △

Engine intake air must be filtered to prevent dirt and debris from entering the engine. If air intake piping is damaged or loose, unfiltered air will enter the engine and cause premature wear.

Maximum Temperature Rise between Ambient Air and Engine Air Inlet (ambient above 0°C [32°F]) .. 15°C [30°F]

Maximum Inlet Restriction (clean filter) Normal-Duty Element ..... 250 mm H_2O [10 in H_2O]

Maximum Inlet Restriction (dirty filter) ..... 635 mm H_2O [25 in H_2O]

Maximum Allowable Pressure Drop across Charge Air Cooler:
- psi ..... 21 kPa [3 psi]
- Hg (mercury) ..... 152 mm Hg [6 in-Hg]

Exhaust System

Maximum Back Pressure at Turbocharger:
- Mercury ..... 76 mm Hg [3 in Hg]
- Water ..... 1016 mm H_2O [40 in H_2O]

Exhaust Pipe Size (normally acceptable inside diameter) ..... 127 mm [5 in]

Electrical System

Minimum Recommended Battery Capacity

System Voltage	Ambient Temperatures			
	−18°C [0°F]		0°C [32°F]	
	Cold Cranking Amperes	Reserve Capacity[1] Amperes	Cold Cranking Amperes	Reserve Capacity[1] Amperes
12 VDC	1800	640	1280	480
24 VDC[2]	900	320	640	240

(1) The number of plates within a given battery size determines reserve capacity. Reserve capacity determines the duration of sustained cranking.

(2) CCA ratings are based on two 12-VDC batteries in series.

A minimum of 6.0 VDC at the 3-pin power connector is required to power up the ECM on CELECT™ Plus engines.

Batteries (Specific Gravity)

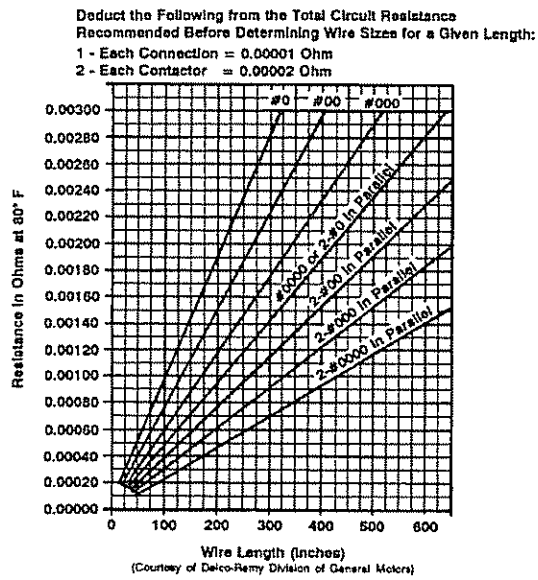
Specific Gravity at 27°C [80°F]	State of Charge
1.260 to 1.280	100%
1.230 to 1.250	75%
1.200 to 1.220	50%
1.170 to 1.190	25%
1.110 to 1.130	Discharged

Maximum Resistance of Starting Motor Circuit

12-VDC Starting Motor (Ohms) 0.00075
24-VDC Starting Motor (Ohms) 0.002

Cable resistances can be obtained in the accompanying Battery Cable Resistance Chart. If the frame is in ground circuit, the frame length **must** be considered, to be cable of the same size as that used in the balance of the system.

Item	Resistance Ohms
Connection	0.00001
Additional Contacter (Series-Parallel Switch, Relays, etc.)	0.00020



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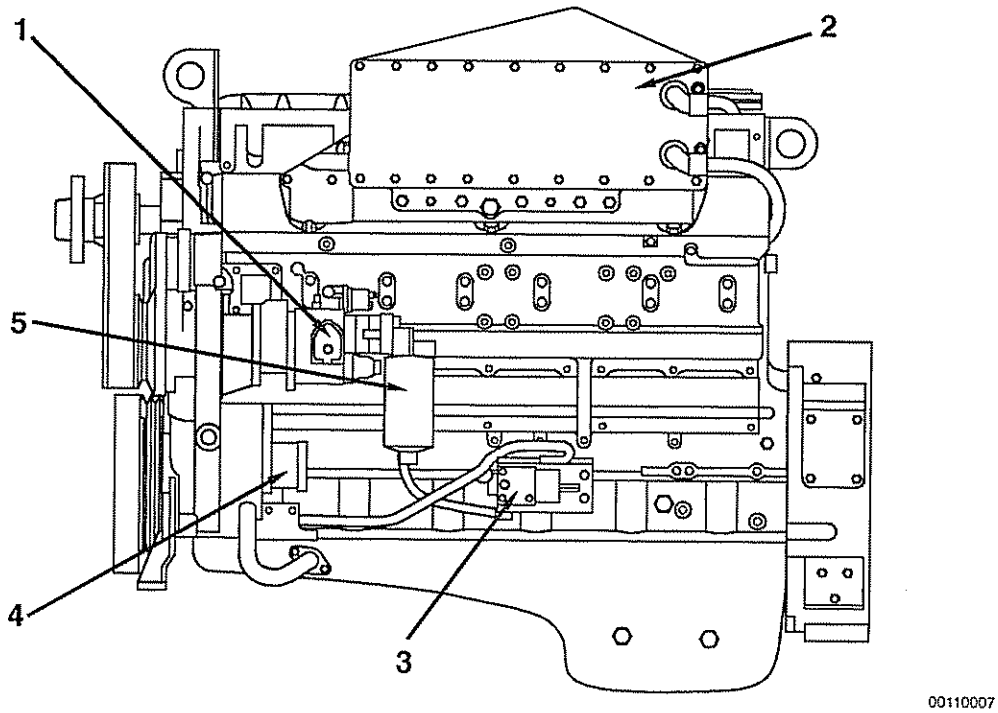
Engine Diagrams

Engine Views

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

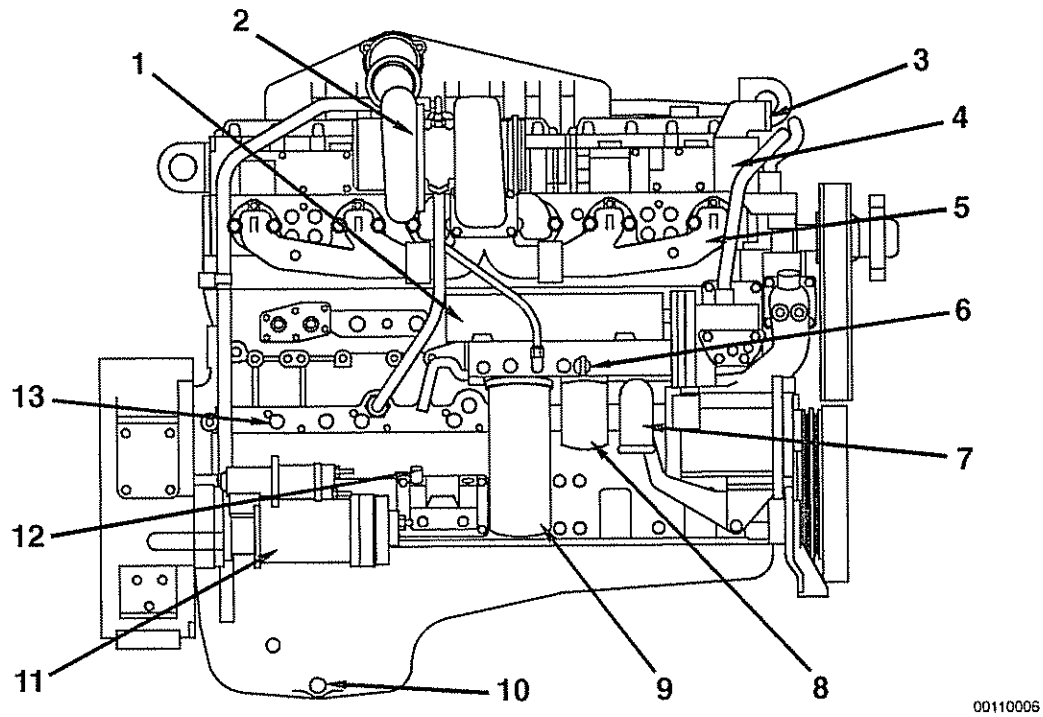
PT®-STC Industrial Models



Fuel Pump Side

1. PT Fuel Pump
2. Aftercooler
3. STC Valve
4. Lubricating Oil Pump
5. Fuel Filter.

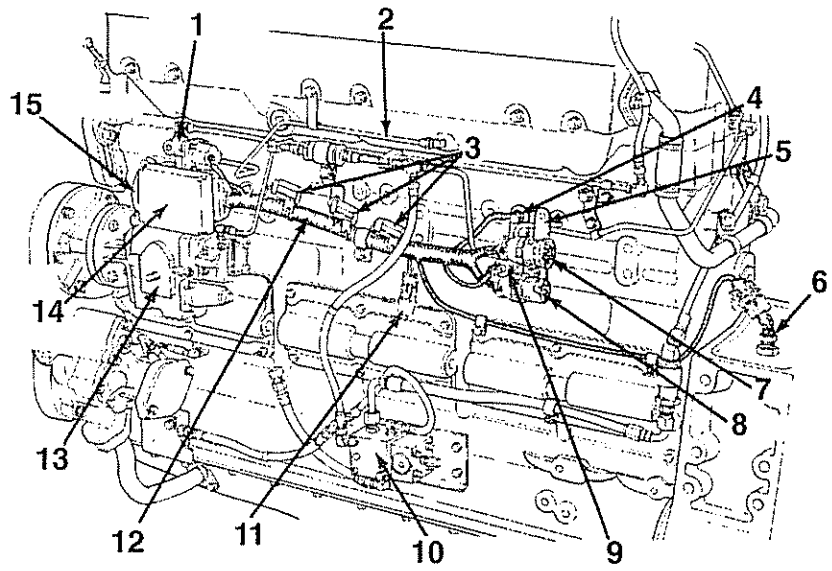
PT®-STC Industrial Models



Exhaust Side

1. Oil Cooler
2. Turbocharger
3. Engine Water Outlet (to radiator)
4. Thermostat Housing
5. Exhaust Manifold
6. Remote Filter Bypass Supply
7. Engine Water Inlet (from radiator)
8. Coolant Filter
9. Combination Filter
10. Oil Drain
11. Starting Motor
12. Dipstick
13. Piston Cooling Nozzle.

CENTRY™



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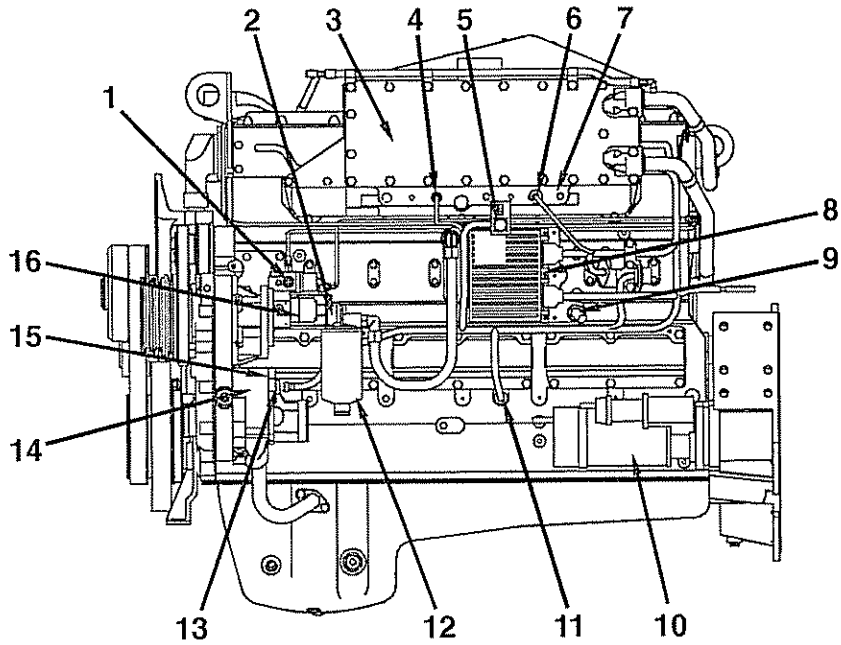
Fuel Pump Side

1. Fuel Shutoff Valve
2. Air-Fuel Control Sensing Line
3. 5–Amp Fuses
4. System Ground Connector
5. OEM C5 and C6 Connector Bracket
6. Engine Speed Sensor
7. C5 Connector
8. C6 Connector
9. Rail Pressure Sensor and Fuel Block
10. Hydromechanical STC Actuator
11. Engine-Side Datalink Connector
12. Engine Harness
13. Fuel Pump
14. ECM
15. Electronic Fuel Control Valve

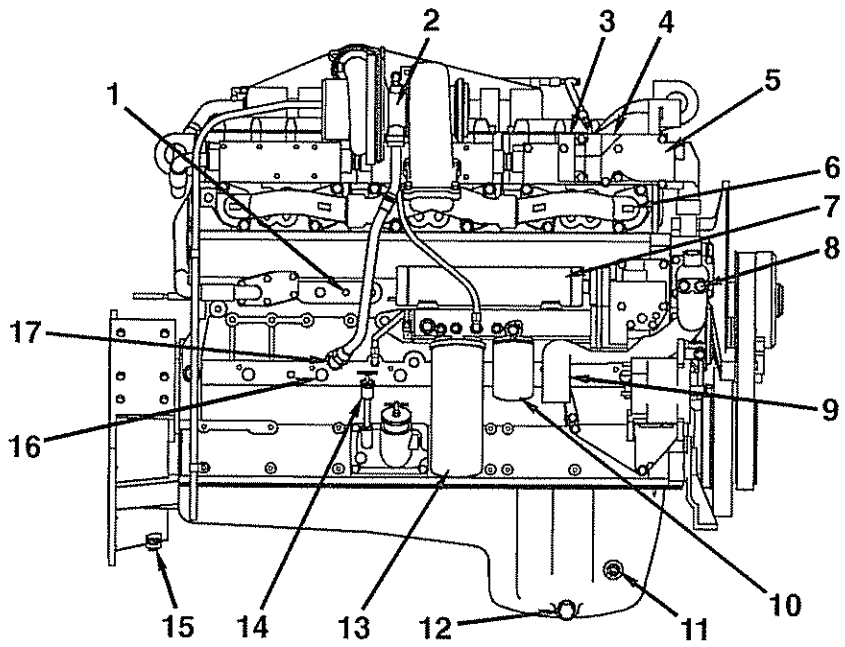
CELECT™ Plus - Jacket Water Aftercooled Model



Fuel Pump Side

1. Compuchek® Adapter Fuel Rail Pressure
2. Compuchek® Adapter Fuel Inlet Pressure
3. Aftercooler
4. Intake Air Temperature Sensor
5. Service Tool Datalink (engine-mounted)
6. Intake Manifold Pressure Sensor
7. Intake Manifold
8. ECM
9. Fuel Inlet Fitting
10. Starter Motor
11. Lubricating Oil Pressure Sensor
12. Fuel Filter
13. Lubricating Oil Temperature Sensor
14. Lubricating Oil Pump
15. Engine Position Sensor (behind lubricating oil pump)
16. Fuel Gear Pump.

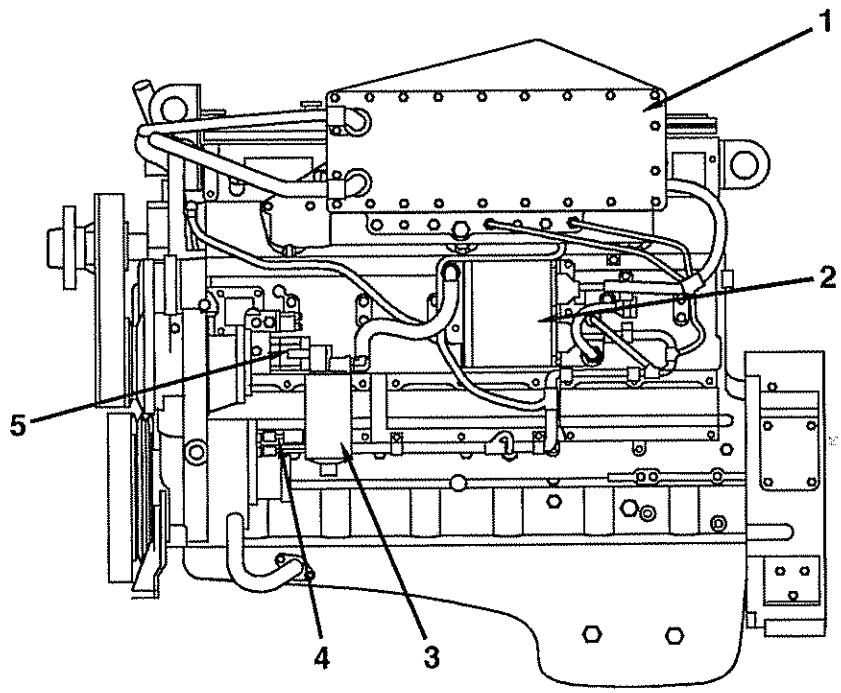
CELECT™ Plus - Jacket Water Aftercooled Model



Exhaust Side

1. Compuchek® Adapter Block Pressure
2. Turbocharger
3. Coolant Tempersture Sensor
4. Compuchek® Adapter Coolant Temperature
5. Thermostat Housing
6. Exhaust Manifold
7. Oil Cooler
8. Compuchek® Adapter Water Pump Inlet Pressure
9. Engine Water Inlet (from radiator)
10. Coolant Filter
11. Compuchek® Adapter Oil Temperature
12. Oil Drain
13. Combination Filter
14. Dipstick
15. Compuchek® Adapter Flywheel Ring Gear Sensor
16. Compuchek® Adapter Oil Rifle Pressure
17. Turbocharger Oil Supply Check Valve.

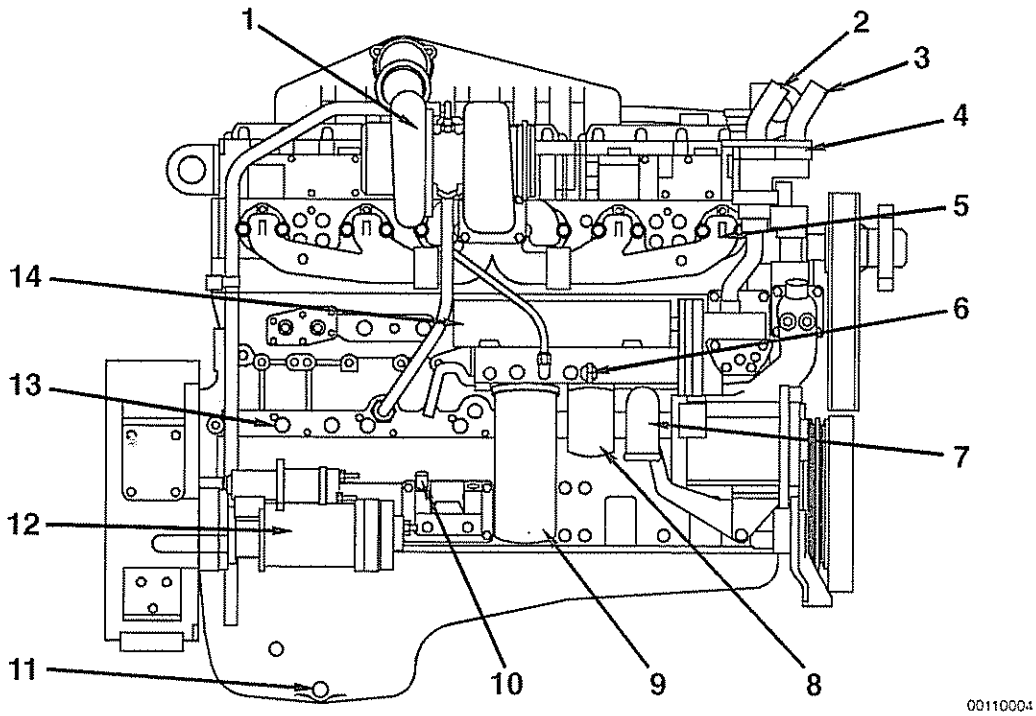
CELECT™ Plus - Low Temperature Aftercooled Model



Fuel Pump Side

1. Aftercooler
2. ECM
3. Fuel Filter
4. Engine Position Sensor (behind lubricating oil pump)
5. Fuel Gear Pump.

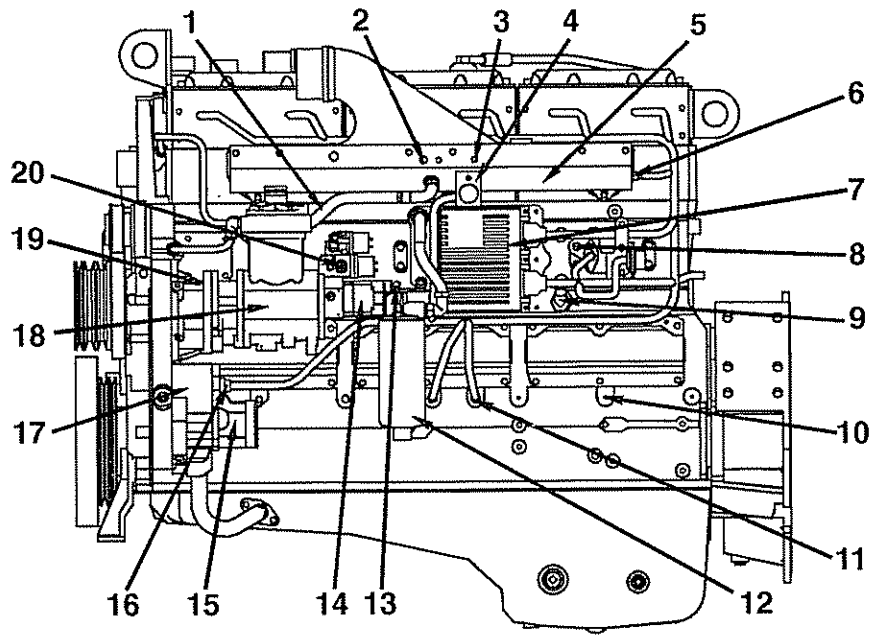
CELECT™ Plus - Low Temperature Aftercooled Model



Exhaust Side

1. Turbocharger
2. Engine Water (aftercooler) Outlet to Front Radiator
3. Engine Water (jacket water) Outlet to Rear Radiator
4. Thermostat Housing
5. Exhaust Manifold
6. Remote Filter Bypass Supply
7. Engine Water Inlet
8. Coolant Filter
9. Combination Filter
10. Dipstick
11. Oil Drain
12. Starting Motor
13. Piston Cooling Nozzle
14. Lubricating Oil Cooler.

CELECT™ Plus - Charge Air Cooled Model



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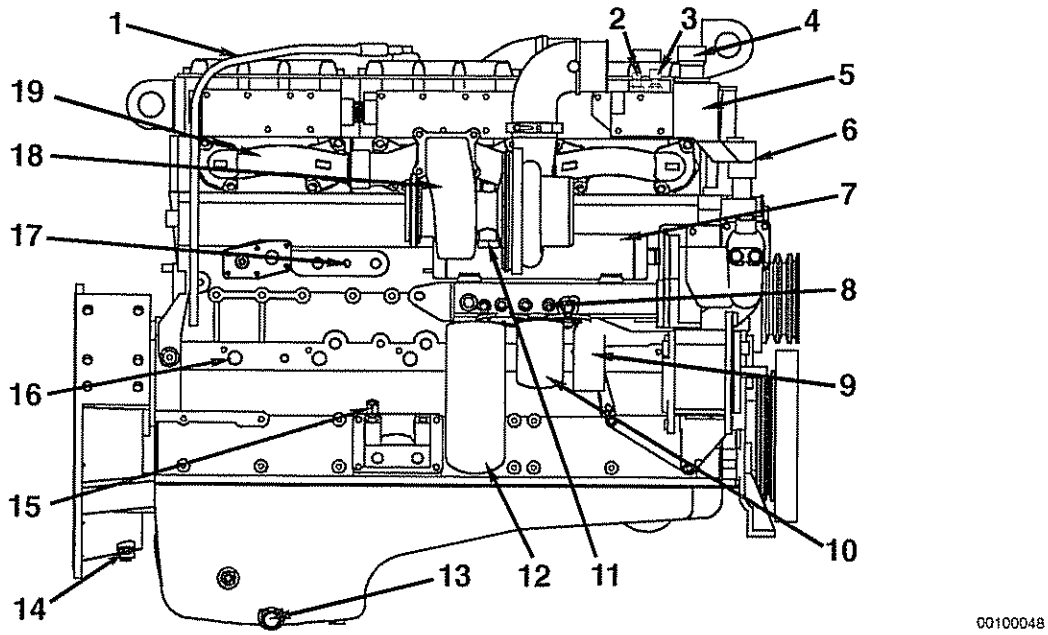
Fuel Pump Side

1. Compressor Air Discharge
2. Intake Air Temperature Sensor
3. Compuchek® Adapter Intake Manifold Pressure (from charge air cooler)
4. Engine-Mounted Service Tool Datalink
5. Intake Manifold
6. Intake Manifold Pressure Sensor
7. ECM
8. Ambient Air Pressure Sensor (when required)
9. Fuel Inlet Fitting
10. Compuchek® Adapter (oil rifle pressure)
11. Lubricating Oil Pressure Sensor
12. Fuel Filter
13. Compuchek® Adapter Fuel Inlet Pressure
14. Fuel Gear Pump
15. Lubricating Oil Pump
16. Lubricating Oil Temperature Sensor
17. Engine Piston Sensor (behind lubricating oil pump)
18. Air Compressor
19. Compuchek® Adapter Oil Temperature.
20. Fuel Temperature Sensor.

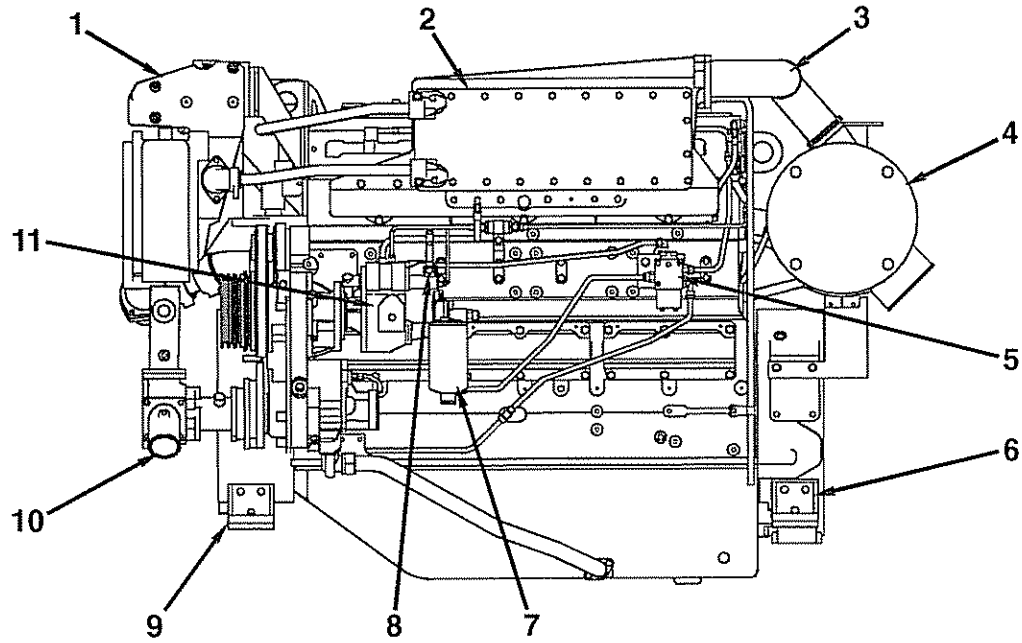
CELECT™ Plus - Charge Air Cooled Model



Exhaust Side

1. Compuchek® Adapter Cycle Event Marker (behind breather tube)
2. Compuchek® Adapter Coolant Temperature
3. Coolant Temperature Sensor
4. Engine Water Outlet (to radiator)
5. Thrrmostat Housing
6. Compuchek® Adapter Water Pump Inlet Pressure
7. Oil Cooler
8. Remote Filter Bypass Supply
9. Engine Water Outlet (from radiator)
10. Coolant Filter
11. Turbocharger Oil Supply Check Valve (behind turbocharger)
12. Combination Full-Flow/Bypass Lubricating Oil Filter
13. Oil Drain
14. Compuchek® Adapter Flywheel Ring Gear Sensor
15. Dipstick
16. Piston Cooling Nozzle
17. Compuchek® Adapter Block Pressure
18. Turbocharger
19. Exhaust Manifold.

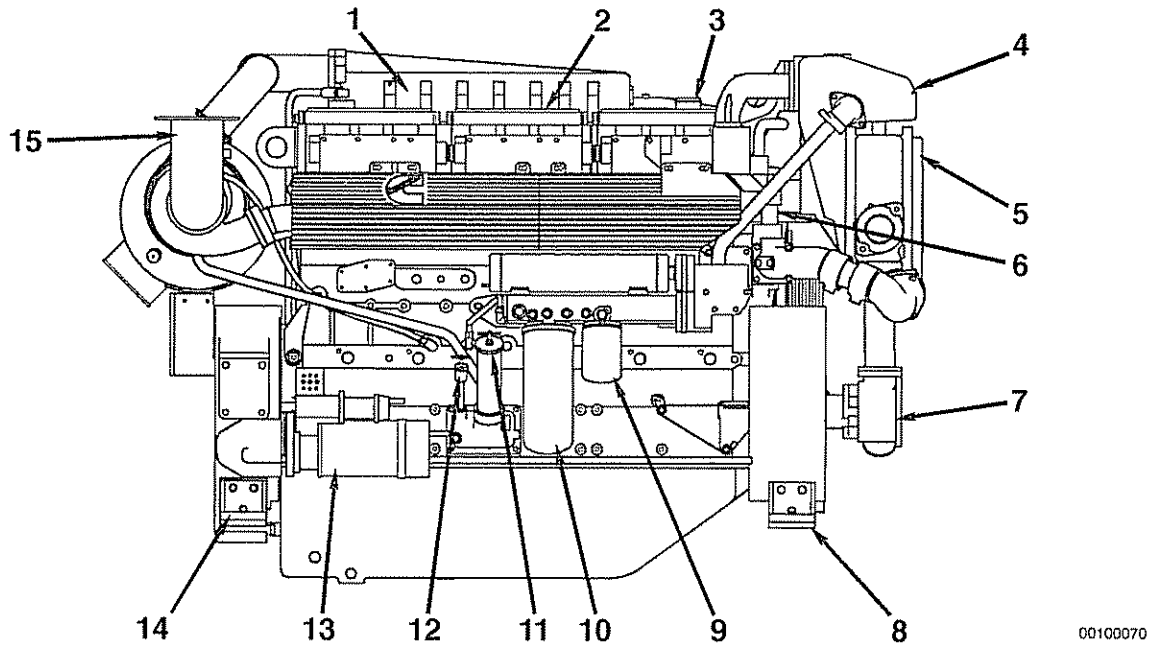
Marine Model



Port Side

1. Coolant Fill
2. Aftercooler
3. Air Inlet Piping
4. Air Cleaner
5. STC Valve
6. Rear Engine Mount
7. Fuel Filter
8. Throttle Lever
9. Front Engine Mount
10. Sea Water Pump Inlet
11. Fuel Pump.

Marine Model



Starboard Side

1. Aftercooler
2. Valve Cover
3. Alternate Oil Fill
4. Coolant Expansion Tank
5. Heat Exchanger
6. Thermostat Housing
7. Sea Water Pump
8. Front Engine Mount
9. Water Filter (coolant)
10. Lubricating Oil Filter
11. Oil Filter
12. Dipstick
13. Starter
14. Rear Engine Mount
15. Exhaust Elbow.

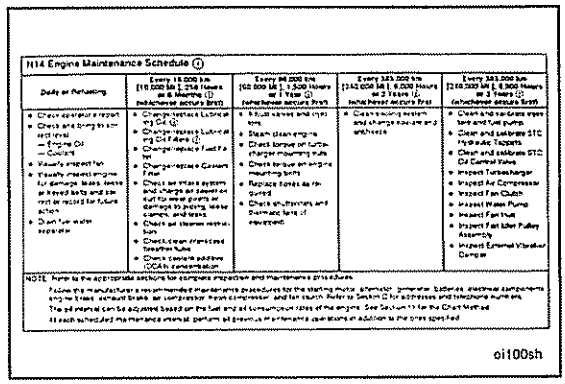
Section 1 - Operating Instructions

Section Contents

Operating Instructions - General Information

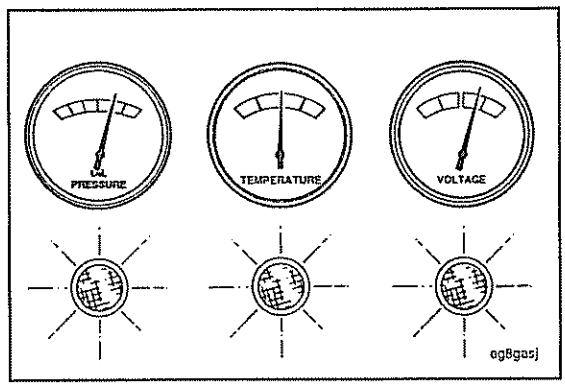
Correct care of your engine will result in longer life, better performance, and more economical operation.

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



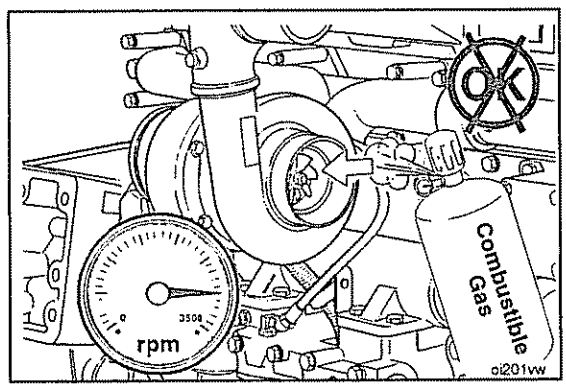
Check the oil pressure indicators, temperature indicators, warning lights, and other gauges daily to make sure they are operational.

Avoid exposure of your engine to corrosive chemicals.

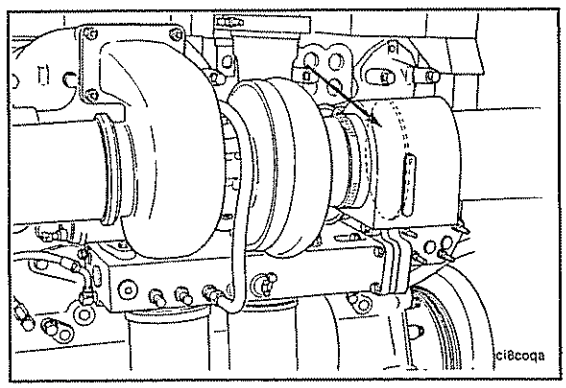


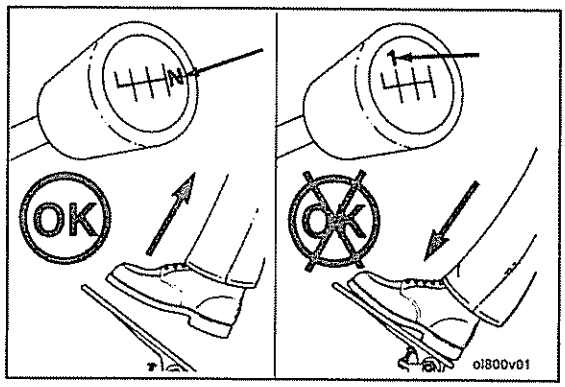
⚠ WARNING ⚠

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, which can result in a fire, an explosion and extensive property damage. Numerous safety devices are available, such as air intake shut off devices, to minimize the risk of over-speeding where an engine, due to its application, might operate in a combustible environment, such as due to a fuel spill or gas leak. Remember, Cummins has no way of knowing the use you have for your engine. THE EQUIPMENT OWNER AND OPERATOR ARE RESPONSIBLE FOR SAFE OPERATION IN A HOSTILE ENVIRONMENT. CONSULT YOUR CUMMINS AUTHORIZED REPAIR LOCATION FOR FURTHER INFORMATION.



NOTE: Cummins recommends the installation of an air intake shutoff device or a similar safety device to minimize the risk of overspeeding where an engine, due to its application, might operate in a combustible environment, such as due to a fuel spill or gas leak.





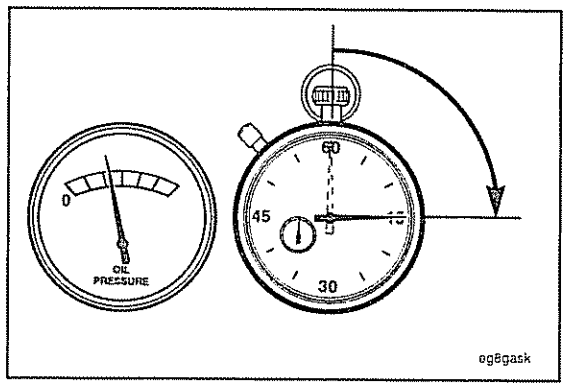
Normal Starting Procedure

⚠ CAUTION ⚠

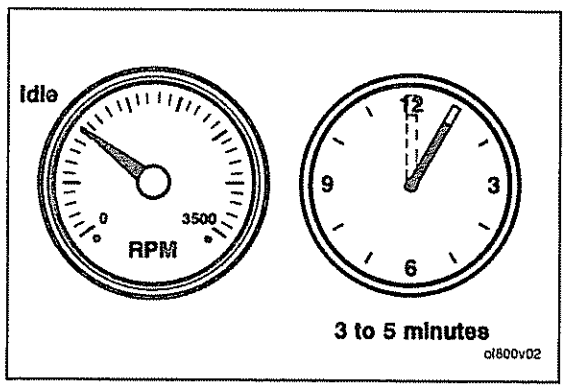
To prevent damage to the starter, do not engage the starting motor for more than 30 seconds. Wait 2 minutes between each attempt to start (electrical starting motors only).

- Disengage the driven unit, or, if equipped, put the transmission in NEUTRAL.
- Start the engine with the throttle in the IDLE position.

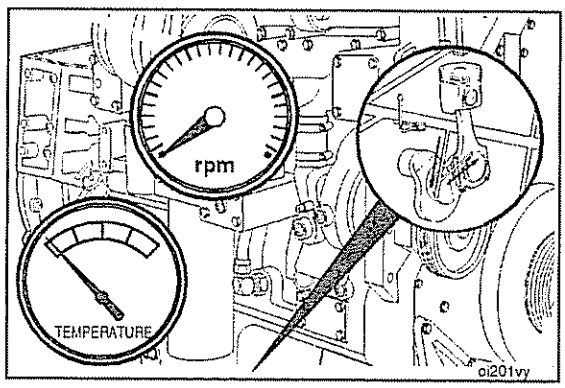
NOTE: Engines equipped with air starting motors require a minimum of 480 kPa [70 psi].



The engine **must** have adequate oil pressure within 15 seconds after starting. If the warning light 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. Confirm the correct oil level in the oil pan. Refer to troubleshooting symptom tree Lubricating Oil Pressure Low in Section TS.

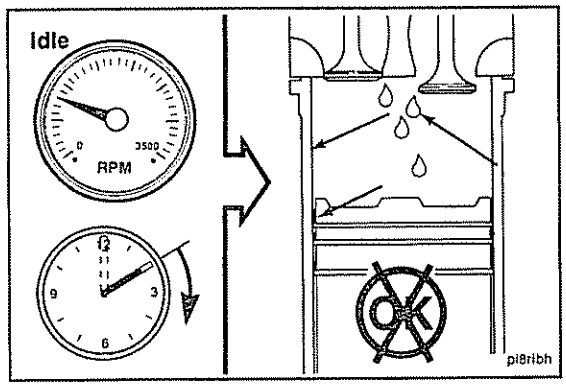


Idle the engine 3 to 5 minutes at approximately 1000 rpm **before** operating with a load or activating the engine brakes.

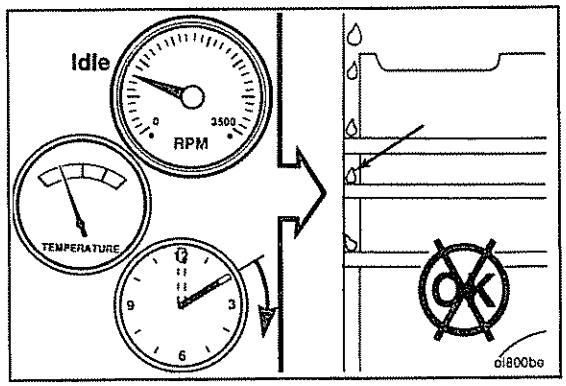


Increase the engine speed (rpm) slowly to provide adequate lubrication to the bearings and to allow the oil pressure to stabilize.

Do **not** keep the engine at low idle for long periods. Long periods (more than 10 minutes) at low idle can damage an engine because combustion chamber temperatures drop so low the fuel will **not** burn completely. This will cause carbon to build up around the injector spray holes and piston rings, and can cause the valves to stick.



If the engine coolant temperature becomes too low, 60°C [140°F], raw fuel will wash the lubricating oil off the cylinder walls and dilute the crankcase oil. Fuel dilution adversely affects lubricating oil properties and can shorten engine life. Use the fast idle to prevent these conditions.



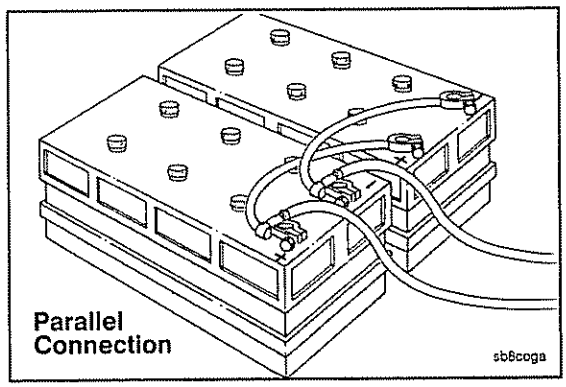
⚠ WARNING ⚠

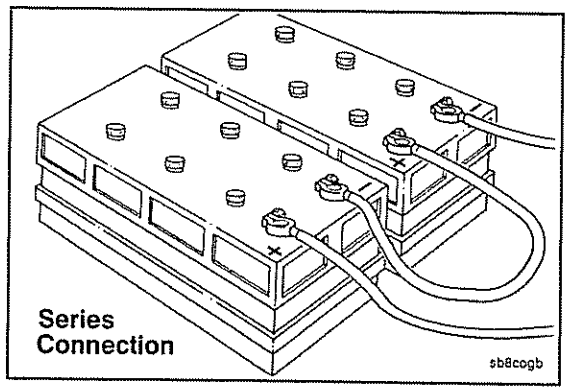
Batteries can emit explosive gases. To avoid personal injury, always ventilate the compartment before servicing the batteries. To avoid arcing, remove the negative (-) battery cable first, and attach the negative (-) battery cable last.

⚠ CAUTION ⚠

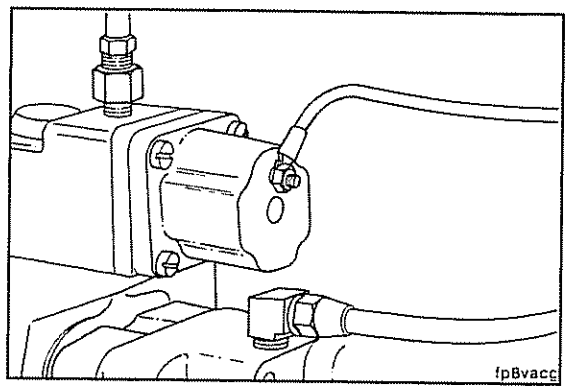
To avoid damage to CELECT™ Plus engine parts, do not connect jumper starting or battery charging cables to any CELECT™ Plus part. When using jumper cables to start the engine, make sure to connect the cables in parallel: positive (+) to positive (+) and negative (-) to negative (-). When using an external electrical source to start the engine, turn the keyswitch to the OFF position. Remove the key before attaching the jumper cables.

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





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



Fuel Shutoff Valve

△ CAUTION △

The CELECT™ Plus ECM provides a voltage output in the harness to control the fuel shutoff valve solenoid. The output voltage is equal to the battery voltage (system voltage). This must be the only wire connected to the fuel shutoff valve solenoid. Excessive current draw will cause possible engine shutdowns and fault codes to be logged.

Cold Weather Operation

Satisfactory performance of a diesel engine operating in low ambient temperature conditions requires modification of the engine, surrounding equipment, operating practices, and maintenance procedures. The colder the temperatures encountered, the greater the amount of modification required; yet with the modifications applied, the engines **must** still be capable of operation in warmer climates without extensive changes. The following information is provided to engine owners, operators, and maintenance personnel on how the modifications can be applied to get satisfactory performance from their diesel engines.

There are three basic objectives to be accomplished:

1. Reasonable starting characteristics, followed by practical and dependable warm-up of the engine and equipment.
2. A unit or installation that is as independent as possible from external influences.
3. Modifications that maintain satisfactory operating temperatures with a minimum increase in maintenance of the equipment and accessories.

If satisfactory engine temperature is **not** maintained, higher maintenance cost will result due to the increased engine wear, poor performance and formation of excessive carbon, varnish, and other deposits. Special provisions to overcome low temperatures are definitely necessary, whereas a change to warmer climate normally requires **only** minimum revision. Most of the accessories will be designed in such a way that they can be disconnected so there is little effect on the engine when they are **not** in use.

The two most commonly used terms associated with preparation of equipment for low-temperature operation are **winterization** and **arctic specifications**.

Winterization of the engine and/or components so starting and operation are possible in the lowest temperature to be encountered requires:

1. Use of correct materials.
2. Proper lubrication, low-temperature lubricating oils.
3. Protection from the low-temperature air. The metal temperature does **not** change, but the rate of heat dissipation is affected.
4. Fuel of the proper grade for the lowest temperature.
5. Heating to be provided to increase the engine block and component temperature to a minimum of -32°C [-25°F] for starting in lower temperatures.
6. Proper external heating source available.
7. Electrical equipment capable of operating in the lowest expected temperature.

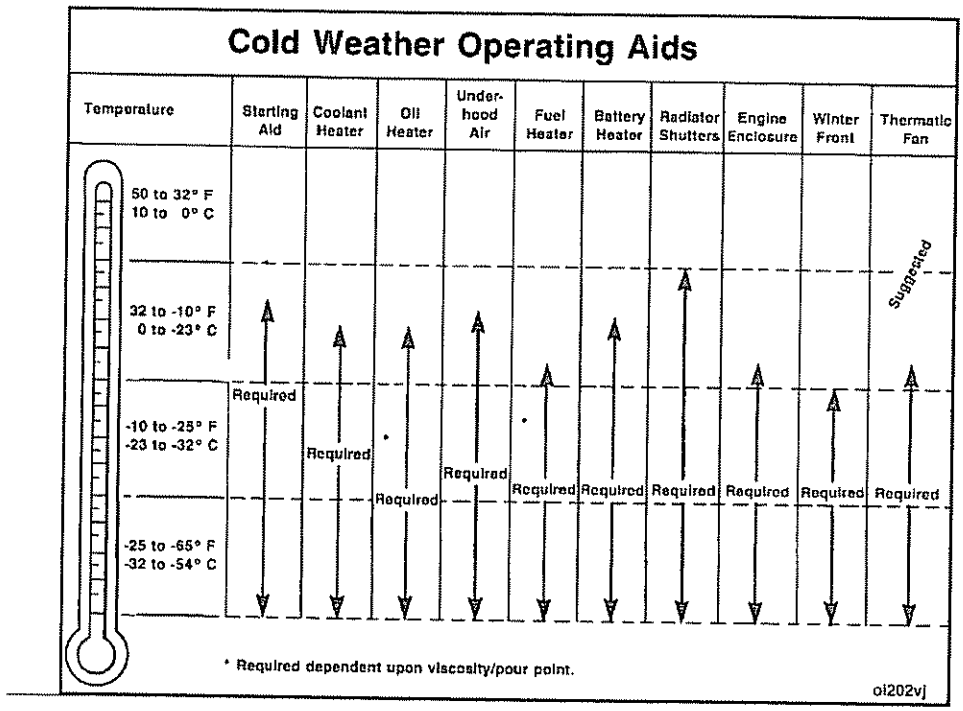
Arctic specifications refer to the design material and specifications of the components necessary for satisfactory engine operation in extreme low temperatures -54°C [-65°F]. Contact Cummins Engine Company, Inc. or the equipment manufacturer to obtain the special items required.

For additional information on cold weather operation, obtain Service Bulletin No. 3379009, Engine Operation in Cold Weather, from the nearest Cummins Distributor or Dealer.

It is possible to operate diesel engines in extremely cold environments if they are properly prepared and maintained. The correct lubricants, fuels, and coolant **must** be used for the cold weather range for which the vehicle is being operated. Refer to the chart below for recommendations in different operating ranges.

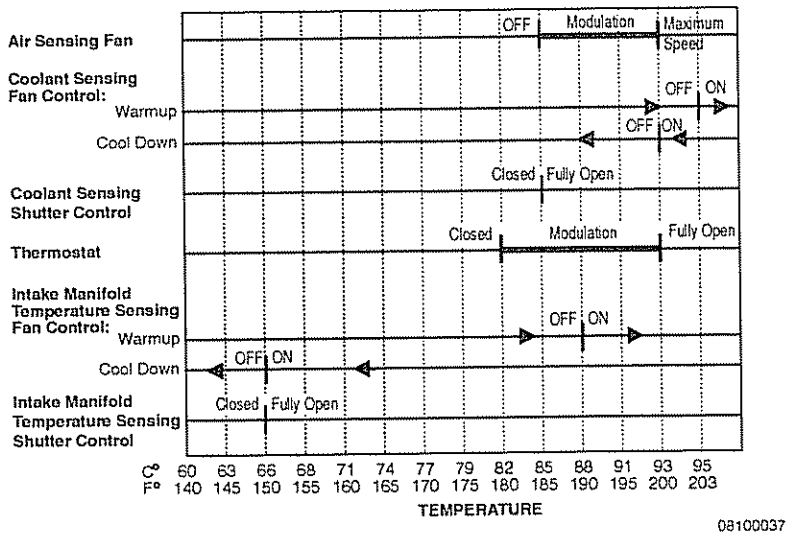
Winterize 0° to −32°C [32° to −25°F]	**Arctic Specification −32 to −54°C [−25 to −65°F]**
Use 50 percent of the recommended antifreeze, refer to Section V, and 50-percent water mixture.	Use 60-percent ethylene or propyleneglycol anti-freeze, 40-percent water mixture.
Use a recommended multiviscosity oil meeting API, CH4 specifications.	Use arctic oil meeting API, CH4 specifications.
Fuel to have a maximum cloud and pour points 6°C [10°F] lower than ambient temperature in which the enigne operates.	Fuel to have a maximum cloud and pour points 6°C [10°F] lower than ambient temperature in which the engine operates.

The following cold weather operating aids can be required for cold weather situations depending on your application:



Thermo Control Settings

The temperatures listed in this chart for coolant temperature sensing fan control and intake manifold temperature sensing fan control are correct for vehicles that allow the ECM to control the on/off operation of the cooling fan. Consult your local OEM for other types of control.



Cold Weather Starting Using Starting Fluid

Without Metering Equipment

⚠ WARNING ⚠

Do not use volatile cold starting aids in underground mine and tunnel operations, or marine applications due to the potential for an explosion. Check with the local U.S. Bureau of Mines inspector for instructions.

⚠ WARNING ⚠

Do not use starting fluid near an open flame or with a preheater or flame thrower equipment. This combination can cause an explosion.

⚠ WARNING ⚠

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

△ CAUTION △

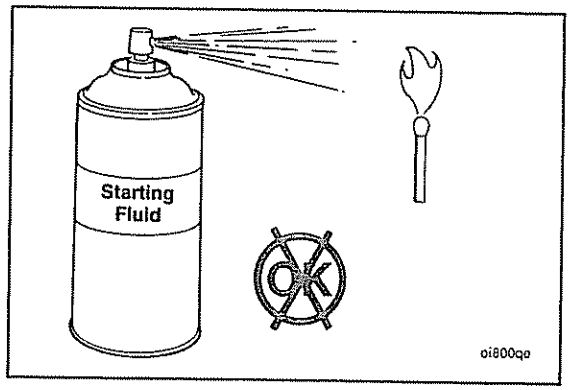
Cummins Engine Company, Inc., does not recommend the use of unmetered starting fluid. Uncontrolled use of starting fluid will cause engine damage.

△ CAUTION △

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

Use of starting fluid without metering equipment is **not** a recommended policy of Cummins Engine Company, Inc. If it is necessary to use this method:

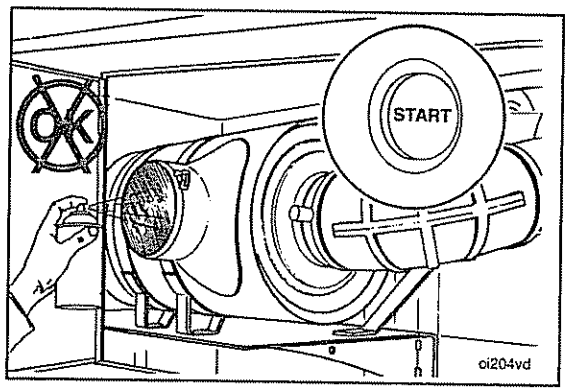
- Set the throttle at idle.
- Disengage the driven unit, or make sure the gears are in neutral.
- Open the manual fuel shutdown valve, or electric shutdown valve, whichever is used.
- Engage the starter; while cranking the engine, spray starting fluid into the intake of the air cleaner for 2 seconds. The starting fluid vapors will be drawn into the air intake manifold, and the engine will start.
- If the engine begins to stop, spray the fluid into the intake of the air cleaner for 1 second. **Never** apply a continuous spray to keep the engine running; engine damage will result. Wait at least 10 seconds between one spray sequence and the next.



With Mechanical or Electrical Metering Equipment (Ether)

⚠ WARNING ⚠

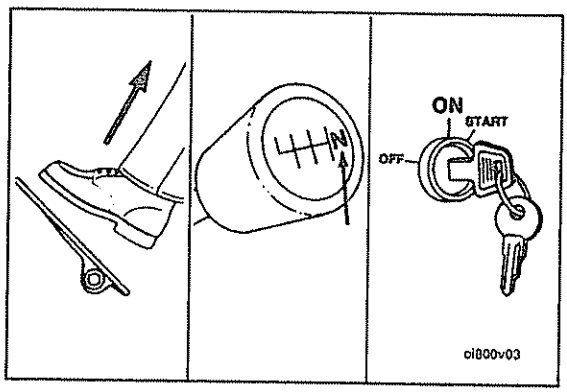
Do not use volatile cold starting aids in underground mine and tunnel operations, or marine applications, due to the potential for an explosion. Check with the local U.S. Bureau of Mines inspector for instructions.



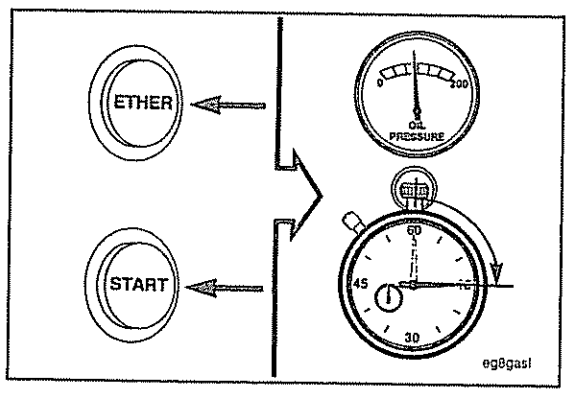
⚠ WARNING ⚠

Starting fluid is highly flammable and explosive. Do not smoke. Keep flames, sparks, and arcing equipment and switches away from starting fluid.

Due to increased safety hazards and potential for engine damage, do **not** use starting fluid without metering equipment.



- Set the throttle at idle.
- Disengage any driven unit, or, if equipped, put the transmission in NEUTRAL.
- Activate the switch to open the fuel pump shutoff valve.



⚠ CAUTION ⚠

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

- While cranking the engine, inject a metered amount of starting fluid.
- Engine oil pressure **must** be indicated on the gauge within 15 seconds after starting.

Cold Weather Starting Aids

Ether Starting Aids

⚠ WARNING ⚠

Starting fluid contains ether and is extremely flammable. Misuse or mishandling can cause an explosion. Never handle starting fluid near an open flame. Never use starting fluid with a preheater, glow plug, flame thrower or other type of electrical starting equipment. Do not breathe the fumes. Serious lung damage will result. Fuel oil or volatile fuel cold starting aids are not to be used in marine and underground mine and tunnel operations.

⚠ WARNING ⚠

Do not use volatile cold starting aids in underground mine and tunnel operations, or marine applications, due to the potential for an explosion. Check with the local U.S. Bureau of Mines Inspector for instructions.

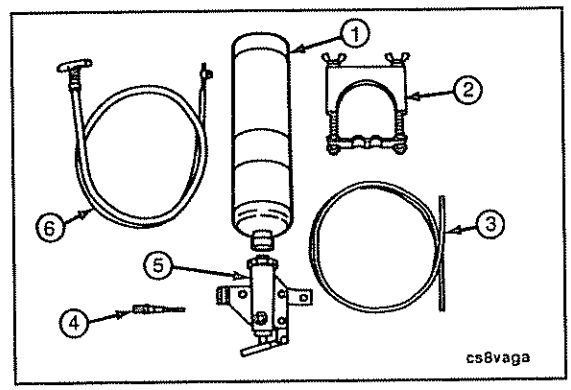
⚠ CAUTION ⚠

Using too much starting fluid will cause extremely high pressures and detonation in the engine cylinders, resulting in damage to the cylinder parts and bearings. Too much starting fluid can also cause damage from engine overspeed.

Ether Valve, Manual

The manually operated ether valve includes the valve body assembly (5), clamp (2), and nylon tube (3). The fuel cylinder (1), atomizer fitting (4), and pull control (6) **must** be ordered separately.

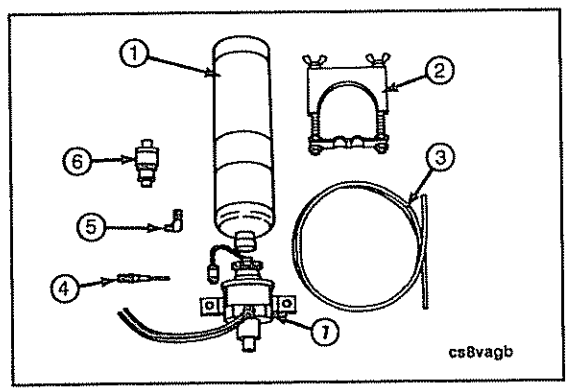
NOTE: Standard pull or throttle control cables can be used to actuate the manual valve, if desired.



Ether Valve, Electric

The electrically operated ether valve includes the valve body (7), 90-degree elbow (5), clamp (2), push button switch (6), and nylon tube (3). A thermostat is mounted on the engine exhaust manifold and cuts out the valve by sensing manifold heat when the engine is running. See the parts catalog for fuel cylinder (1) and fuel atomizer fittings (4).

NOTE: These fittings **must** be ordered separately, as required.

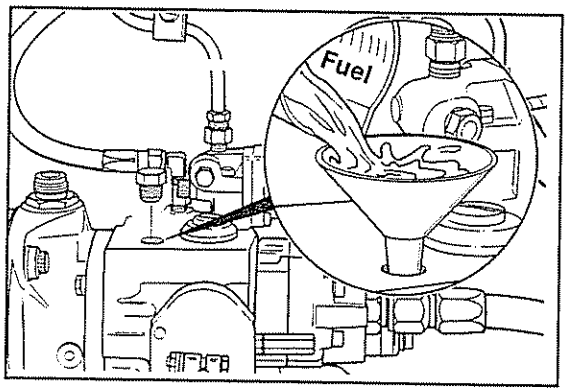


Installation Recommendations

The atomizer fittings **must** be mounted in the engine air intake manifold or inlet connection to provide an equal distribution of starting fuel to each cylinder.

The atomizer holes are 180 degrees apart and **must** be mounted so the spray is injected the long way of the manifold.

NOTE: If incorrectly installed, the spray goes crosswise of the manifold.



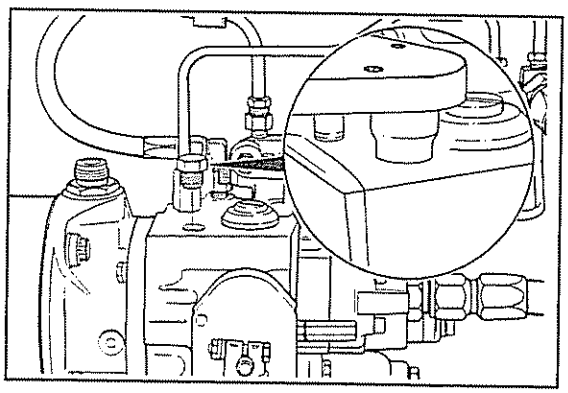
Fuel Pump

Prime

PT or STC

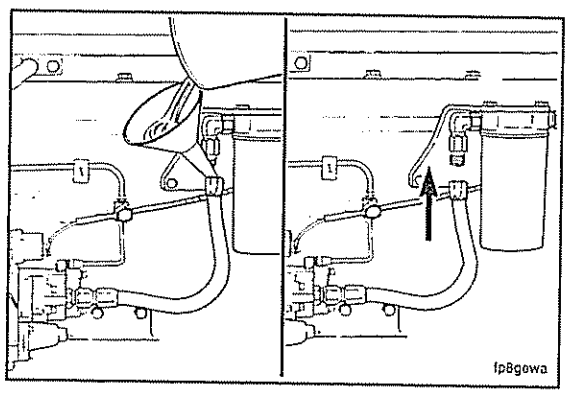
Remove the plug from the top of the housing.

Fill the housing with clean fuel oil.



Install the plug into the top of the housing.

Torque Value: 27 N•m [20 ft-lb]



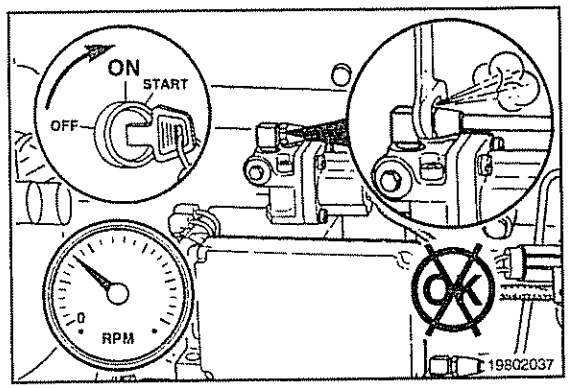
If the priming plug is hard to remove or the fuel pump is a VS type, remove the fuel supply hose from the gear pump.

Fill the hose and gear pump with clean fuel.

Install the fuel supply hose to the filter head.

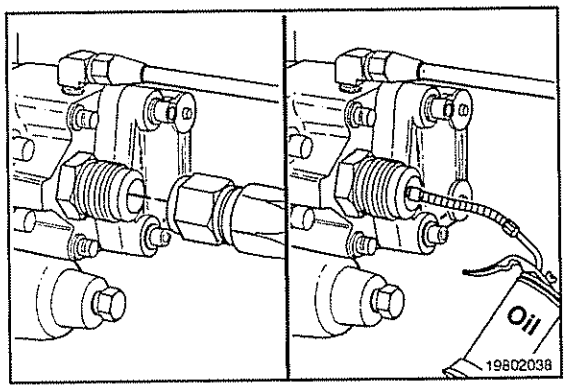
CENTRY™

Loosen the fuel line at the shutoff valve while the engine is cranking. If the fuel does **not** come out of the connection, the pump **must** be primed.

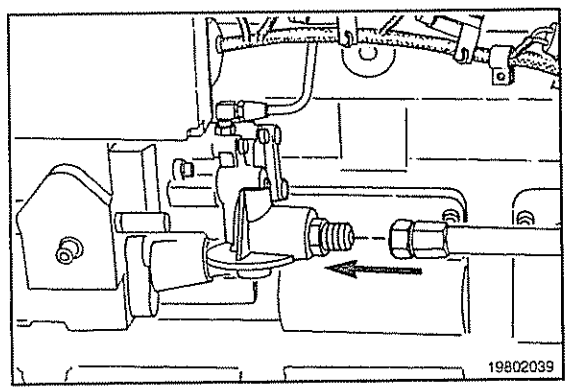


Disconnect the fuel supply hose from the gear pump.

Fill the gear pump with clean engine lubricating oil. Engine lubricating oil will seal the gears in the fuel pump and cause fuel to be sucked into the pump.

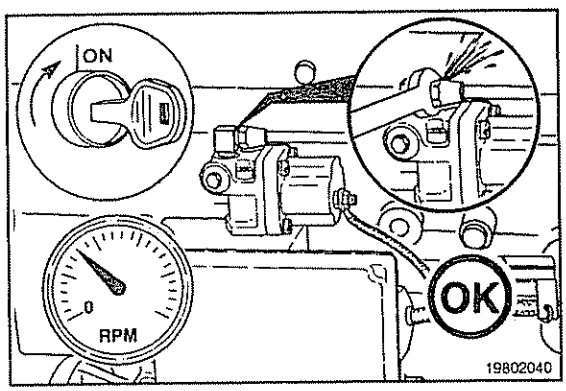


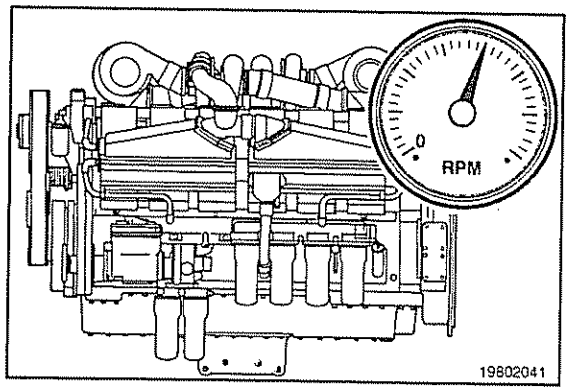
Connect the supply hose to the gear pump.



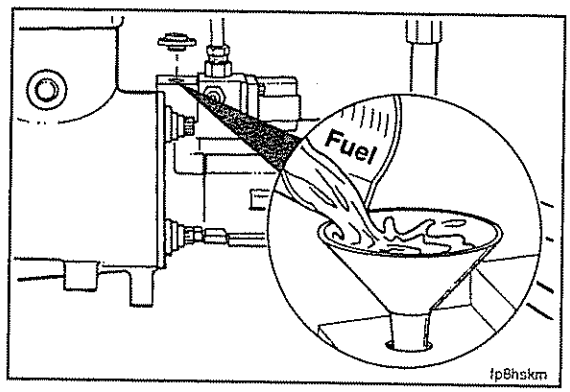
Use the starter and crank the engine until fuel comes out of the connection at the shutoff valve.

Tighten the connection.





Start the engine. Operate at high idle until all air is removed from the fuel lines.



CELECT™ Plus

Whenever the fuel pump is removed, it is necessary to prime the pump after installing it on the engine to remove any trapped air.

NOTE: If the fuel pump is dirty, clean the outside of the pump.

Remove the filter cap from the top of the front support.

Fill the housing with clean fuel. Install and tighten the filter cap.

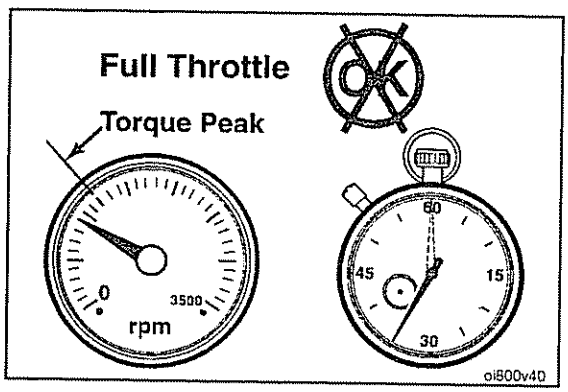
Torque Value: 18 N•m [13 ft-lb]

Starting Procedure After Extended Shutdown or Oil Change

General Information

Complete the following steps after each oil change or after the engine has been shut off for more than 3 days to make sure the engine receives the correct oil flow through the lubricating system:

- Disconnect the electrical wire from the fuel pump solenoid valve.
- Rotate the crankshaft by the starting motor until oil pressure appears on the gauge or the warning light goes out.
- Connect the electrical wire to the fuel pump solenoid valve.
- Start the engine. Refer to normal starting procedures in this section.



Operating the Engine

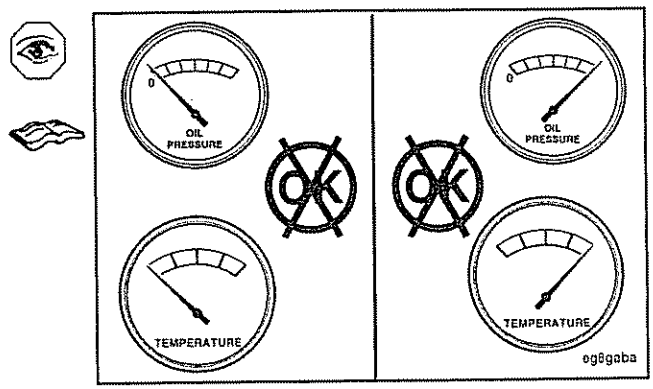
General Information

- Do **not** operate the engine at full throttle below peak torque engine speed (rpm) for extended periods (more than 30 seconds) of time.
- STC engines' peak torque rpm is typically 1100 to 1300 rpm. Refer to your engine dataplate for peak torque rpm.
- On a CELECT™ Plus engine, the peak torque rpm is typically 1100 rpm. Refer to your engine dataplate for peak torque rpm.

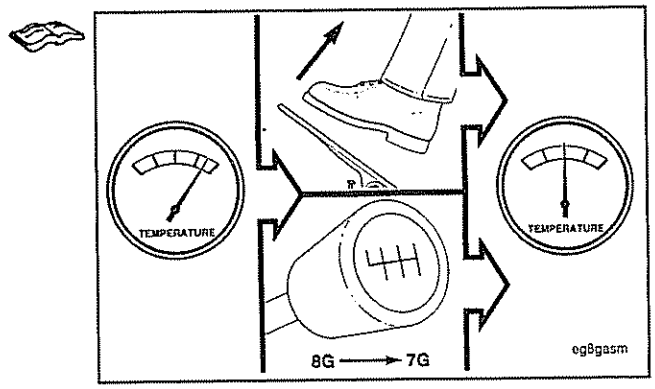
⚠ CAUTION ⚠

Continuous operation with a low coolant temperature, below 60°C [140°F], or a high coolant temperature, above 100°C [212°F], can damage the engine.

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

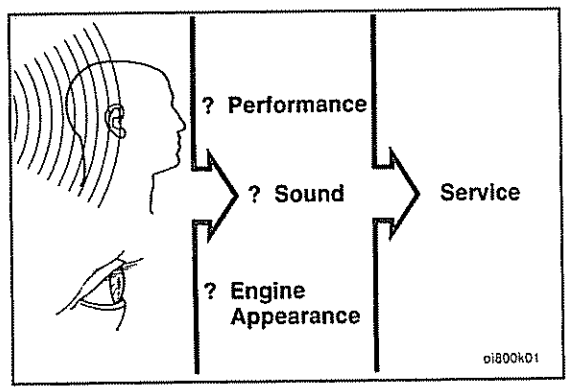


If an overheating condition starts to occur, reduce the power output of the engine by releasing the throttle pedal pressure or shifting the transmission to a lower gear, or both, until the temperature returns to the normal operating range. If the engine temperature does **not** return to normal, shut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

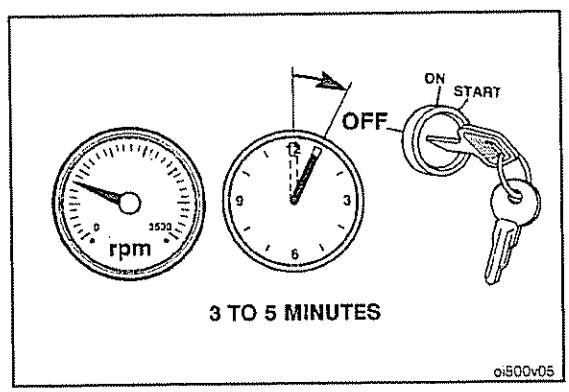


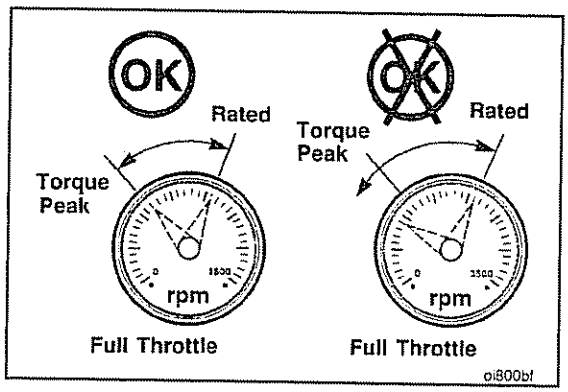
Most failures give an early warning. Look and listen for changes in performance, sound, or engine appearance that can indicate service or engine repair is needed. Some changes to look for are as follows:

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



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

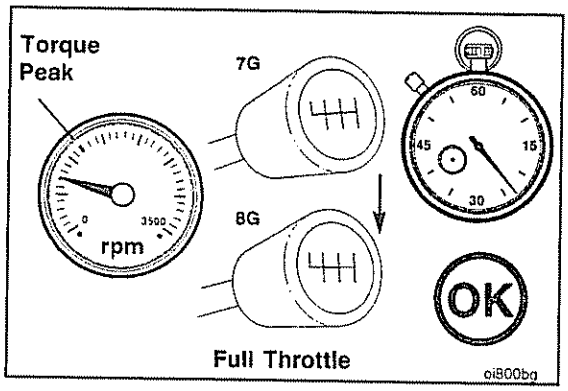




Engine Operating Range

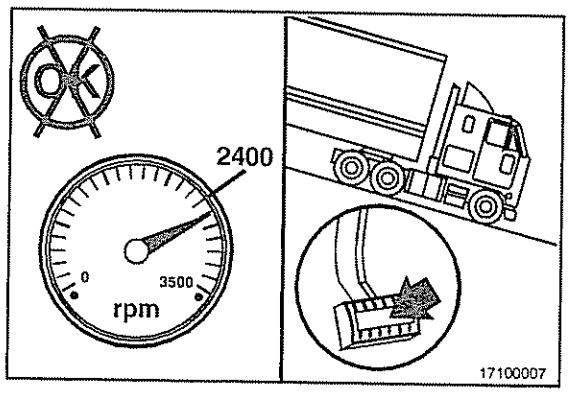
△ CAUTION △

Cummins engines are designed to operate successfully at full throttle under transient conditions down to peak torque engine speed (rpm). Excessive full throttle operation below peak torque rpm (peak torque rpm varies from 1100 rpm to 1500 rpm, depending upon rated engine speed) will shorten engine life to overhaul, can cause serious engine damage, and is considered engine abuse.



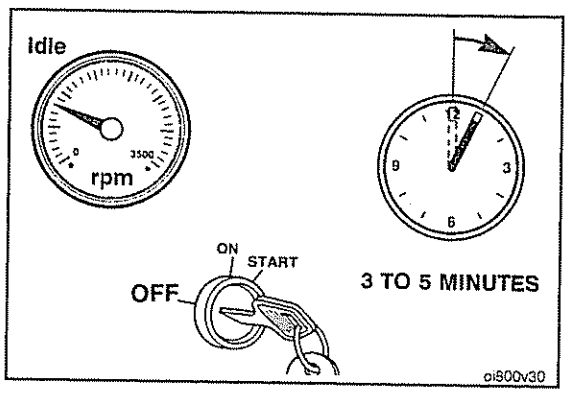
△ CAUTION △

Operation of the engine below peak torque rpm must not be sustained more than 30 seconds at full throttle below peak torque rpm.



△ CAUTION △

Do not operate the engine beyond high-idle speed. Operating the engine beyond high-idle speed can cause severe engine damage. The engine speed must not exceed 2400 rpm under any circumstances.



Engine Shutdown

Engine Operation before Shutdown

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

The turbocharger contains bearings and seals that are subject to the high heat of combustion exhaust gases. While the engine is running, this heat is carried away by oil circulation; but if the engine is stopped suddenly, the turbocharger temperature can rise as much as 38°C [100°F]. The results of the extreme heat can be seized bearings or loose oil seals.

NOTE: Do **not** idle for excessively long periods.

Long periods of idling are **not** good for an engine because the combustion chamber temperatures drop so low the fuel can **not** burn completely. This will cause carbon to clog the injector spray holes and piston rings and can result in stuck valves.

If the engine coolant temperature becomes too low, raw fuel will wash the lubricating oil off the cylinder walls and dilute the crankcase oil so all moving parts of the engine will suffer from poor lubrication.

If the engine is **not** being used, shut it down.

The engine can be shut down completely by turning off the switch on installations equipped with an electric shutdown valve, or by turning the manual shutdown valve knob. Turning off the switch that controls the electric shutdown valve stops the engine unless the override button on the shutdown valve has been locked in the open position. If the manual override on the electric shutdown valve is being used, turn the button fully **counterclockwise** to stop the engine. Refer to Normal Starting Procedure in this section. The valve can **not** be reopened by the switch until after the engine comes to a complete stop, unless a rapid restart valve is installed.

⚠ CAUTION ⚠

Do not leave the keyswitch or the override button in the valve open or in the run position when the engine is not running. With overhead tanks this can allow fuel to drain into the cylinders, causing a hydraulic lock. Therefore, stop the engine immediately in the event of any malfunction or part failure.

Practically all failures give some warning to the operator before the parts fail and ruin the engine. Many engines are saved because alert operators heed warning signs (sudden drop in oil pressure, unusual noises, etc.) and immediately shut down the engine.

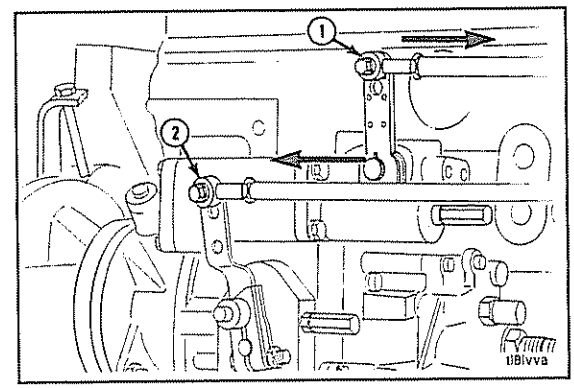
PTO Application with Variable Speed

STC Engines Only

The variable-speed governor on power take-off applications is used to control engine speed at the desired rpm.

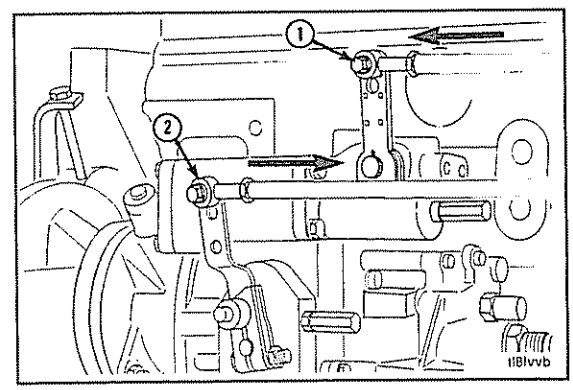
To engage the variable speed governor with the engine idling on standard throttle:

- Put the variable speed control lever (1) in the idle position.
- Lock the standard throttle lever (2) in the full-open position.
- Adjust the variable-speed control lever (1) to the speed desired.



To return to standard throttle operation:

- Return the standard throttle lever to the idle position (1).
- Lock the variable speed control lever in the maximum speed position (2).

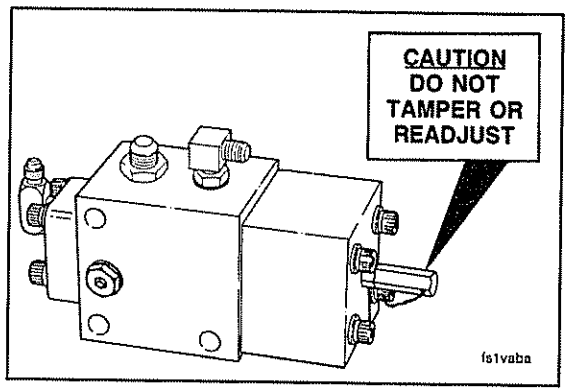


For CELECT™ Plus engine power take-off operation, refer to this section.

Step Timing Control (STC)

General Information

Some engine models are equipped with STC. STC allows the engine to operate in advanced injection timing during start-up and light-duty engine load conditions and to return to normal timing during medium and high engine load conditions.

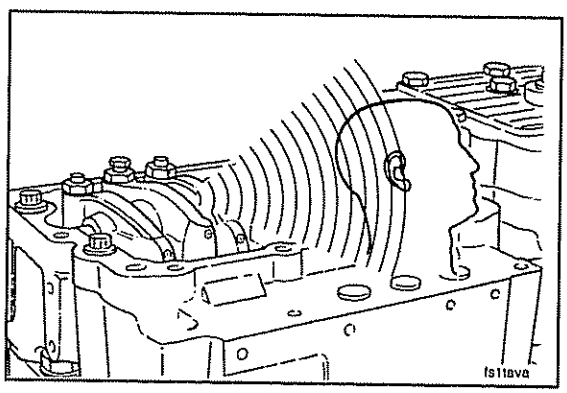


⚠ CAUTION ⚠

Do not attempt to bypass or otherwise tamper with the STC oil control valve or plumbing. This will result in the loss of both fuel economy and engine durability. Correct valve operation is necessary to maintain acceptable cylinder pressures and temperatures and to yield optimal fuel economy during high-load operation and to control white smoke at idle.

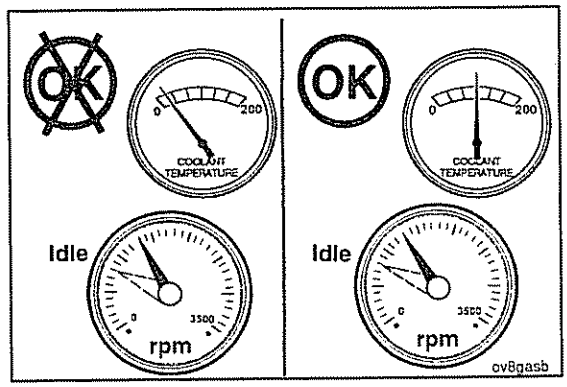
Benefits include:

- Improved cold weather idling characteristics
- Reduced cold weather white smoke
- Improved light-load fuel economy
- Reduced injector carboning.



When operating in the advanced mode, a light ticking noise will, possibly, be noted at the overhead. This sound is normal and is caused by the actuation of the STC hydraulic tappets during each injection cycle.

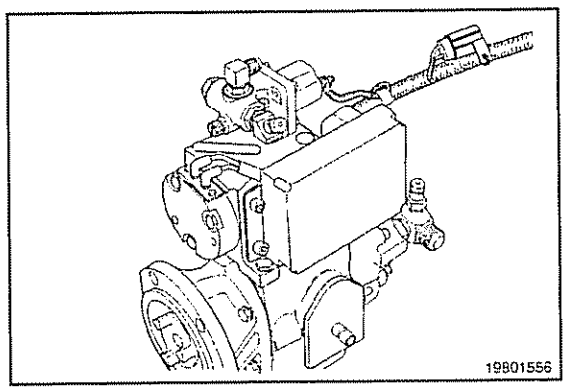
For optimal white smoke control on STC-equipped engines, do **not** increase engine speed above idle during engine start-up until the coolant temperature reaches 38°C [100°F] or until ready to apply load to the engine.



CENTRY™ System

The CENTRY™ system is an intelligent electronic engine control system designed to optimize engine control on mining, construction, agriculture, and other off-highway equipment. This system can be applied to all engine models that use the PT® fuel system. The CENTRY™ system controls engine speed and fuel pressure based on input from the electronic throttle and other equipment-specific and/or engine-model-specific features.

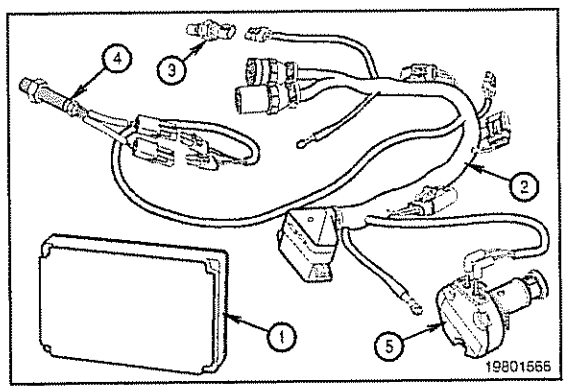
The CENTRY™ system consists of hydromechanical and electronic subsystems. The electronic subsystem manages fuel delivery using an electronic fuel control (EFC) valve while the hydromechanical subsystem provides backup maximum engine torque and speed protection.



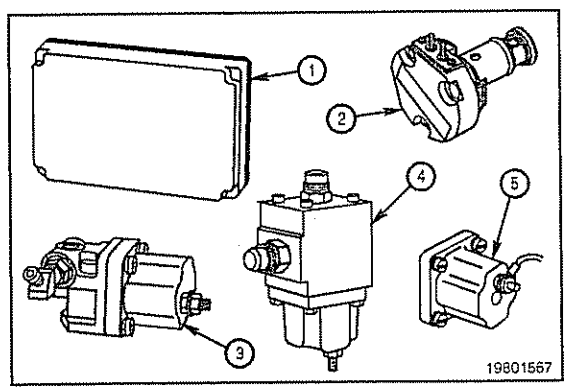
CENTRY™ System Description

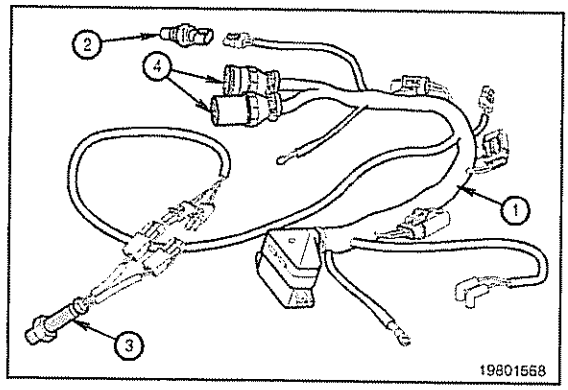
Electronic Subsystem

The engine subsystem contains:
1. Electronic Control Module (ECM)
2. Main Engine Harness
3. Rail Pressure Sensor
4. Engine Speed Sensor
5. Electronic Fuel Control Valve (EFC)



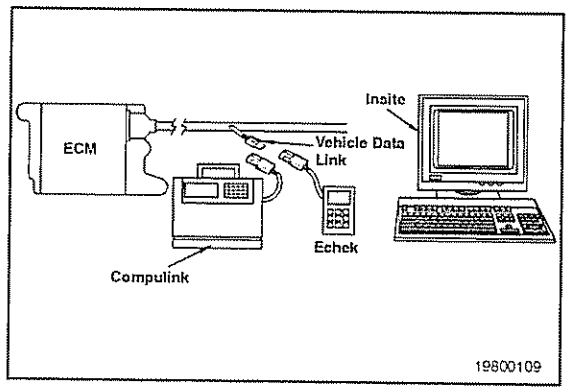
The CENTRY™ system has been designed for both 12- and 24-VDC original Equipment manufacturer (OEM) electrical systems. The following components are different between 12- and 24-VDC systems:
1. ECM
2. EFC Valve
3. Fuel Shutoff Valve
4. Electric STC Actuator (if used)
5. Auxiliary Shutdown Device (if used)



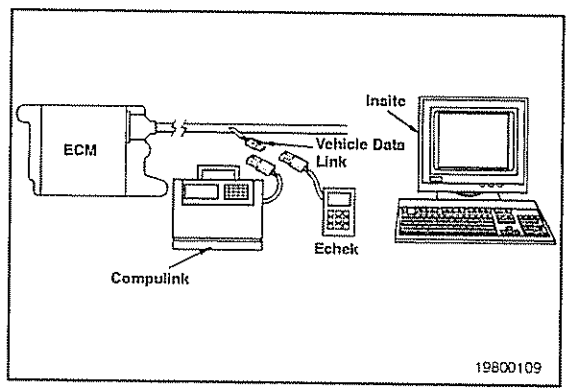


The following components are the same in both 12- and 24-VDC systems:

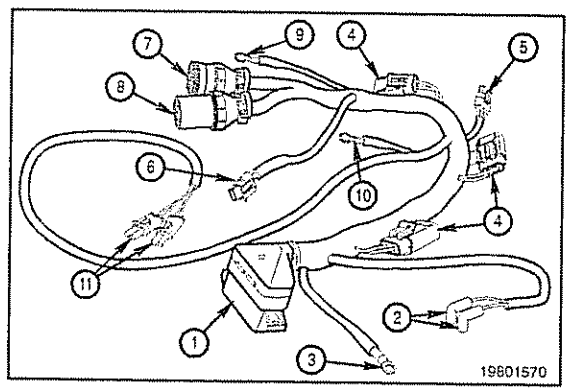
1. Main Engine Harness
2. Rail Pressure Sensor
3. Engine Speed Sensor
4. OEM Throttle Switch Interface



The CENTRY™ ECM is loaded with a calibration containing engine control and OEM application-specific information. A Cummins Authorized Repair Location can recalibrate an ECM on the equipment by use of the INSITE™, Compulink™, or Echek™ and the Electronic Software Database and Network (ESDN). Some adjustments can be made with the Cummins INSITE™, Compulink™, or Echek™, when a CENTRY™ cartridge is used.



CENTRY™ features used in an application will be displayed in INSITE™, Compulink™, or Echek™ monitor mode and view parameter screens. The OEM and calibration will determine which features are used and which parameters can be adjustable.



The CENTRY™ main engine harness contains the following connections and fuses:

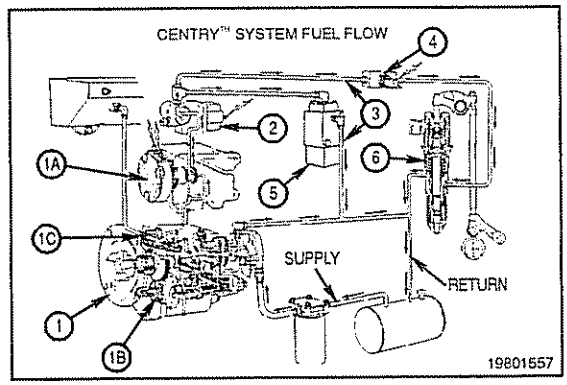
1. ECM Connector
2. EFC Valve 90° Connectors
3. Fuel Shutoff Valve Ring Terminal
4. 5-amp Fuses
5. Engine-Side Datalink Connector
6. Rail Pressure Sensor Connector
7. OEM 9-pin Connector (C-5)
8. OEM 9-pin Connector (C-6)
9. CENTRY™ Ground Ring Terminal
10. Electric STC Ring Terminal (optional)
11. Engine Speed Sensor Connectors

NOTE: Harness connector breakout locations differ between engine families.

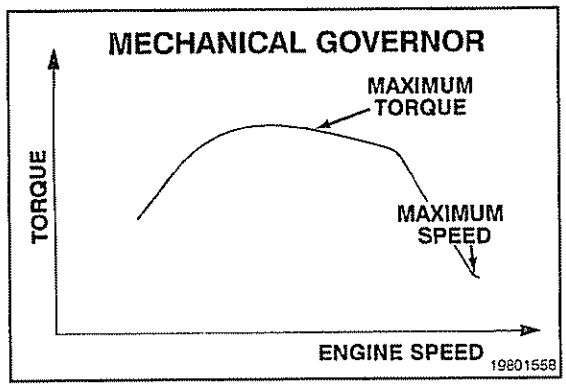
Hydromechanical Subsystem

This subsystem contains:

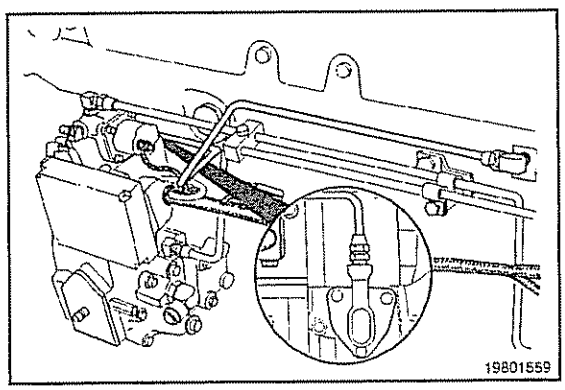
1. Fuel Pump
   a. Electronic Fuel Control Module Assembly
   b. Backup Mechanical Governor
   c. Air-Fuel Control.
2. Fuel Shutoff Valve
3. Fuel Tubes
4. Fuel Block (Rail Pressure Sensor Mount)
5. Step Timing Control
6. Injectors.



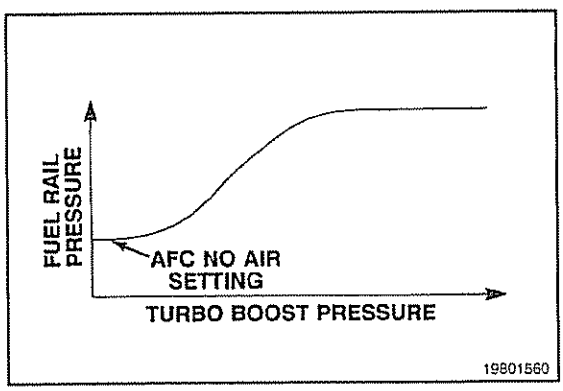
The fuel pump is the main part of the hydromechanical subsystem because it supplies the fuel pressure controlled by the electronic fuel control valve. The mechanical governor for the fuel pump provides backup maximum engine torque and speed control.

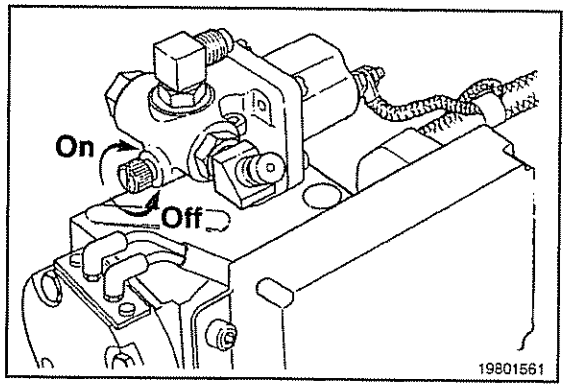


The fuel pump air-fuel control uses a turbocharger boost pressure line to regulate the fuel pressure supplied to the electronic fuel control valve. The air-fuel control reduces black smoke and improves engine performance during low-boost conditions.



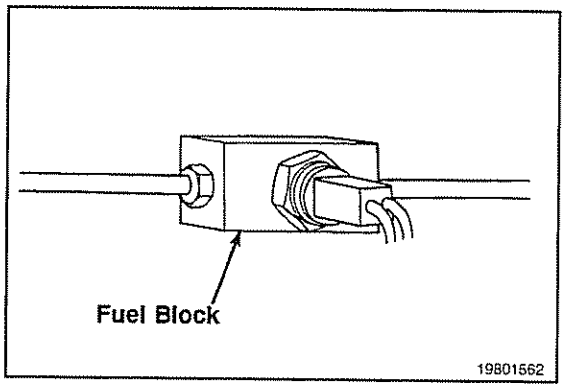
The air-fuel control, NO-AIR setting is the maximum fuel rail pressure that the fuel pump can supply when no boost pressure is detected on the boost pressure sensing line. The following graph shows a typical rail pressure versus boost pressure acceleration transition curve. The air-fuel control allows the maximum available fuel rail pressure to increase as boost pressure increases.



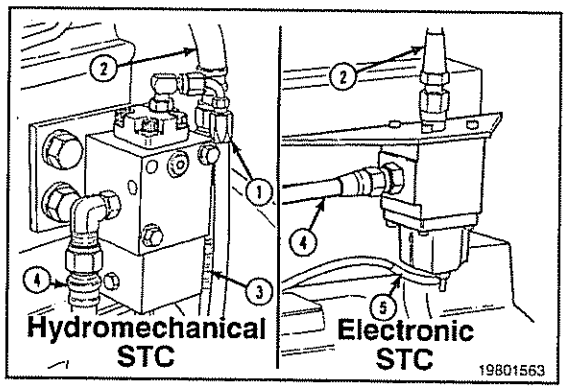


Many engine models use a fuel shutdown valve having a manual override screw. Turning this screw in overrides the shutdown valve and/or shutdown systems connected to the fuel shutoff valve.

NOTE: This screw does **not** override the electronic fuel control valve in the CENTRY™ system.



The CENTRY™ system uses a fuel block to provide a solid location for the rail pressure sensor.

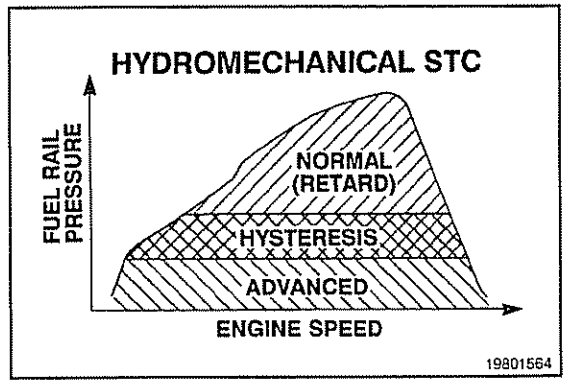


On engine models that use STC, some engines will use a fuel pressure sensing line to control a hydromechanical step timing control switch and other engines will use the CENTRY™ system to switch an electronic step timing control solenoid.

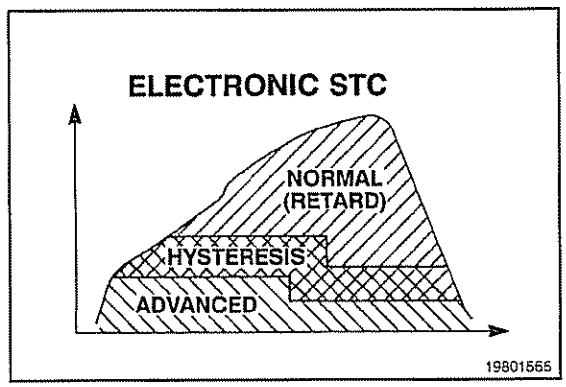
Step Timing Control Identification:
1. Fuel Pressure Sensing Line
2. Oil Line to the Tappets
3. Oil Vent Line
4. Oil Supply Line
5. CENTRY™ STC Actuator Lead Wire.

STC allows the engine to operate in advanced injection timing immediately after start-up and light-duty engine load conditions and to return to normal timing during medium and high engine load conditions. The benefits of this feature include:
1. Improved cold weather idling characteristics
2. Reduced cold weather white smoke
3. Improved light-load fuel economy.

The hydromechanical STC allows two different injection timing modes based on fuel rail pressure detected on the fuel pressure sensing line. Hysterisis provides the maximum rail pressure for the engine to shift from ADVANCED™ to normal timing and the minimum rail pressure for a shift from normal to ADVANCED™ timing. Hysterisis prevents unstable and rapid switching of STC timing modes when the engine is operating at rail pressures within the hysterisis rail pressure range.



The CENTRY™ electronic STC also allows two different injection timing modes based on measured rail pressure and engine speed. However, CENTRY™ has the capability to provide two different sets of rail pressure STC switch points above and below a calibrated engine speed point. This provides further optimization of engine performance with STC. The ECM provides 12- and 24-VDC to the electronic STC actuator when it is commanding ADVANCED™ timing mode.



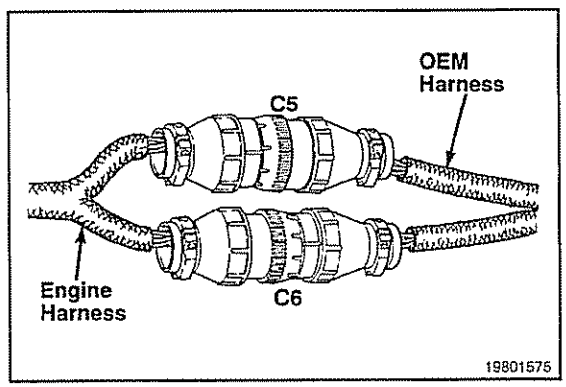
Electronic Controlled Fuel System

Programmable Features

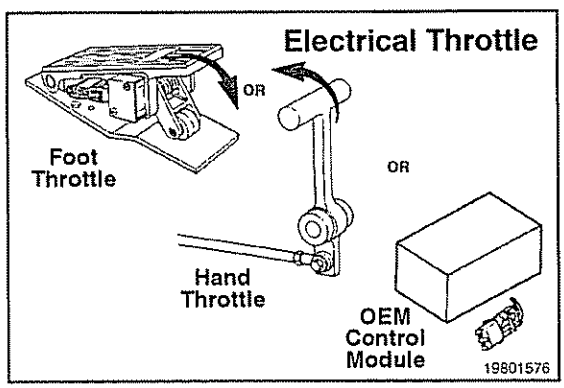
CENTRY™

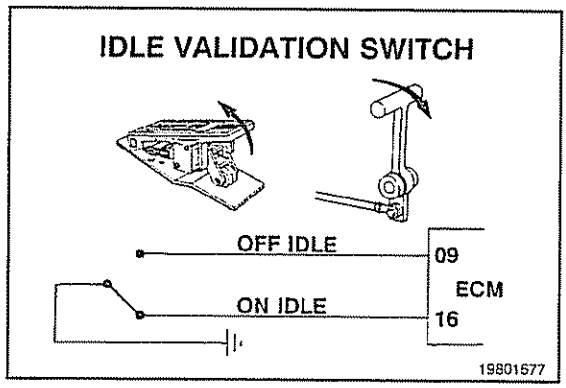
OEM Interface Components

The CENTRY™ system is connected to the OEM equipment through the two OEM 9-pin connectors on the main engine harness.



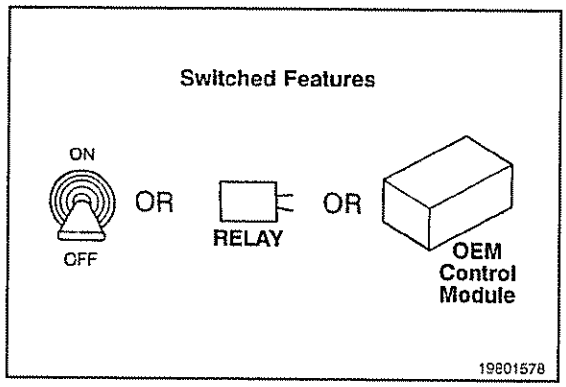
The OEM equipment will supply an electronic throttle signal.
It can be supplied by an electronic foot throttle, hand throttle, switch, or equipment ECM (OEM control module).





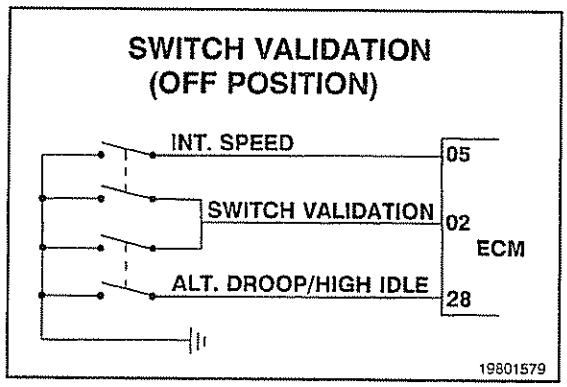
Most mechanical drive transmission (vehicular) applications will use an idle validation switch in the throttle interface. The idle validation switch is an on/off switch that indicates idle or off idle. This switch will verify when the throttle is in the idle position.

Most stationary power, hydraulic pump drive, or electric drive applications will **not** use idle validation.



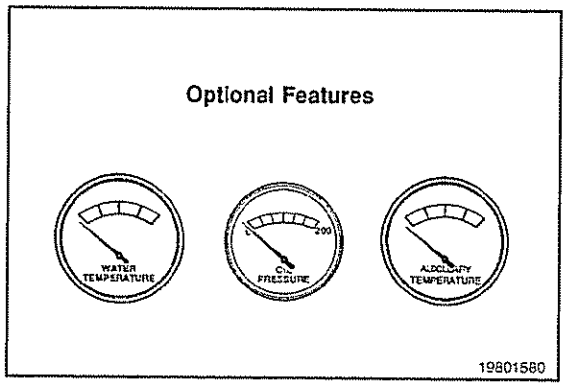
The OEM equipment can interface with one or more of the following CENTRY™ switch features:

1. Alternate Torque Control
2. Alternate Low-Idle Control
3. Intermediate-Speed Control
4. Alternate Droop/High-Idle Control



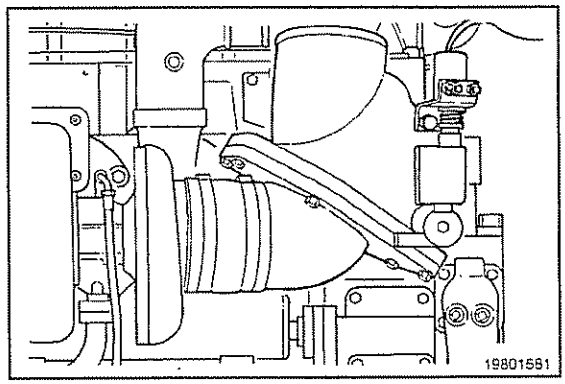
Most mechanical drive transmission (vehicular) applications will use a redundant validation switch on the alternate droop/high idle control and Intermediate speed control switches. Switch validation provides a secondary signal to indicate whether or **not** the switch is on.

Most stationary power, hydraulic pump drive, or electric drive applications will **not** use switch validation.

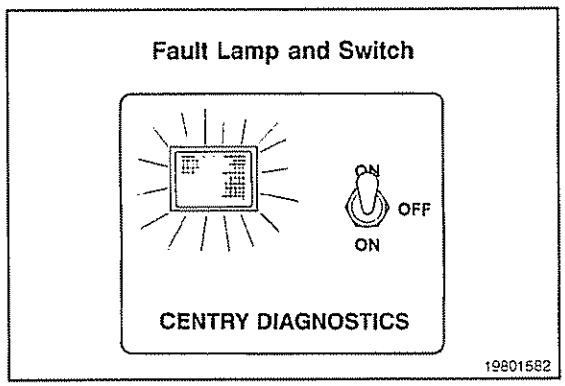


If none of the switched features are used, the OEM equipment can use the CENTRY™ system to read coolant temperature, oil pressure, and auxiliary oil temperature (transmission temperature). This data is available to the OEM through the public datalink and requires an OEM electronic interface.

The OEM equipment can utilize the optional auxiliary driver lead. This can be used to power auxiliary shutdown devices or provide an engine torque output signal.

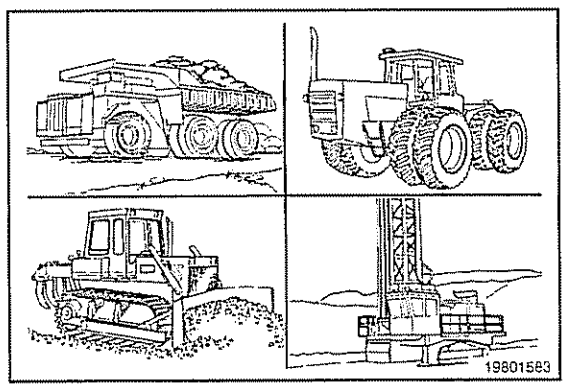


The OEM equipment contains a fault lamp and switch in the cab or operator location. The fault lamp will light for 1 to 2 seconds after the key is turned on. The lamp will go out if no active faults are detected in the CENTRY™ system.

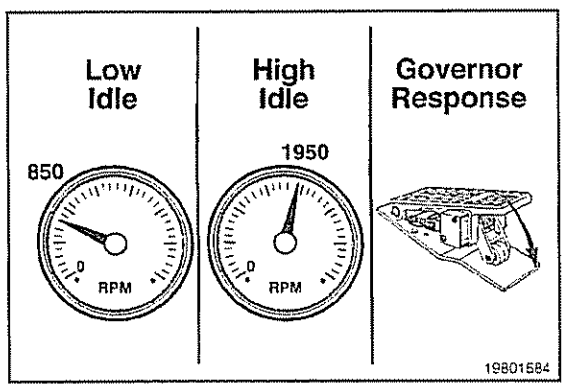


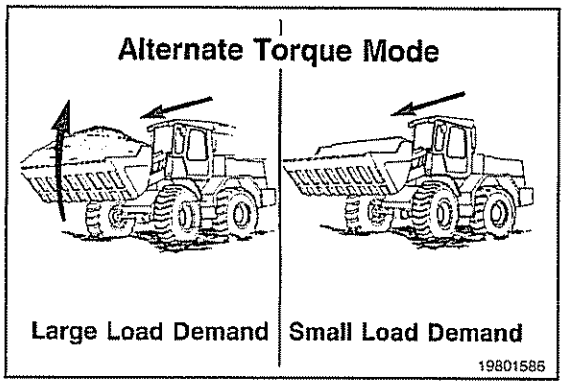
Electronic Governor Operation

The CENTRY™ electronic governor has been designed to be flexible to meet the wide variety of engine control needs of off-highway equipment.



The OEM selects low- and high-idle settings along with the optimum engine response governor droop characteristics, for the application. The OEMs also decide whether or **not** some of these settings will be Compulink™ or Echek™ adjustable.



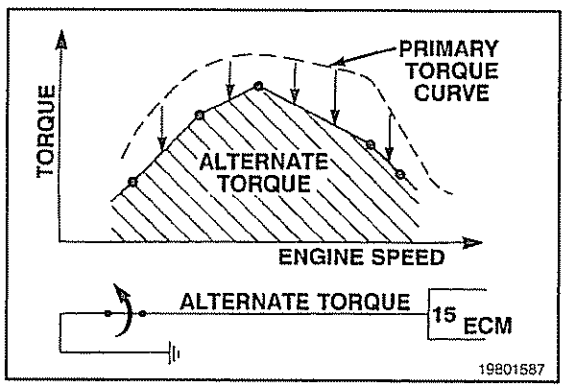


Operational Features

The CENTRY™ system contains optional OEM-selected features to maximize engine speed, power, torque, response, and smoke performance to meet specific application needs. On all optional features the OEM will determine the type of switch used and its location.

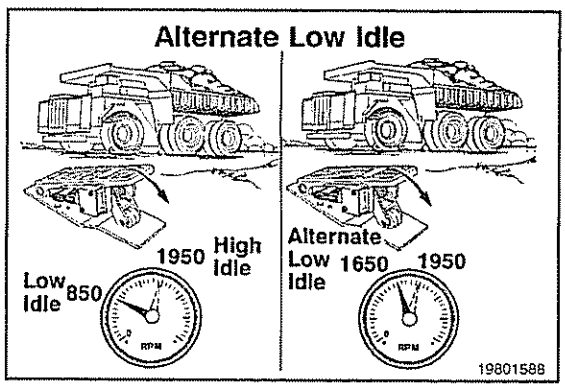
Alternate Torque Control

This feature enables an alternative electronically controlled maximum engine torque curve for optimum operating efficiency in loaded versus unloaded conditions.



The alternate torque feature is activated whenever the normally closed alternate torque switch is opened and 5 VDC are detected on the alternate torque signal line. Five rail pressure versus engine speed points define the alternate torque curve.

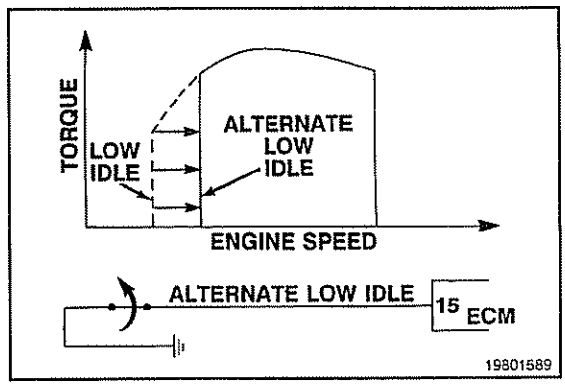
Shown is a graph illustrating an alternate torque curve that is below the normal torque curve.



Alternate Low Idle Control

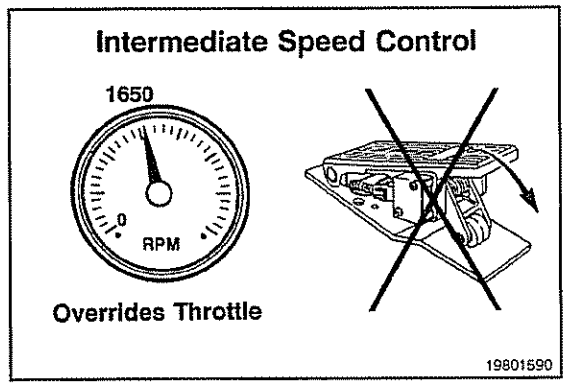
This feature allows for two different low-idle speed settings with normal throttle control above the low-idle speed setting. This feature is often used on electric-drive haul trucks when they are traveling above 5 kph [3/mph].

The alternate low-idle feature is activated whenever the normally closed alternate low idle switch is opened and 5 VDC are detected on the alternate low idle signal line. The following art illustrates an alternate low-idle speed that is above the normal low-idle speed.

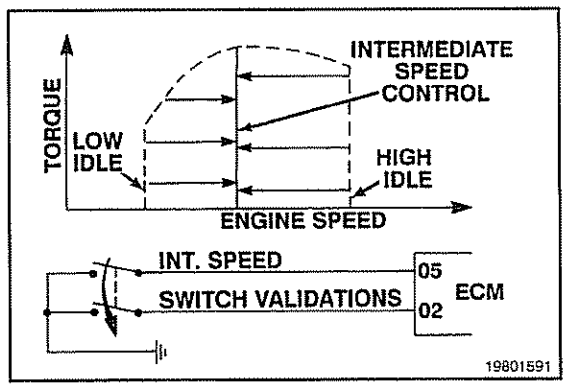


Intermediate Speed Control

This feature will override the throttle and control the engine speed to the calibrated speed setting. This feature is often used in conjunction with power take-off (PTO) on some equipment or dynamic brake engine speed on electric-drive haul trucks.

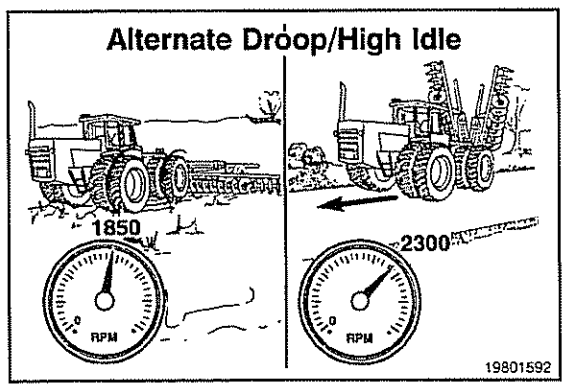


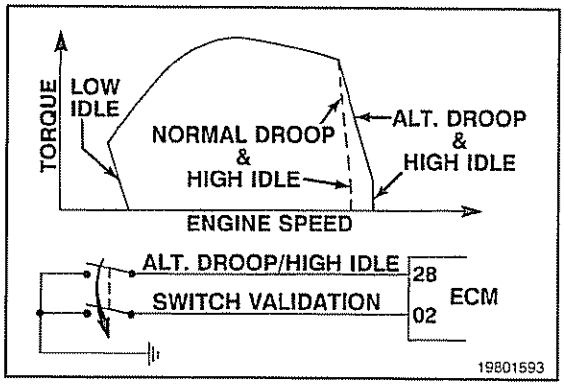
The intermediate-speed feature is activated whenever the normally open intermediate -speed control switch is closed and less than 1 VDC is detected on the intermediate-speed signal line. If switch validation is used, both intermediate-speed and switch validation signals **must** be less than 1 VDC before this feature can be detected.



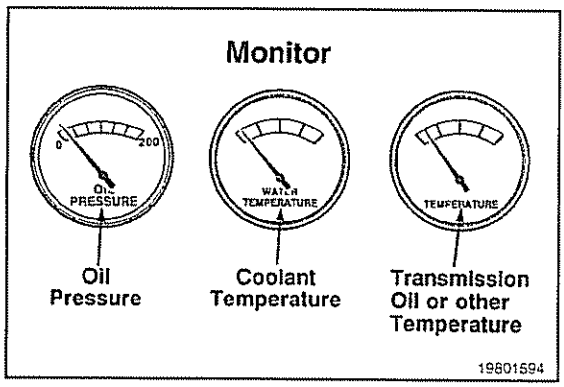
Alternate Droop/High Idle Control

This feature allows two different engine response and high-idle settings. This allows two different operating modes to optimize governor performance.



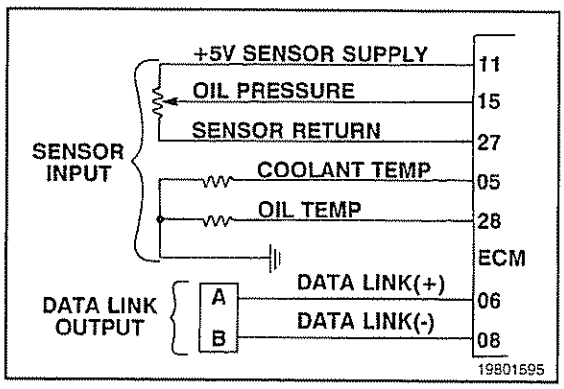


The alternate droop/high idle feature is activated whenever the normally open alternate droop/high idle switch is closed and less than 1 VDC is detected on the alternate droop/ high idle signal line. If switch validation is used, both alternate droop/high-idle and switch validation signals **must** be less than 1 VDC before this feature can be activated.

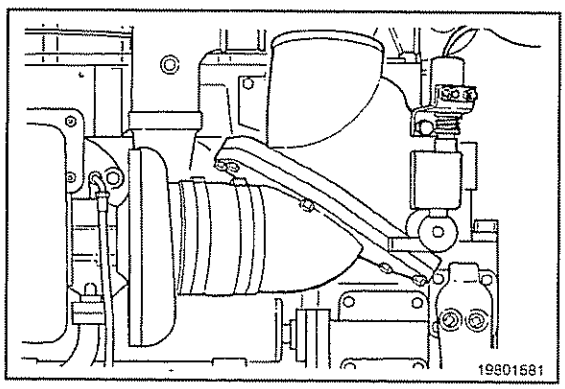


Monitor

This feature can be used when none of the switched features are used. It allows for the CENTRY™ system to read oil pressure, coolant temperature, and/or an auxiliary temperature sensor and broadcasts these inputs on the datalink to an OEM electronic dash or OEM control module.



Shown is a wiring diagram illustrating the monitor feature circuits.



Auxiliary Shutdown Control

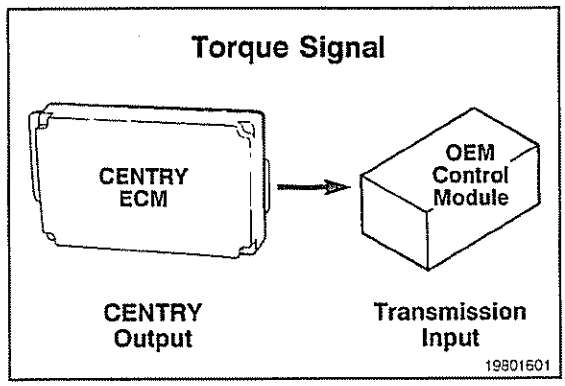
The auxiliary driver in the CENTRY™ system can be used to power auxiliary shutdown devices such as air intake flaps or additional fuel shutdown devices. It can also be used to shut off other equipment when the engine shuts down.

Auxiliary shutdown control will remove electrical power to the auxiliary driver when the keyswitch is turned off or if the engine shuts down due to an overspeed condition.

Torque Output Signal

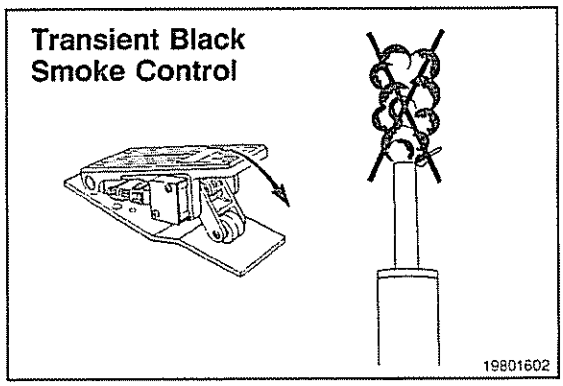
The torque output signal is a standard broadcast on the datalink. In addition, the auxiliary driver lead can be used to provide an engine torque output signal in applications where the CENTRY™ auxiliary shutdown control feature is **not** used.

The torque output signal is used in some transmission interfaces for optimization of shift schedules and to provide smoother shifting.

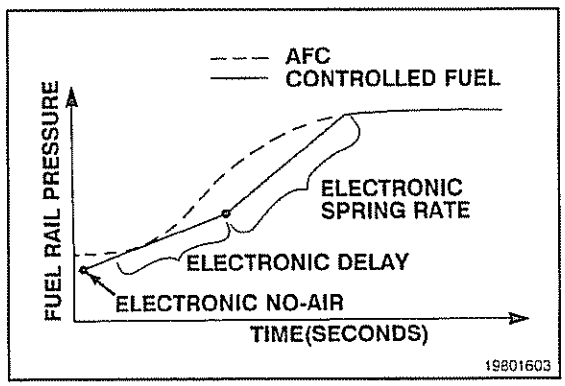


Transient Black Smoke Control

This feature limits fueling based on time and fuel delivery in addition to the AFC and STC hydromechanical smoke, control functions CENTRY™ vehicles have installed.

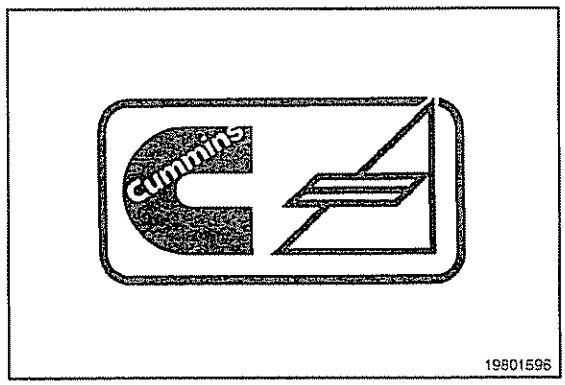


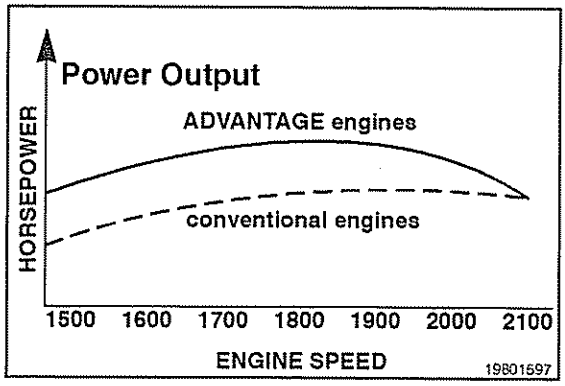
The CENTRY™ transient black smoke feature limits the rate of fuel rail pressure increase per unit time. On some applications, the Electronic No-Air, Delay, and Spring Rate can be Compulink™/Echeck™ adjustable. These electronic parameters are similar to those on the hydromechanical AFC in the fuel pump.



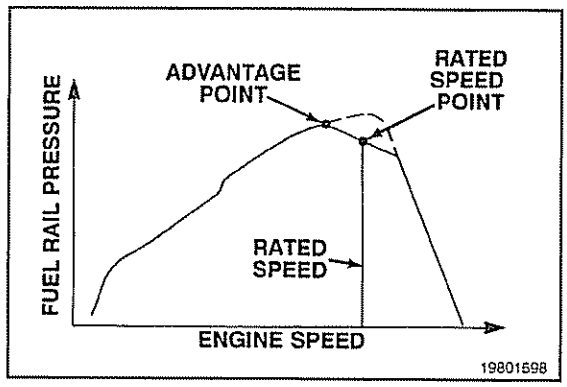
ADVANTAGE™

Many agricultural applications will use the CENTRY™ electronic governor to provide ADVANTAGE™ torque and power control.

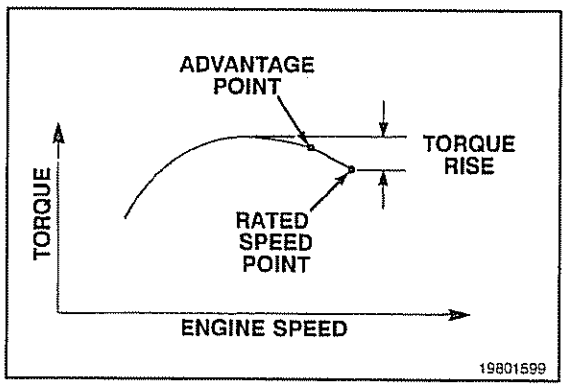




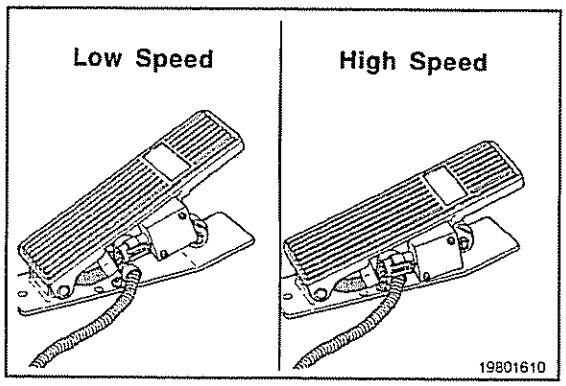
ADVANTAGE™ control allows the engine to deliver additional horsepower and torque rise as the engine is lugged below rated speed. This provides improved operating efficiency in applications where steady ground speeds are desired with continuously changing engine load.



CENTRY™ ADVANTAGE™ electronically controls the maximum fuel rail pressure available according to the electronically calibrated peak power rail pressure point (advantage point) and the electronically calibrated maximum rail pressure at rated engine speed point.



ADVANTAGE™ provides a steeper torque rise between peak power and rated conditions than is obtainable with the hydromechanical fuel system. This results in reduced speed drop and more available power under external loading conditions.

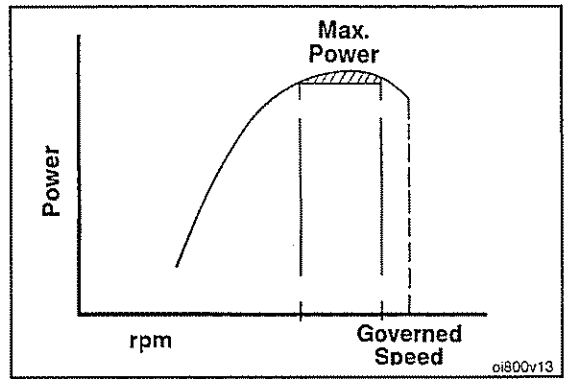


Back-up Mode Operation

When certain system faults are detected, the engine will default to backup mode. The definition of backup mode is different for different faults. In general, if an idle validation switch is **not** used, the backup mode will be some constant-calibrated speed. If an idle validation switch is used, the backup mode will be two speeds based on switch position-low speed when switch on-idle, high speed when switch off-idle.

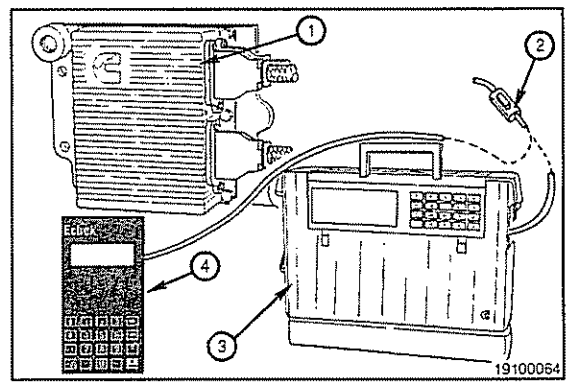
CELECT™ Plus

The CELECT™ Plus system is an electronically controlled fuel injection system that optimizes fuel economy and reduces exhaust emissions. It does this by controlling the torque and horsepower curve, AFC function, engine high speed, low idle, and road speed.



The CELECT™ Plus system provides additional electronic features that enhance engine and vehicle performance and control.

- ECM
- Datalink Connector
- Compulink™
- Echek™.



The **automotive/variable-speed (VS) governor** feature gives the owner a choice of engine speed governors. The automotive governor operates like the conventional PT® governor, that provides constant fueling for a given throttle position (engine speed varies with load). The VS governor maintains a constant engine speed for a given throttle position under varying load conditions.

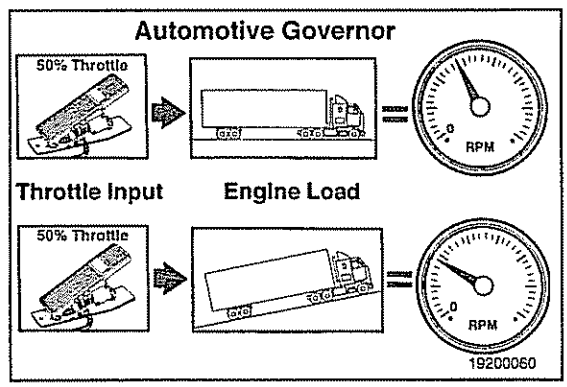
This is a programmable feature in the ECM. To alter this feature or setting, refer to your Cummins Authorized Repair Location.

Automotive Governor

- **Engine Speed Varies with Load**

Variable Speed Governor

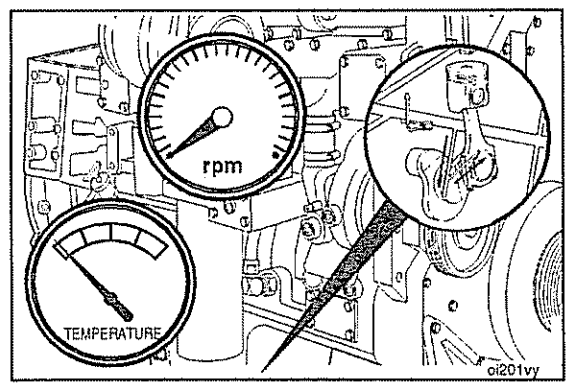
- **Engine Speed Is Constant under Varying Loads**

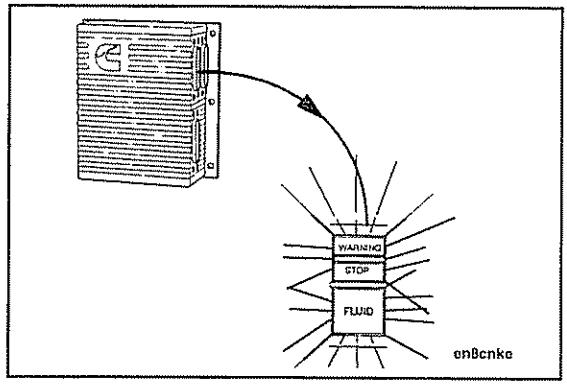


The **engine warm-up protection** feature helps to prevent internal engine damage, such as rod bearing and turbocharger bearing failure. Engine speed at start-up is maintained to idle until adequate oil pressure is attained.

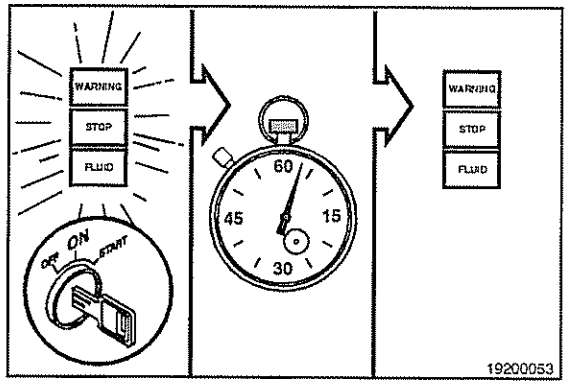
This is **not** a customer-adjustable feature.

NOTE: Engine brakes will **not** activate until the engine oil temperature has reached 33°C [92°F].



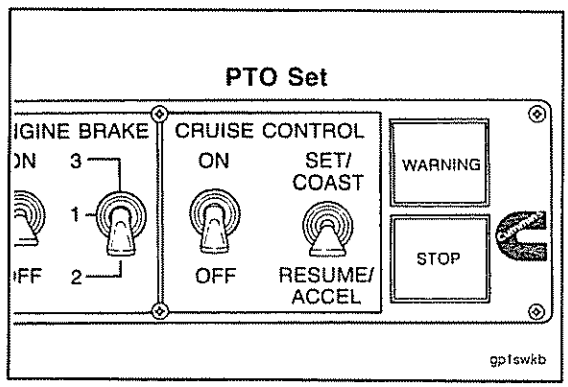


The **fault lamp sequencing** feature is used to determine if the diagnostic dashboard lamps have been installed and wired correctly. After key-on, all dashboard diagnostic lamps will turn on at once and then turn off in sequence.



The process will occur as follows:

1. After the key is on, all dashboard diagnostic lamps will turn on for 2 seconds. At the end of the 2-second period, the yellow warning lamp will turn off.
2. After an additional 1/2-second interval, the red stop lamp will turn off.
3. Finally, after an additional 1/2-second interval, the engine protection fluid lamp will turn off.



The **PTO** feature controls the engine at a constant engine speed selected by the operator. For applications needing the PTO mode, a remote-mounted switch can be used when a cab switch is **not** desirable. The PTO engine speed is set with the dash-mounted switches.

This is a programmable feature in the ECM. To alter this feature or setting, refer to a Cummins Authorized Repair Location.

NOTE: The cab-mounted controls can have a different appearance depending on the OEM.

The **clutch/brake PTO disable** is a feature that allows the customer to exit PTO operation if the clutch or brake is activated. If this feature is turned off, the clutch or brake activation will **not** disable the PTO. This will only disable the cab PTO. The remote PTO will **not** be affected.

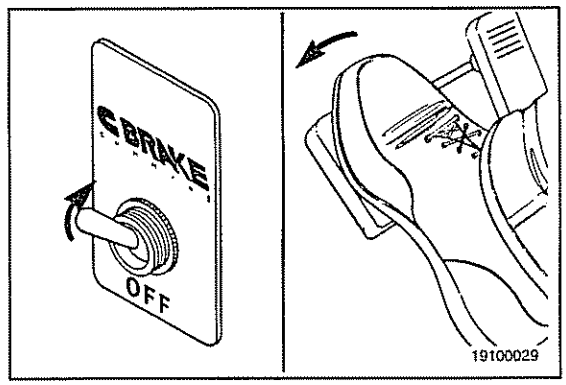
The original factory programmed value is YES.

The **throttle disable in PTO** feature allows the customer to exit PTO operation if the throttle is activated. If this feature is turned off, the throttle activation will **not** disable the PTO.

The original factory programmed value is NO.

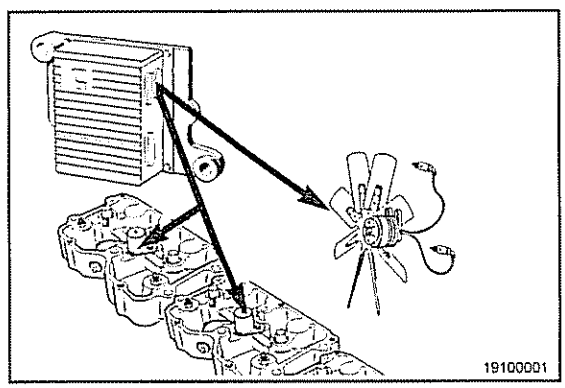
The **pedal-activated engine braking** feature tells the ECM that the brake pedal **must** be tapped before the engine brakes will be activated. The brake pedal **must** be tapped after all the other engine brake criteria have been met.

The original factory programmed value is NO.



The **fan-on during engine braking** feature automatically turns the fan on both after some delay and after all engine brakes have engaged. Turning the fan on will provide additional braking power during extended braking periods.

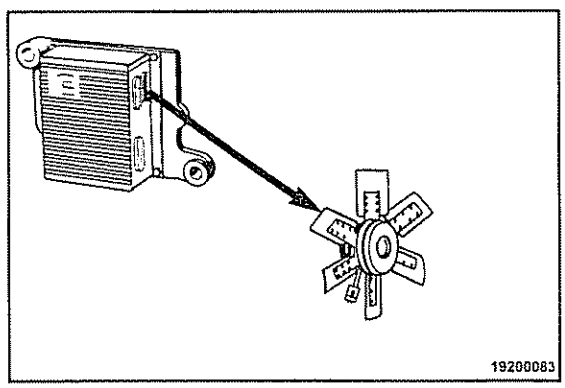
The original factory programmed value is NO.

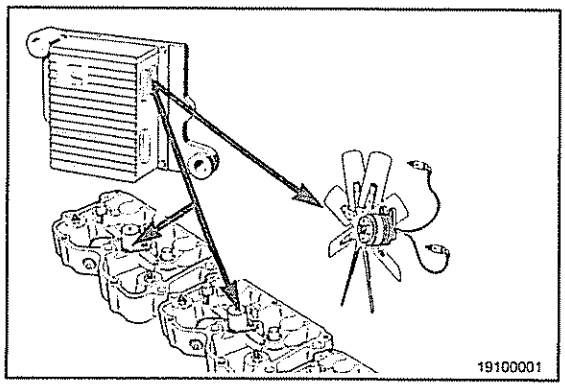


The following three features apply to ECM fan control logic.

The **air conditioner pressure switch input** feature disables the circuit for the air conditioning refrigerant pressure switch input to the ECM. The ECM will **always** show that this circuit is closed and will **never** turn the fan on due to external input to the circuit. This feature **must** be selected YES if the vehicle is **not** equipped with air conditioning.

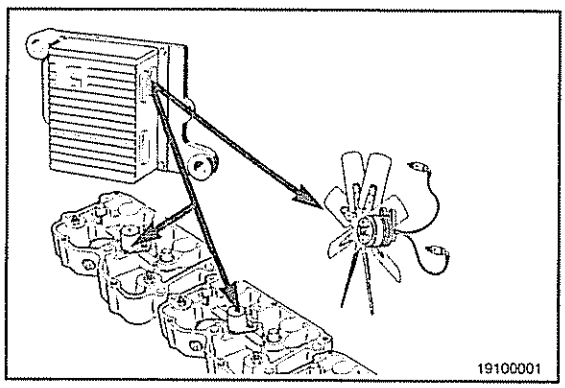
The original factory programmed value is YES.





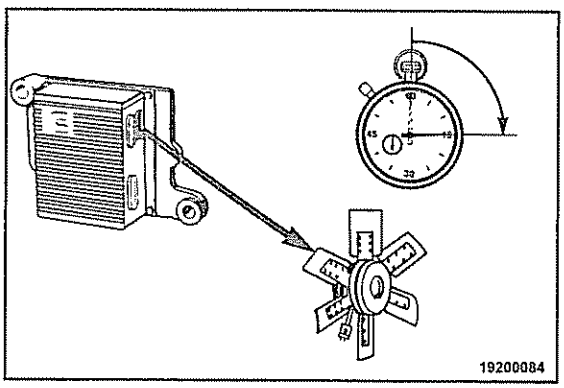
The **fan clutch 2 enable** feature is for applications that have two cooling fans that are desired to be controlled separately. This feature will engage fan driver 1 for engine coolant temperature and air conditioning refrigerant pressure. Fan driver 2 will engage from the intake manifold temperature.

The original factory programmed value is NO.



The **fan accessory switch input** feature will disable the circuit for manual fan switch input to the ECM. The ECM will **always** show that this circuit is closed and will **never** turn the fan on due to external input to the circuit. This feature **must** be selected YES if the vehicle is **not** equipped with a manual fan switch.

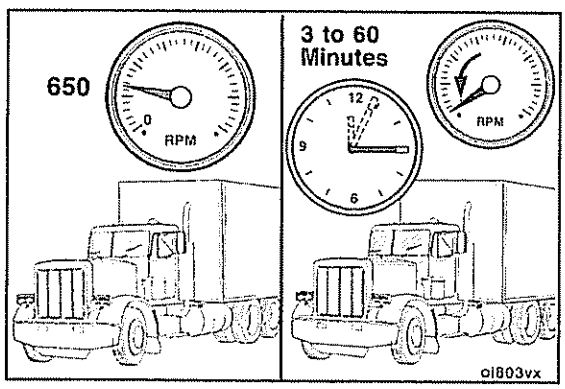
The original factory programmed value is NO.



The **minimum fan-on for air conditioner pressure switch** is the minimum amount of time (in seconds) that the ECM-controlled cooling fan will stay engaged due to the air conditioning refrigerant pressure switch. This provides protection against rapid cooling fan cycling.

The fan-on time can be set to between 0 to 999 seconds.

The original factory programmed value is 180 seconds.



The **idle shutdown** feature automatically shuts off an engine after a period of idling when there is no activity from the driver such as clutch, brake, or throttle actuation. The time interval can be changed using an electronic service tool.

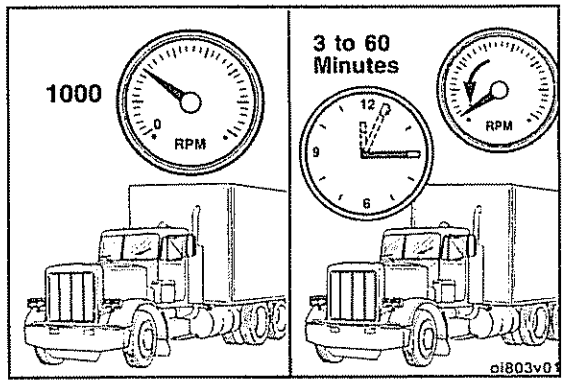
The idle shutdown system will **not** be active at coolant temperatures below 43°C [110°F].

After an engine has been automatically shut off, the key **must** be turned off for 5 seconds before attempting a re-start.

NOTE: This feature will shut off the engine **only**. It will **not** remove power from other accessories powered by the key switch.

The **idle shutdown in PTO** feature automatically shuts off the engine after a period of PTO operation when there is no activity from the driver such as clutch, brake, or throttle actuation.

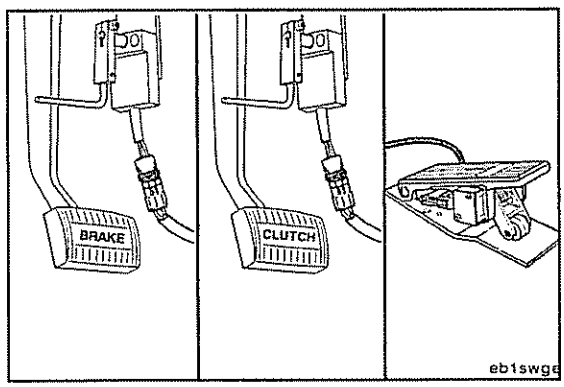
This is a programmable feature in the ECM. To alter this feature or setting, refer to a Cummins Authorized Repair Location.



The **idle shutdown override** feature allows the driver to override the idle shutdown by changing the position of the brake, clutch, or throttle.

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

This is a programmable feature in the ECM. To alter this feature or setting, refer to a Cummins Authorized Repair Location.



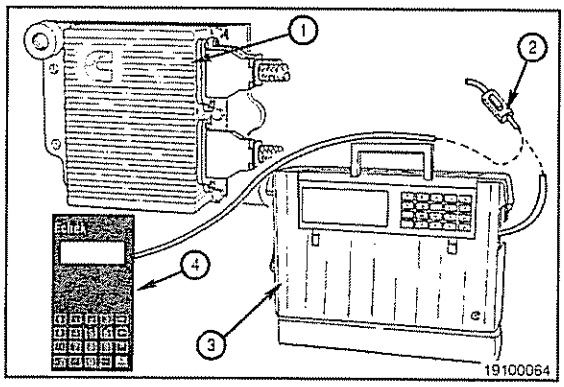
The **idle shutdown ambient air temperature override** feature determines when the idle shutdown feature can be overridden. It uses input from the ambient air temperature sensor and three customer-programmed air temperature values. The programmable ambient air temperature values are:

- Cold temperature settings
- Medium temperature settings
- Hot temperature settings.

The idle shutdown feature will automatically be overridden at ambient air temperatures below the cold temperature setting. If idle shutdown override is enabled, the driver will be able to override idle shutdown at an ambient temperature between the cold and medium temperature settings and above the hot temperature setting. Between medium and hot temperature settings, the drive can **not** override idle shutdown.

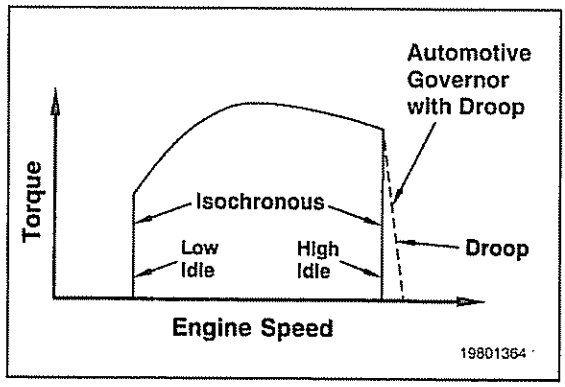
The original factory programmed value is NO.

The **vehicle accessory shutdown** feature allows the OEM/ customer to wire the vehicle accessories' power to a relay connected to the ECM. Once the vehicle is shutdown due to the idle shut down feature, the ECM driver will command the vehicle accessories to shut off. This feature will keep the batteries from discharging due to vehicle accessories that are still on after the engine is shut off due to the idle shutdown.



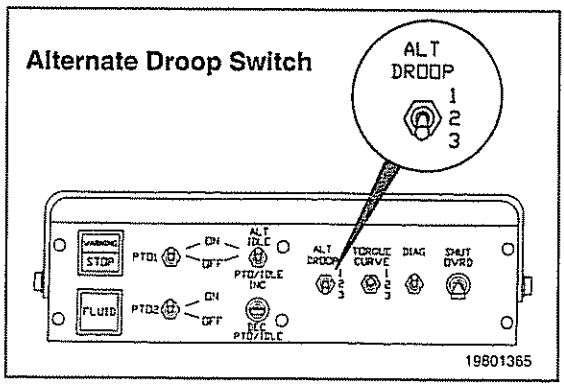
The **J1922/J1939** feature provides the capability for in-board vehicle control devices, such as Antislip Reduction (AS) or electronically controlled transmissions to take control of the engine or engine subassemblies by way of SAE J1922/J1939 data link interface.

- ECM
- Datalink Connector
- Compulink™
- Echek™.



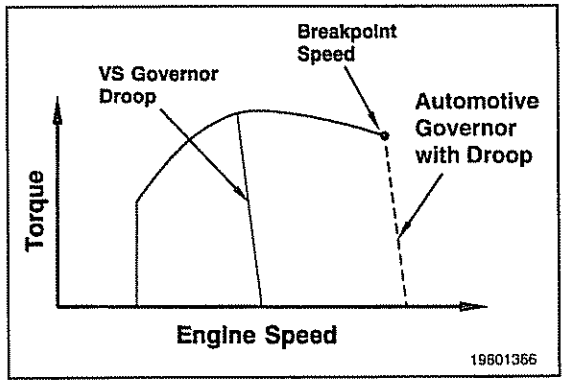
The **alternate droop** feature allows characteristics to be changed for the automotive governor and for the VS governor. Droop is unually expressed as a percentage. the graph to the right illustrates the isochronous (0-percent droop) and droop (more than 0-percent droop) governor characteristics. Less governor droop provides a more responsive governor for more precise engine control. more governor droop provides smoother shifting and smoother mechanical clutch engagement.

Alternate droop is available for industrial calibrations **only** and is specific to each calibration and application.

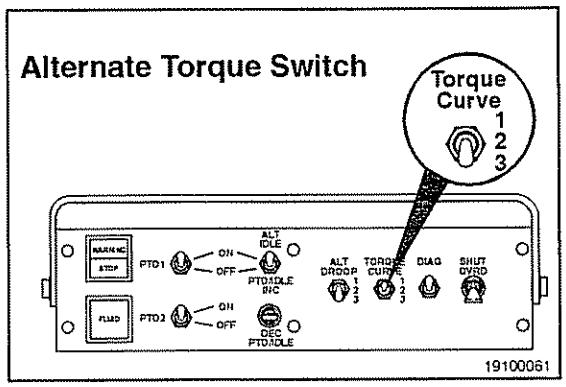


The alternate droop feature provides the ability to select different droop settings as follows. An OEM-provide switch can be used to select up to three droop ettings (base, alternate 1, or alternate 2) and/or vehicle speed can be used to select up five droop settings (base, alternate 1, alternate 2, Jcomm, or no selection). The final droop isbased on a user-defined priority assigned to either theswitch or the vehicle speed. The avaiability of these droop settings, abilities is dependent on the individual OEM setup and application.

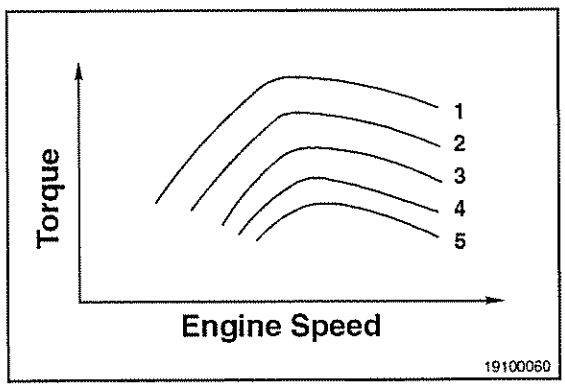
Each alternate droop setting provides the ablity to select the breakpoint droop percent for the automotive governor and droop percent for VS governor. the breakpoint speed determines at what position on the engine torque curve where the automotive governor will start to limit engine torque output.



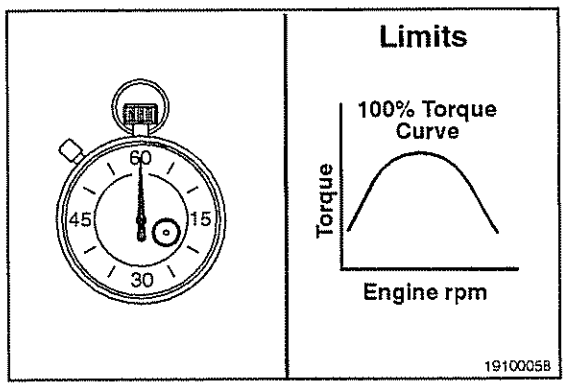
The **alternate torque control** feature allows then engine to switch between the 100-percent torque curve and four additional torque curves that are less than the 100-percent torque curve. Curve 1, 2, and 3 can be selected by an OEM-provided switch and/or vehicle speed can be used. The availablity of these alternate torque-settings' abilities/ priorities is dependent on the individual OEM setup and application.



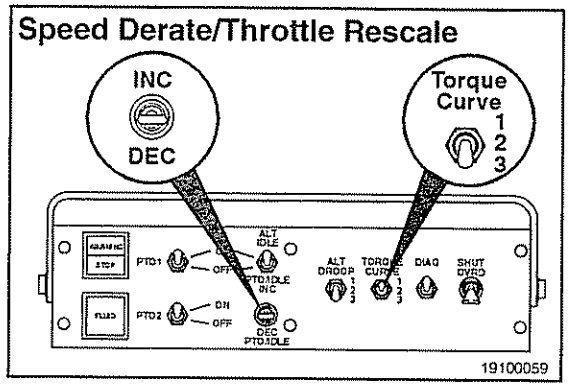
Curves 4 and 5 are selected by other programs in the ECM. Each of the five torque curves will have a priority such that if more than one is selected by an OEM-provided switch, a vehicle speed, or a separate program, the one with the highest priority will have control.



The **boost power** feature will limit the time that the engine can be operate on the 100-percent torque curve. Engine load intake manifold temperature, and coolant temperature shall be compared to thesholds to determine if boost power is available Once boost power has been selected, the amount of the time spent on the 100-percent torque curve is limited. Boost power will active active and **not** time-limited when the engine speed is below a calibration thresh-old. A boost power lamp will be illuminated while active, and will flash as boost powerid about to time out. The availability of this feature is dependent on the individual OEM application.

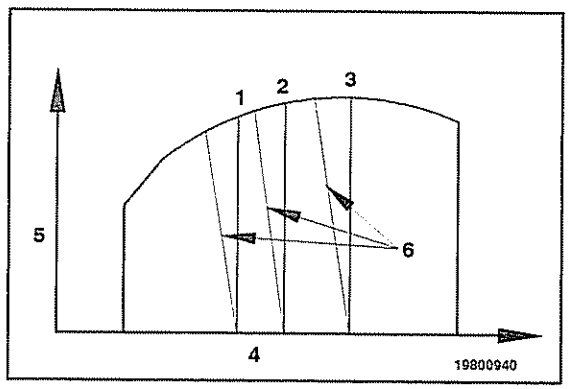


The **hybrid power** feature provides a more consistent power feel while operating on the VS governor **only**. This feature is individually tuned for each OEM application. The availability of this is dependent on the individual OEM applications.



The **engine speed derate with throttle rescale** feature provides the operatore with adjustable engine speed derates. The operator can change the HSG breakpoint durng operations using the OEM-provided alternate torque switch. The operator can also adjust the breaking point up or down via the OEM-provided increment/decrement switch.

An important note for this feature is that HSG breakpoint never actually changes. Insread, the throttle is rescaled so that the full-throttle pedal travel corresponds to a percent that delivers the new breakpoint speed. The operator will,perhaps notice a throttle percent that is less than 100 percent while this feature is enabled. Because this feature utilizes the alternate torque and increment/decrement switches, it will**only** be active if the percent throttle is greater than a calibrated threshold. The availability of this feature is dependent on the individual OEM application.



The **intermediate speed control** feature can control the engine to three programable engine set speeds (1, 2, 3) in three different modes of operation. The three set speeds are determined by a a three-position switch and a two-position switch. The three modes of operation are a manual nornal set speed operation, a low speed limit operation,and a high speed limit operation.

NOTE: These three modes of operation are set by the calibration and are **not** customer adjustable.

An intermediate speed drop is also programmable.

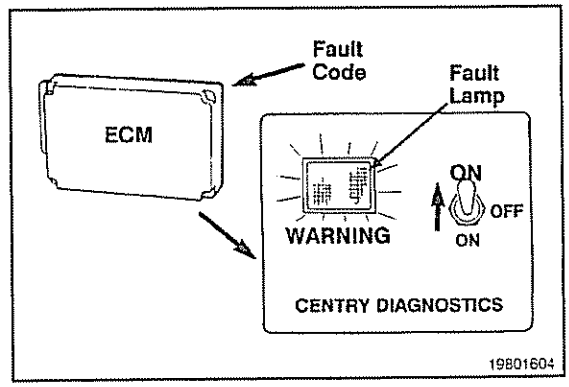
NOTE: Depending on the electronic calibration, the third intermediate speed switch can act as a validation switch. The purpose of the validation switch is to eliminate accidentally switching to intermediate speed 1 or 2. To switch to intermediate speed 1 or 2, the validation switch **must** beengaged first; then move the intermediate speed switch to1or 2.

This feature also uses a momentary increment and decrement switch to raise the engine set speed while in operation.

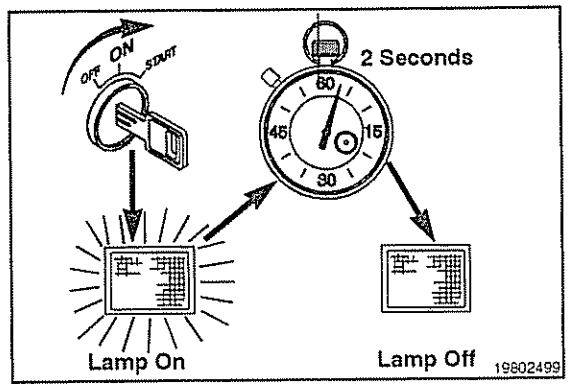
Diagnostic Fault Codes

CENTRY™

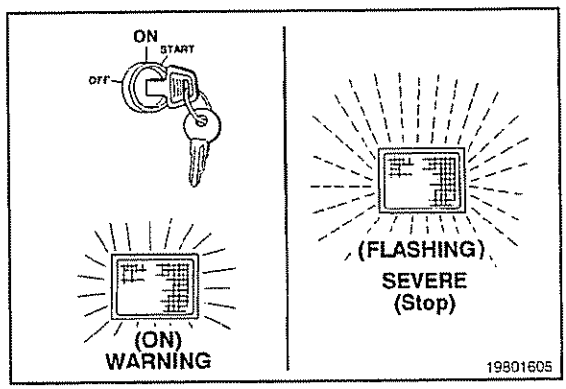
The CENTRY™ system can display and record detectable fault conditions within its systems and circuits. A yellow diagnostic lamp near the operator's controls will be illuminated when a system fault becomes active.



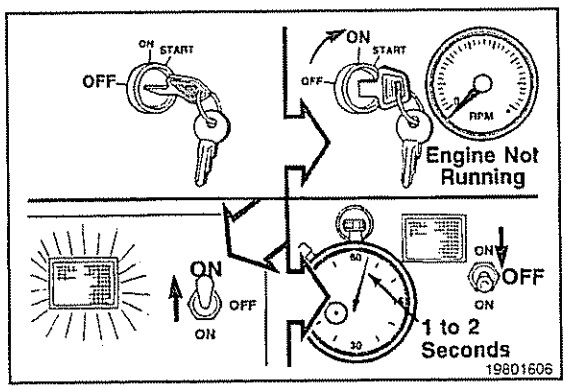
The fault lamp should light for about 1 to 2 seconds after key-on, and then go out after no faults have been detected.

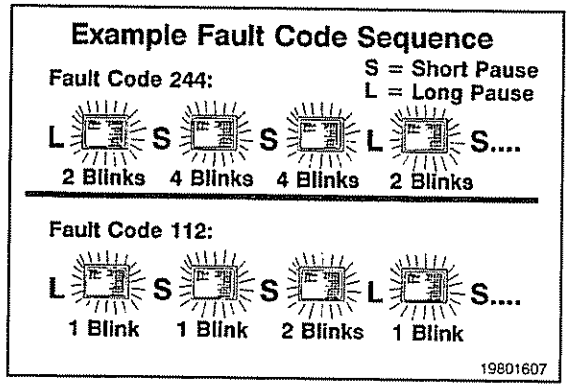


While a fault condition is being detected, the fault lamp will turn ON or ON FLASHING. CENTRY™ will turn the lamp ON for warning faults, and ON FLASHING for more severe faults that can affect engine operation and need immediate attention. Active fault conditions **must** be corrected as soon as possible.

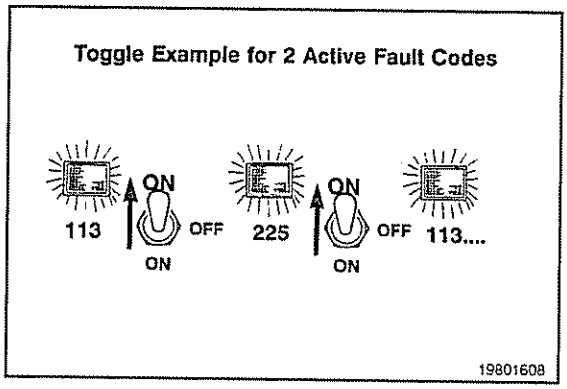


To determine an active CENTRY™ fault code, shut off the engine and turn keyswitch on (engine **not** running). Toggle the diagnostic switch to the ON position for 1 to 2 seconds and then release it. The fault lamp will illuminate while the diagnostic switch is held in the ON position.

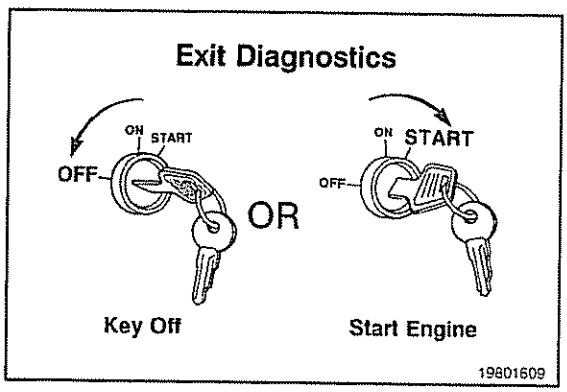




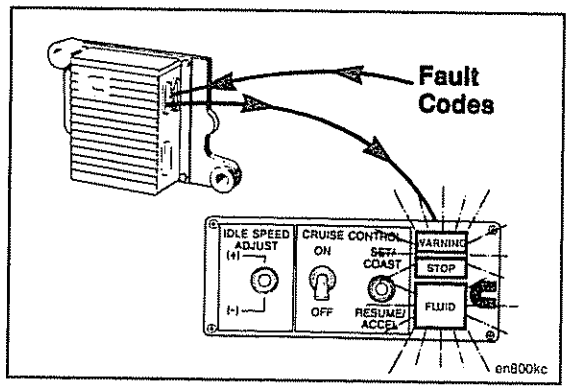
After releasing the diagnostic switch, there is a short pause followed by the first fault code. CENTRY™ fault codes consist of three digits with up to five flashes for each digit. There is a short pause between each digit of the fault code. Once the three digits have flashed and the code is known, there is a longer pause followed by a repeating of the same fault code sequence.



Toggling the diagnostic switch will advance to the next fault code. Once all active fault codes have been displayed, the fault code flash sequence will be repeated, starting from the first fault code.



Starting the engine or turning the keyswitch off will exit the diagnostic's fault flash mode.



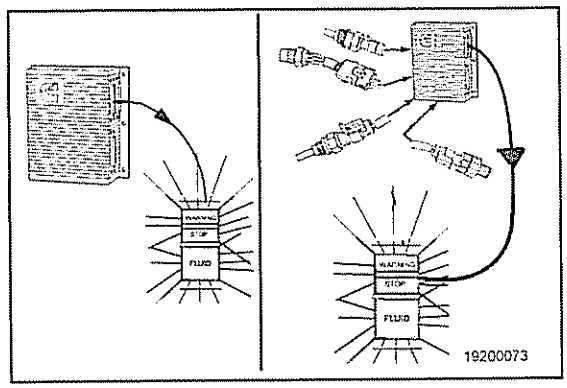
CELECT™ Plus

The CELECT™ Plus system can show and record certain engine faults. The faults are shown as fault codes. These codes will make troubleshooting easier. The fault codes are recorded in the ECM.

NOTE: Not all engine or CELECT™ Plus faults are shown as fault codes.

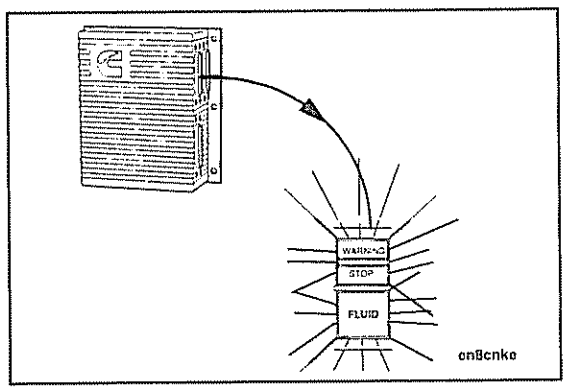
There are two types of fault codes:

- Engine electronic fuel system codes
- Engine protection system codes.

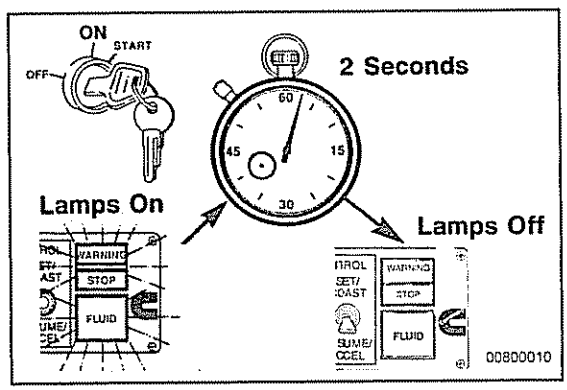


The engine electronic fuel system fault codes can be seen on the WARNING and STOP lights in the cab panel.

NOTE: Inactive fault codes can **not** be blinked out. An electronic service tool **must** be used to read inactive faults in the ECM. Refer to your Cummins Authorized Repair Location.

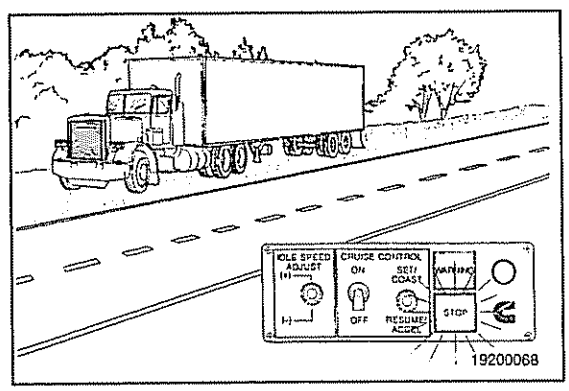


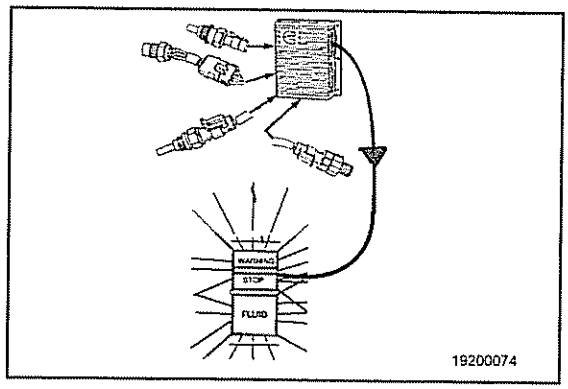
The STOP fault light will be red. The WARNING and FLUID lights will be yellow. When the vehicle keyswitch is turned on and the diagnostic switch is off, all three lights will illuminate. The lights will go off in sequence after about 2 seconds.



The lights will remain off until a fault code is recorded. If a light remains on, an active fault exists.

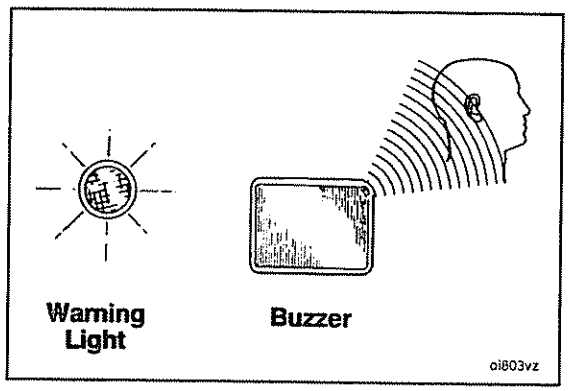
If the STOP light (red) is illuminated, the vehicle **must** be driven to the side of the road and shut off as soon as it can be done in a safe manner. The vehicle **must** remain parked as long as this fault exists. If the WARNING light (yellow) is illuminated, the vehicle can be safely driven; but the fault **must** be corrected as soon as possible.



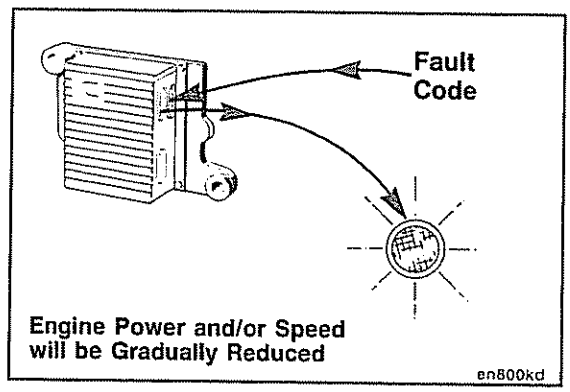


The engine protection system logs separate fault codes for out-of-range conditions associated with any of the following sensors:

- Coolant Temperature
- Coolant Level
- Oil Temperature
- Oil Pressure
- Intake Manifold Temperature.

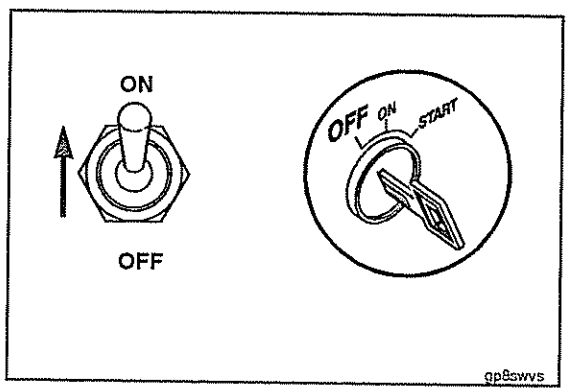


This system will activate an in-cab engine protection warning device when an out-of-range condition occurs. The warning device is a light, a buzzer, or both. This system will also activate the yellow FLUID lamp, if equipped.



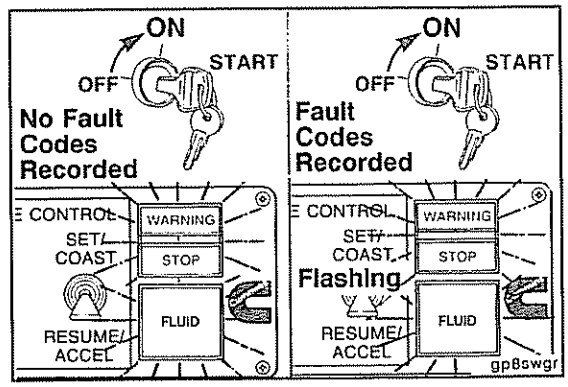
If the light or buzzer comes on while driving, it means a fault code has been recorded. The lamp will remain on as long as the fault exists, and engine power and speed are gradually reduced. If the out-of-range conditions continue, the light will start to flash or blink. The vehicle **must** be parked whenever severe power derates are noticed.

The fault **must** be corrected as soon as possible.



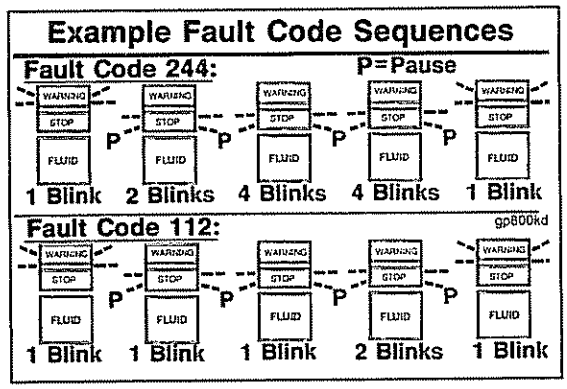
Turn off the vehicle. To check for engine electronic fuel system and engine protection system fault codes, move the diagnostic switch to the ON position, or connect the shorting plug into the diagnostic connector.

Turn on the vehicle keyswitch. If any fault codes were active during system power-down, the lights will begin to flash the code of the recorded faults. If no fault codes are recorded, the lamps will **not** flash but will be illuminated.

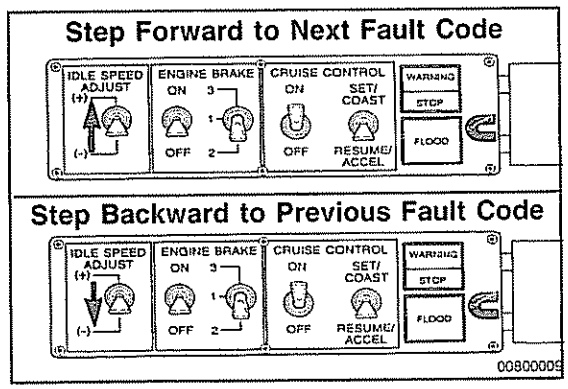


The fault code will flash in the following sequence:

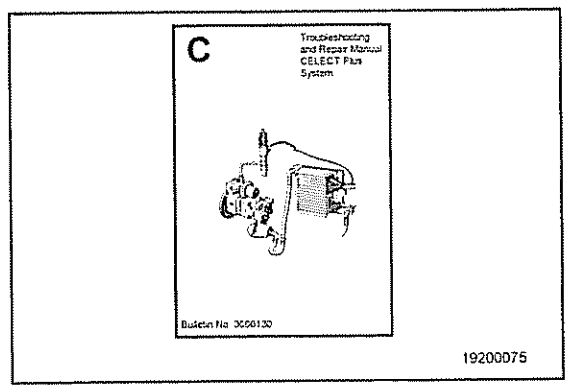
First, a WARNING (yellow) light will flash. Then there will be a short 1- or 2-second pause after which the number of the recorded fault code will flash in STOP (red). There will be a 1 -or 2-second pause between each number. When the number has finished flashing in red, a yellow light will appear again.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

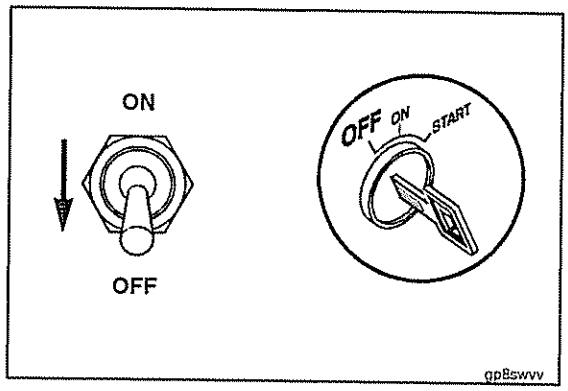


The lights will continue to flash the same code until the system is told to do something else. To go to the next fault code, move the IDLE-SPEED ADJUST switch momentarily to the (+) position. You can go back to the previous fault code by momentarily moving the IDLE-SPEED ADJUST switch to the (-) position. If **only** one active fault is recorded, the CELECT™ Plus system will continuously display the same fault code when either (+) or (-) switch is depressed.



The explanation and correction of the fault codes are in the Troublshooting and Repair Manual, CELECT™ Plus System, Bulletin No. 3666130.





When **not** using the diagnostic system, turn off the diagnostic switch or remove the shorting plug. If the diagnostic switch is left on or the shorting plug in, the ECM will **not** log some faults. The maintenance monitor will **not** function correctly.

To stop the diagnostic system, move the diagnostic switch to the OFF position. Turn off the vehicle keyswitch.

Engine Protection System

The CELECT™ Plus engines are equipped with an engine protection system. The system monitors critical engine temperatures and pressures and will log diagnostic faults when an abnormal operating condition occurs. If an out of range condition exists and engine derate action is to be initiated, the operator will be alerted by an in cab warning light. The warning light will blink or flash when out-of-range conditions continue to get worse. The driver **must** pull to the side of the road, when it is safe to do so, to reduce the possibility of engine damage.

NOTE: Engine power and speed will be gradually reduced, depending on the level of severity of the observed condition. The engine protection system will **not** shut down the engine unless the engine protection shut down feature has been selected. If the feature has been selected and the engine does shut down, the engine can be started again by turning the keyswitch off and back on.

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

This is an optional programmable feature in the ECM.

Engine Protection System Monitors

- **Coolant Temperature**
- **Coolant Level (Optional)**
- **Oil Temperature**
- **Oil Pressure**
- **Intake Manifold Temperature.**

Maintenance Monitor

⚠ CAUTION ⚠

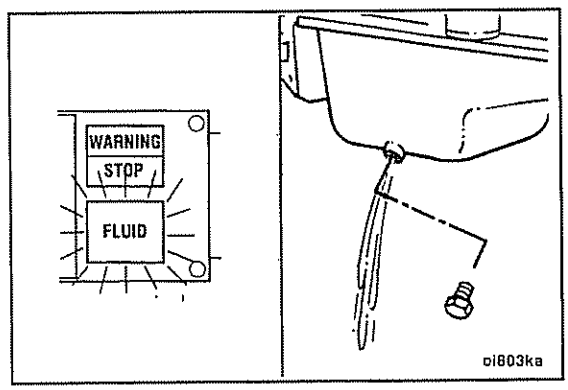
The maintenance monitor is designed to alert the operator of the need for a routine maintenance stop. Maintenance records must still be maintained for historical purposes.

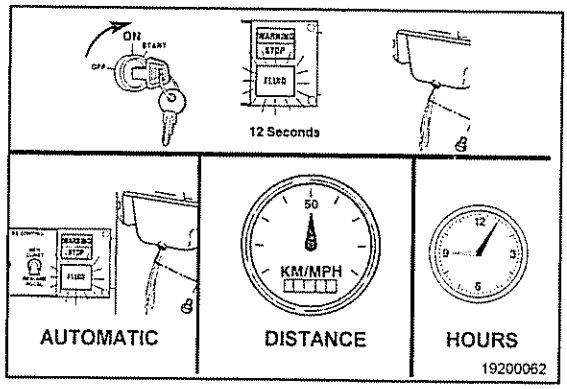
⚠ CAUTION ⚠

The maintenance monitor uses data received from the ECM to determine the amount of fuel burned. Whenever an injector circuit or battery voltage fault has occurred, the maintenance monitor data can be inaccurate.

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

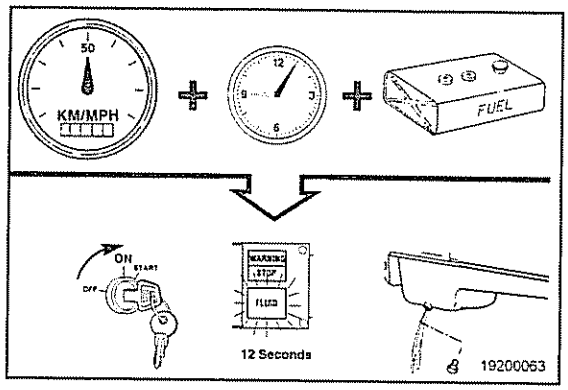
The operator **must** still be alert for any indications that the engine needs other service.





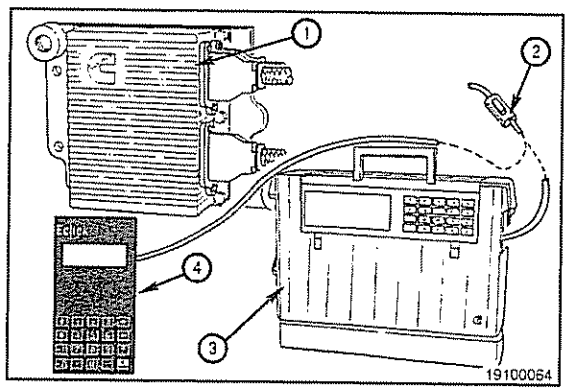
The maintenance monitor has three modes of operation:

- Automatic mode
- Distance mode
- Time mode.



The **automatic mode** alerts the operator when it is time to change oil based on Cummins' recommended interval. It determines the maintenance interval based on engine operating time and fuel burned.

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



The maintenance monitor automatic mode is easily adjusted to accommodate heavy, medium, or light applications. It can also accommodate Valvoline Premium Blue® 2000 engine oil. This is done by using an electronic service tool to enter an interval factor that corresponds to the appropriate duty cycle and type of product used.

1. ECM
2. Datalink Connector
3. compulink™
4. Echek™.

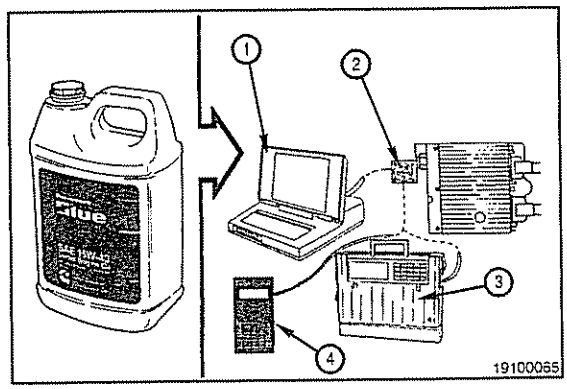
⚠ CAUTION ⚠

Cummins Engine Company, Inc. does not recommend exceeding the published interval factors for your application and is not responsible for damage sustained due to overextended drain intervals.

When selecting the correct interval factor for your application, determine which oil drain interval duty cycle fits your application: heavy, medium, or light . Refer to Section 2, Oil Drain Interval.Once the duty cycle is chosen, use an interval factor of 1.00 for severe-duty, 1.50 for normal-duty, and 2.00 for light-duty.

NOTE: These interval factors **must** be adjusted accordingly if Premium Blue® 2000 oil is used to extend the oil drain interval. Refer to the Premium Blue® 2000 product literature to determine how much your drain interval can be extended.

1. Insite™
2. Datalink Connector
3. Compulink™
4. Echek™.

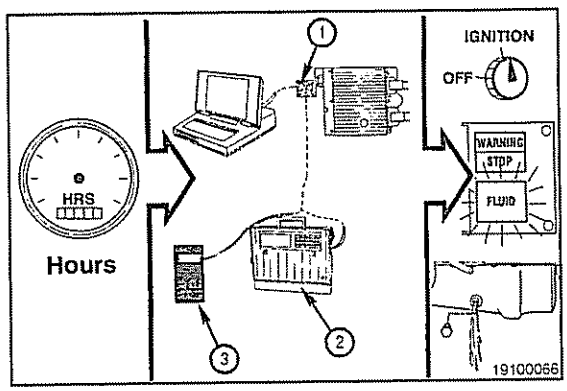


⚠ CAUTION ⚠

Refer to Oil Drain Intervals in Section 2 of this manual when selecting the correct oil change interval for your application. Cummins Engine Company, Inc. does not recommend exceeding these published intervals and is not responsible for damage sustained due to overextended drain intervals.

The **time mode** allows the customer to enter a desired time interval. The maintenance monitor will then monitor the time the engine has been operating and alert the operator when the interval ends.

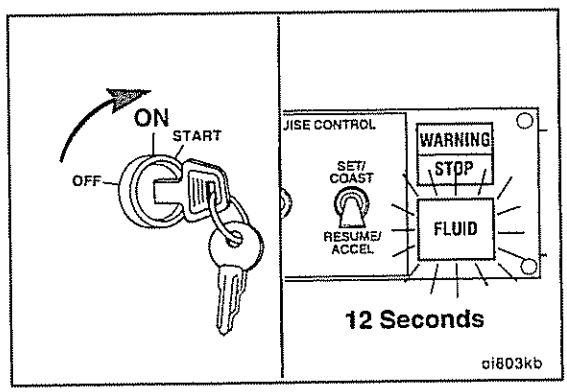
1. Datalink Connector
2. Compulink™
3. Echek™.



⚠ CAUTION ⚠

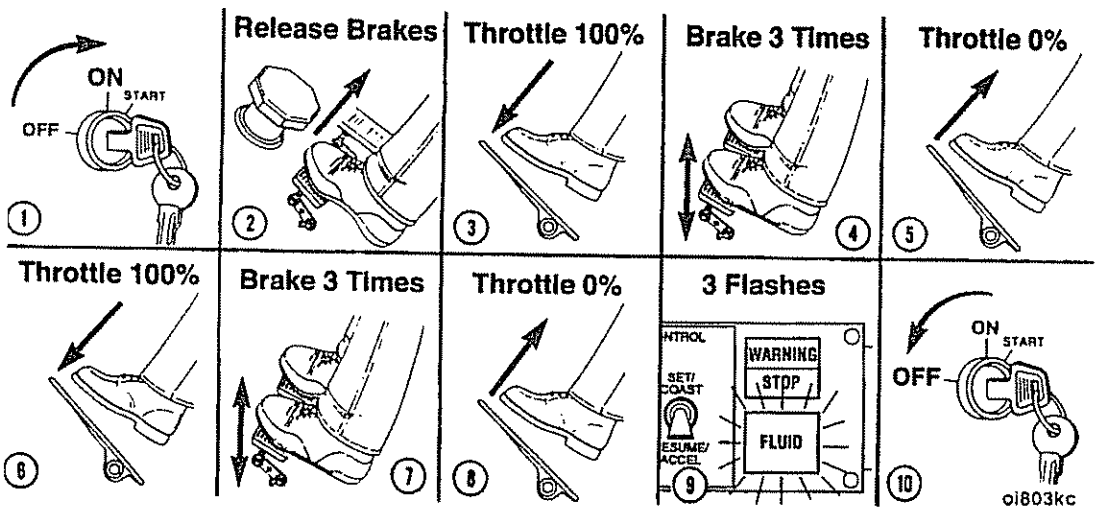
The diagnostic switch must be in the OFF position for the flashing sequence to occur.

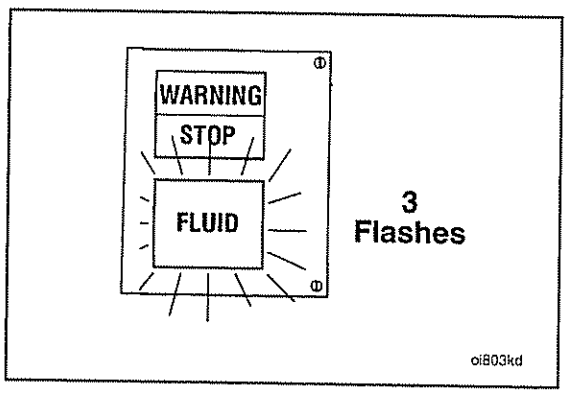
Alerting the operator: The maintenance monitor will alert the operator of the need to change oil by flashing the engine protection lamp (fluids lamp) for approximately 12-second after key ON. The flashing sequence will be three quick flashes followed by a pause. This flash sequence will go through five cycles in the 12-second period. This sequence will occur at every key on until the maintenance monitor has been reset.



Resetting the maintenance monitor: The maintenance monitor can be reset using a Compulink™ or Echek™ service tool or by following steps 1 through 10 below. Steps 3 through 8 **must** be done within 12-second in order for the maintenance monitor to be reset. The diagnostic switch **must** be in the OFF position and the vehicle air system **must** be fully charged.

1. Turn on the keyswitch (engine **must not** be operating).
2. Make sure brakes are released (service and trailer brakes).
3. Hold throttle pedal at 100 percent throttle.
4. Press and release service brake three times.
5. Release throttle pedal.
6. Depress and hold throttle pedal at 100-percent throttle again.
7. Press and release service brake three more times.
8. Release throttle pedal.
9. The light will flash three times.
10. Turn off the keyswitch.



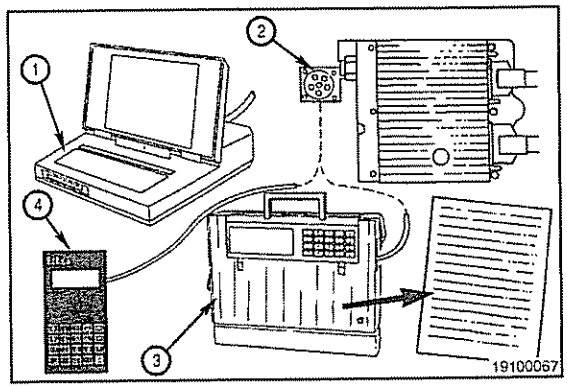


As soon as the throttle pedal is released (step 8), the engine protection lamp will flash three quick flashes. This means that the reset command has been received and the maintenance monitor will reset its distance (miles or kilometers), time (hours), and fuel (gallons or liters) to zero the next time the keyswitch is turned off (step 10).

NOTE: If the engine protection lamp does **not** flash after the throttle pedal is released on step 8 above, the reset sequence **must** be performed again.

Viewing maintenance monitor data: With the use of an electronic service tool, the following maintenance data can be viewed or printed from the ECM:

- Percent of current interval consumed
- Fuel since last reset
- Time since last reset
- Reset log (fuel and time at the last three resets).

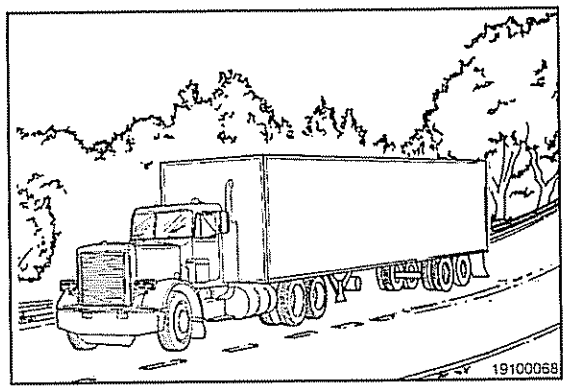


1. INSITE™
2. Datalink Connector
3. Compulink™
4. Echek™.

Trip Information System

The trip information system constantly monitors and records various engine and operating data necessary to track both engine and driver performance. The data can be viewed using a Cummins electronic service tool. If any faults occur that can corrupt the trip data, the system will caution the user when the data are viewed.

The fuel data of the trip information system are calculated based on the fuel commanded by the ECM and are **not** a measurement of actual fuel used. For this reason, fuel usage **must** be collected by other means if precise data are required. The data collected are listed below.



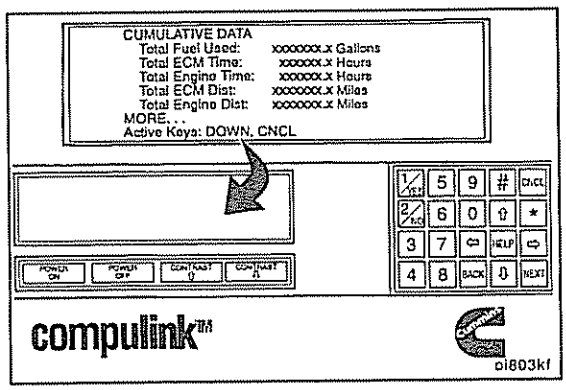
Cumulative Data (Not Resettable)

Total fuel used – Fuel consumed as recorded by this ECM.

Total ECM time – Engine run time recorded by this ECM.

Total engine time – Cumulative engine run time for all ECMs operated on this engine (prior ECM times **must** be entered by user).

NOTE: These data registers in the ECM are **not** resettable.



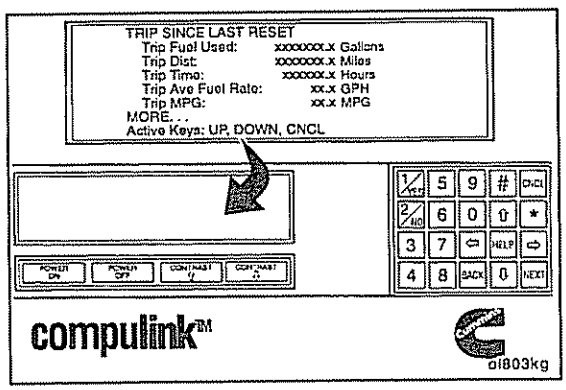
Trip Data (Resettable)

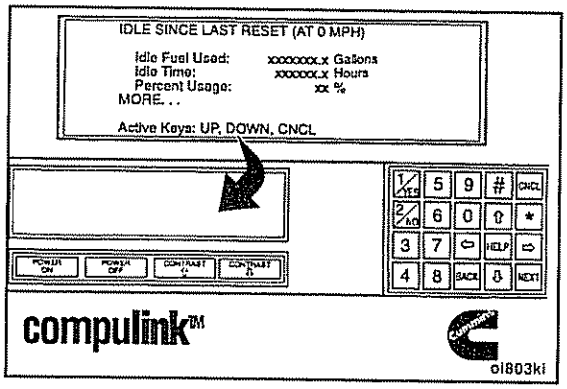
Trip fuel used -- Fuel consumed since last reset.

Trip time -- Engine run time since last reset (rpm > 0).

Trip average fuel rate -- Average fuel rate since last reset.

NOTE: Trip data can be reset **only** with Cummins electronic service tools. Refer to the appropriate electronic service tool manual or contact a Cummins Authorized Repair Location.





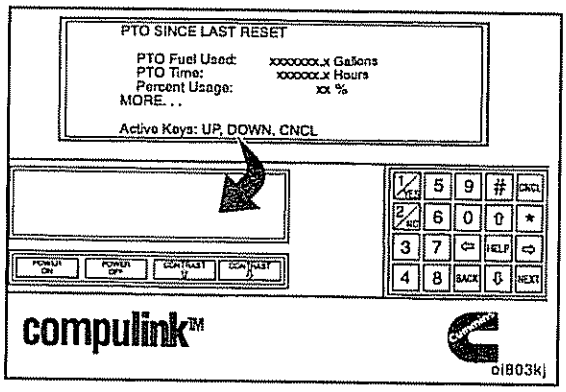
Idle Data (Resettable)

Idle fuel used -- Fuel burned since last reset while engine was at idle.

Idle time -- Time since last reset in which engine was at idle.

Percent usage -- Percentage of time since last reset that engine was at idle.

NOTE: Idle data can be reset **only** with Cummins electronic service tools. Refer to the appropriate electronic service tool manual or contact a Cummins Authorized Repair Location.



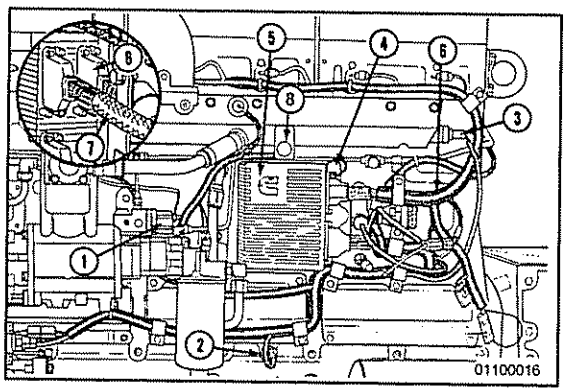
PTO Data (Resettable)

PTO fuel used -- Fuel burned in PTO since last reset.

PTO time -- Time spent in PTO since last reset.

Percent usage -- Percentage of time since last reset spent in PTO.

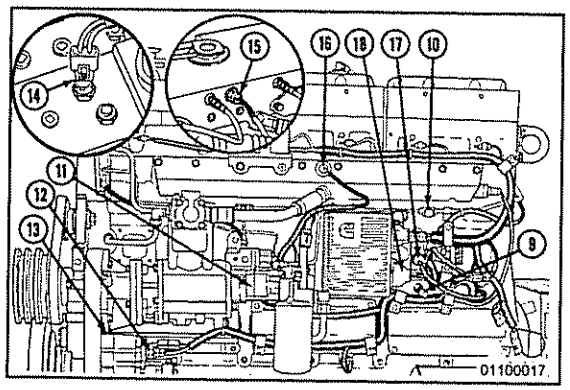
NOTE: PTO data can be reset **only** with Cummins electronic service tools. Refer to the appropriate electronic service tool manual or contact a Cummins Authorized Repair Location.



CELECT™ System Description

The CELECT™ Plus system consists of:

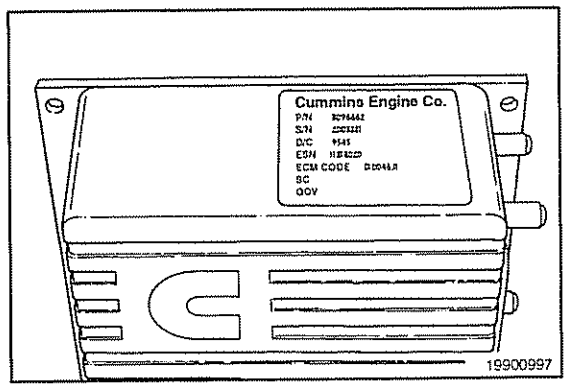
1. Fuel Shutoff Valve
2. Oil Pressure Sensor
3. Intake Manifold Pressure Sensor
4. Cooling Plate
5. ECM
6. Engine Wiring Harness (actuator amp connector)
7. OEM Wiring Harness
8. Engine Mounted Service Tool Datalink



9. Fuel In
10. Fuel Out
11. Fuel Pump Gear Pump
12. Oil Temperature Sensor
13. Engine Position Speed Sensor (behind lubricating oil pump)
14. Coolant Temperature Sensor (in thermostat housing)
15. Coolant Level Sensor (in radiator) - Optional
16. Intake Manifold Temperature Sensor
17. Ambient Air Pressure Sensor (when required)
18. Engine Wiring Harness (sensor amp connector)

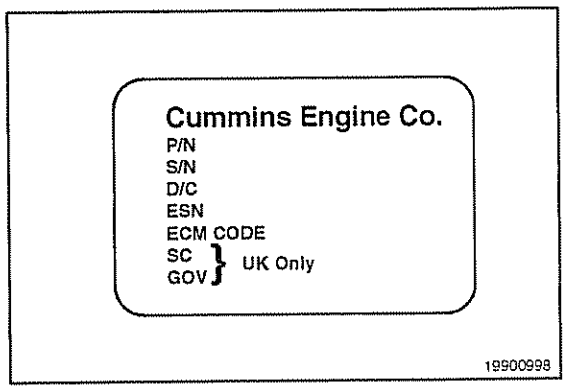
Engine Identification-ECM Dataplate

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



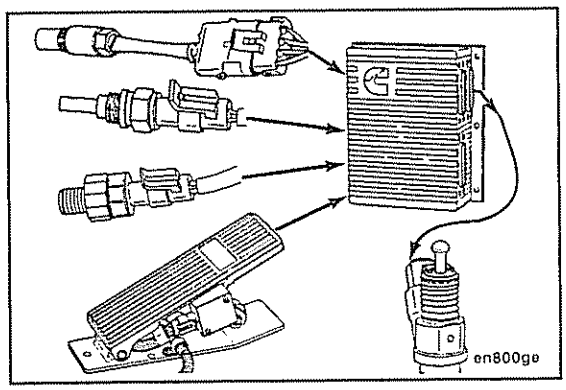
The dataplate contains the ECM part Number (P/N), the ECM serial number (S/N), the manufacturing date code (D/C), the engine serial number (ESN), and the ECM code.

NOTE: UK engines also have a software calibration code (SC) and a governor type (GOV) shown on the dataplate.



The injectors are a closed-nozzle design. The injector assembly contains a solenoid control valve.

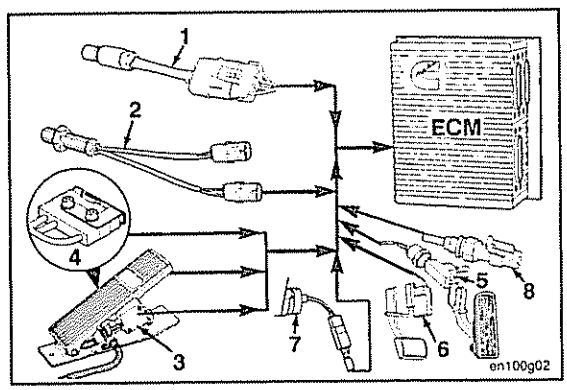
The ECM processes the information it receives from the sensors and controls the opening and closing of the injector solenoid. This action controls the amount of fuel metered to each injector and the precise time of injection for each injector. This will produce the correct horsepower and torque for the engine.

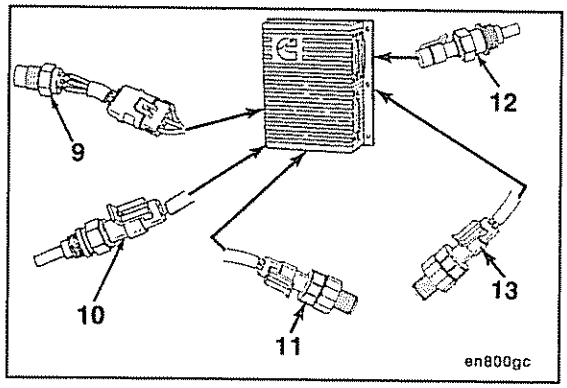


The CELECT™ Plus system receives input from the following components:

1. Engine Position Sensor (EPS)
2. Vehicle Speed Sensor (VSS) *
3. Accelerator Pedal Position Sensor *
4. Idle Validation Switch *
5. Service Brake Pedal Switch *
6. Clutch Pedal Switch *
7. Intake Manifold Pressure Sensor
8. Coolant Temperature Sensor

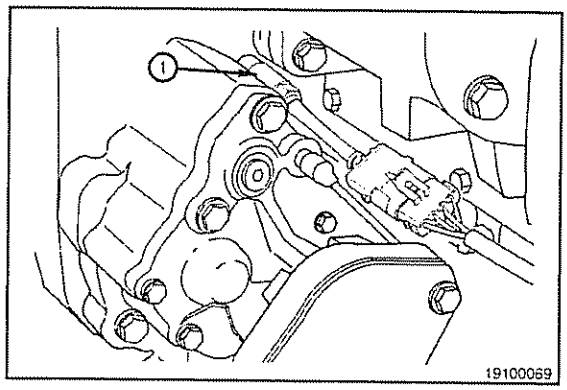
*These are OEM sensors that are **not** installed on the engine.





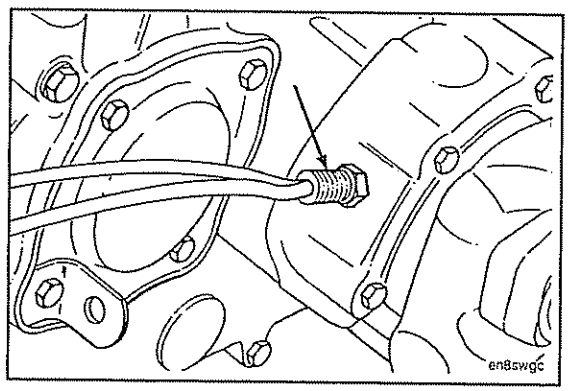
9. Coolant Level Sensor *
10. Intake Manifold Temperature Sensor
11. Oil Pressure Sensor
12. Oil Temperature Sensor
13. Ambient Air Pressure Sensor (when required)

*These are OEM sensors that are **not** installed on the engine.



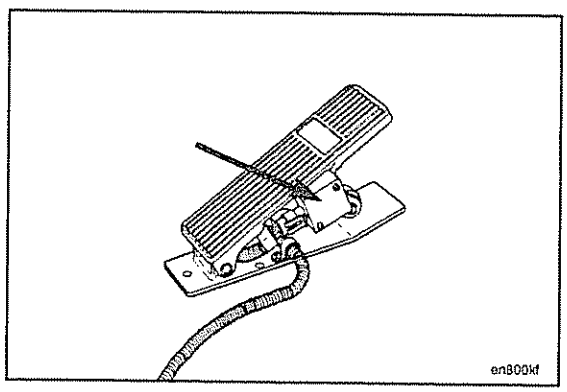
The engine position sensor (1) provides engine speed and position information.

The sensor is located on the backside of the cylinder block gear housing flange just below the accessory drive.



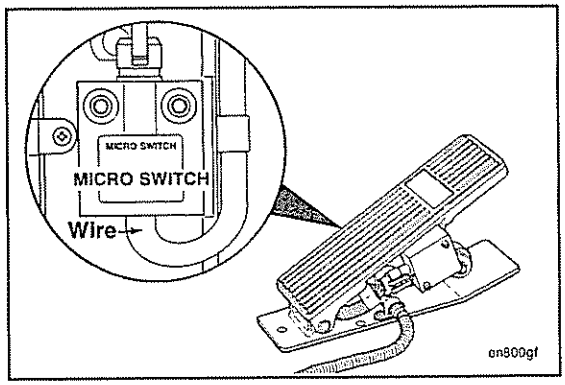
The VSS is mounted in the transmission housing. The unit senses the speed of the output shaft of the transmission. The vehicle speed is computed by the ECM. The ECM uses these data, preprogrammed tire size, and gearing information to adjust the engine speed for road speed governing and cruise control.

If the OEM uses a mechanical speedometer, then a cable-driven minigen sensor mounted on the output of the transmission can be used.

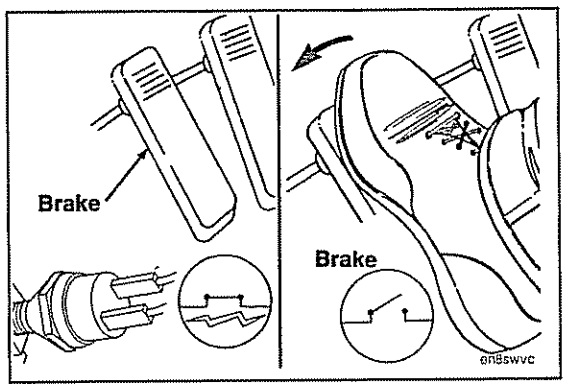


The throttle position sensor is located in the accelerator pedal assembly. When the accelerator pedal is at idle, the engine brakes can be activated. When the accelerator pedal is depressed, the sensor deactivates the engine brakes and the PTO. The accelerator pedal can override the cruise control.

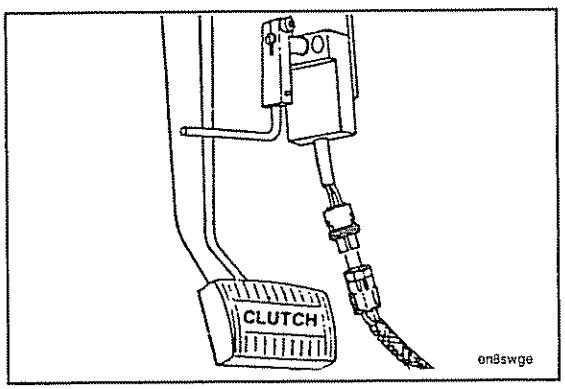
The idle validation switch is added to the accelerator pedal assembly, and will verify that the accelerator pedal is in the low-idle position.



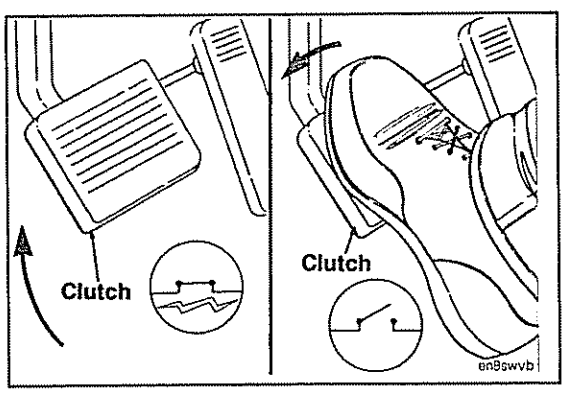
The brake switch is located in the air line of the vehicle service brakes. The brake switch closes when the brake pedal is disengaged. The switch opens when the brakes are engaged. The open switch will deactivate the cruise control and the PTO.

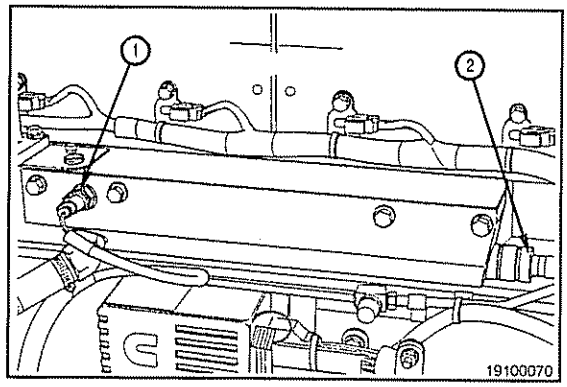


The clutch switch is located near the clutch pedal or linkage.

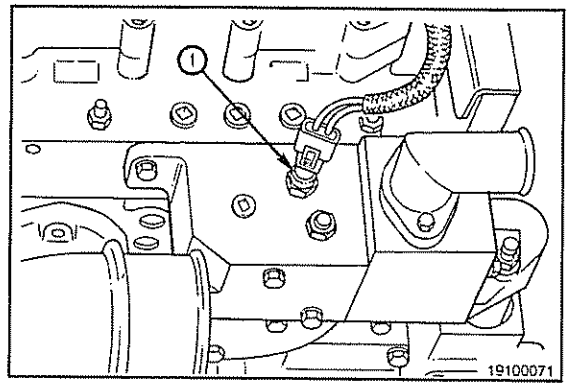


The clutch switch is closed when the clutch is engaged. The clutch switch opens when the clutch is disengaged (pedal depressed). This will deactivate the engine brake, cruise control, or PTO.

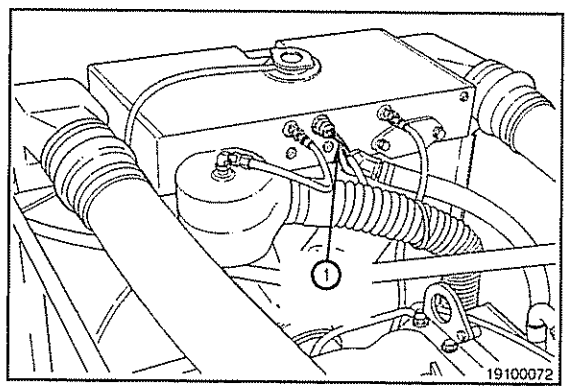




The intake manifold pressure sensor (1) and the intake manifold temperature sensor (2) are located in the intake manifold. The intake manifold pressure sensor monitors positive manifold pressures used in the air-fuel control function. The intake manifold temperature sensor measures the turbocharged intake air temperature. It is also used for the engine protection system.

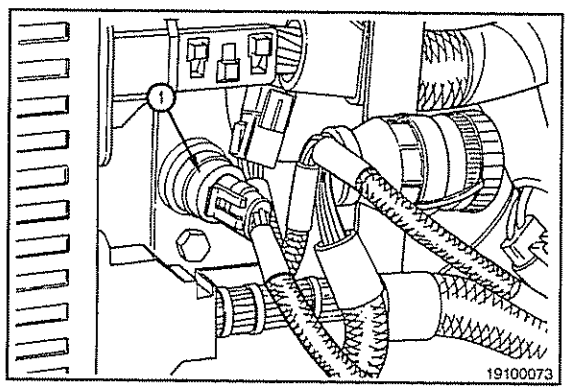


The engine coolant temperature sensor (1) is located in the thermostat support housing. It provides data for optimized timing for emissions reduction, and is used for the engine protection system.



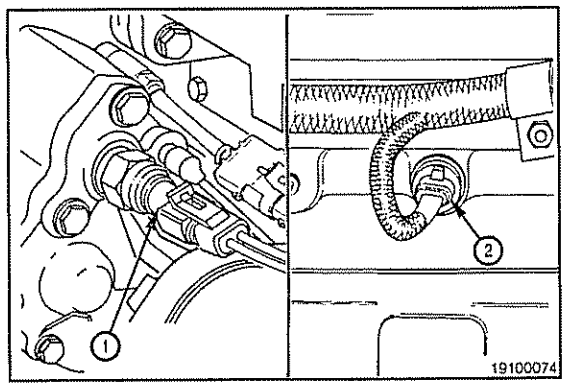
The coolant level sensor (1) is mounted in the radiator top tank or surge tank, depending on the OEM. It is a fluid-level-actuated switch required for the engine protection system.

NOTE: This is an optional sensor that possibly is **not** on all vehicles.



The ambient air pressure sensor (1) (when required) is located on the fuel pump side of the engine just behind the ECM. It is used to control fueling.

The oil temperature sensor (1) and oil pressure sensor (2) are located on the fuel pump side of the engine. The oil temperature sensor is in the lubricating oil pump housing. The oil pressure sensor is located on the main oil rifle. They measure the oil temperature and pressure for the engine protection system.

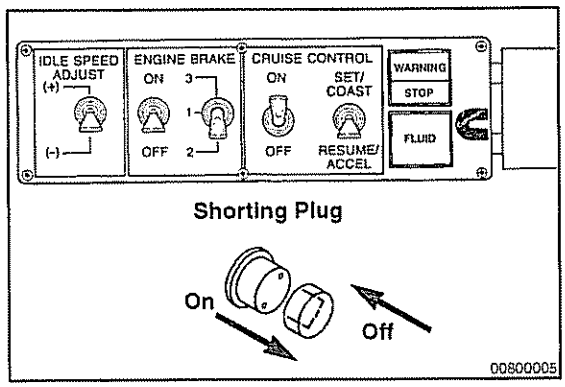


CELECT™ Plus cab-mounted controls consist of:

- Idle Speed Adjust Switch
- Engine Brake on/off Switch*
- Engine Brake Position Switch*
- Cruise Control/PTO on/off Switch
- Cruise Control Set/Cruise, Resume/Accel Switch
- Diagnostic on/off Toggle Switch or Shorting Plug.

* If equipped with engine brakes

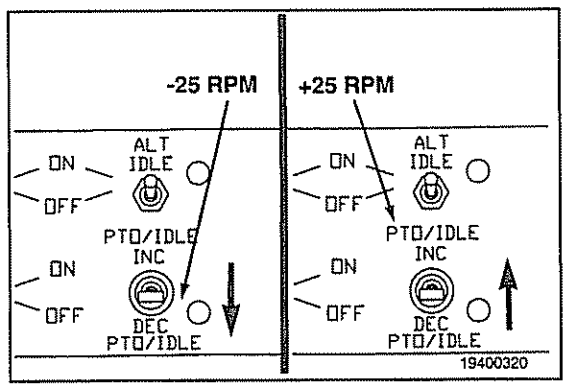
NOTE: The cab-mounted controls can have a different appearance depending on the OEM.



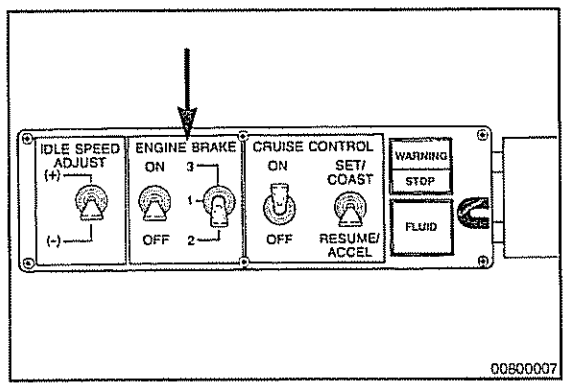
The **idle adjustment** is in the cab panel. Use this switch to adjust the engine idle speed.

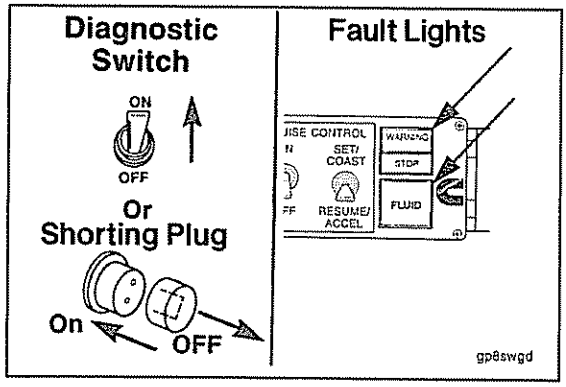
The engine idle speed can be set from 600 to 800 rpm with an electronic service tool. To change the idle set speed, contact a Cummins Authorized Repair Location.

Each time the switch is briefly moved to the minus (-) position, the idle speed is decreased by 25 rpm. The plus (+) position increases the idle speed by 25 rpm.

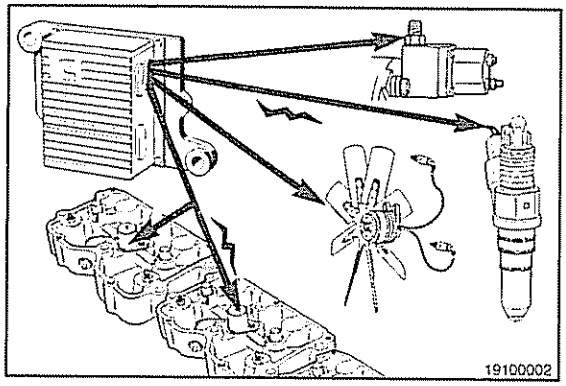


The engine brake has an ON/OFF switch. The engine brake position switch is used to select how much braking power is desired. Position 1 gives braking power to two cylinders. Position 2 gives braking power to four cylinders. Position 3 gives braking power to all six cylinders.



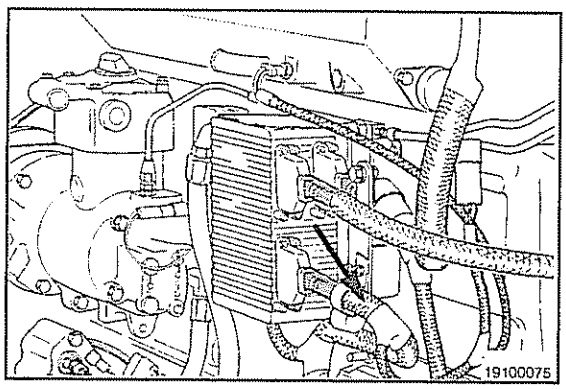


The diagnostic switch is an ON/OFF-type switch, or a jumper connection cap. It is in the cab panel. It is turned on when the operator wants to read any fault codes that the system has recorded. It remains off at all other times. The fault codes are read from the three lamps in the cab panel.

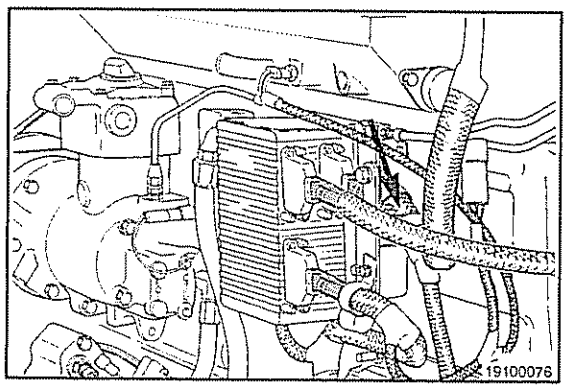


The ECM sends signals to the following components to control the vehicle:

- Fuel Shutoff Valve Solenoid
- Injectors
- Fan Clutch
- Engine Brake Solenoid Valves.

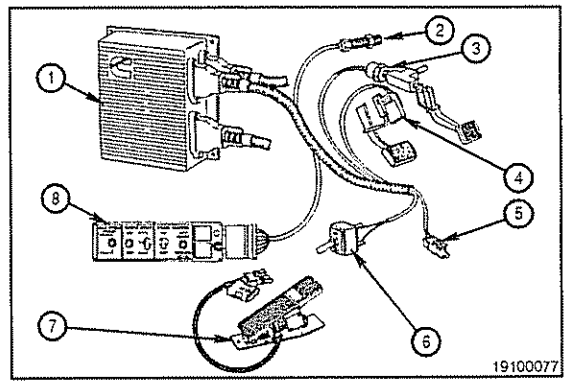


The engine position sensor, intake manifold pressure sensor, oil pressure and temperature sensors, coolant temperature and level sensors, ambient air pressure sensor, and intake manifold temperature sensor are connected to the ECM with the engine wiring harness.



The injector solenoids, engine brake solenoids, fan clutch control, and fuel shutoff valve solenoid are also connected to the ECM with the engine wiring harness.

The VSS (1), brake switch (2), accelerator pedal assembly (3), clutch switch (4), datalink connector (5), diagnostic test switch (6), and cab panel switches (7) are all connected to the ECM with the OEM wiring harness.



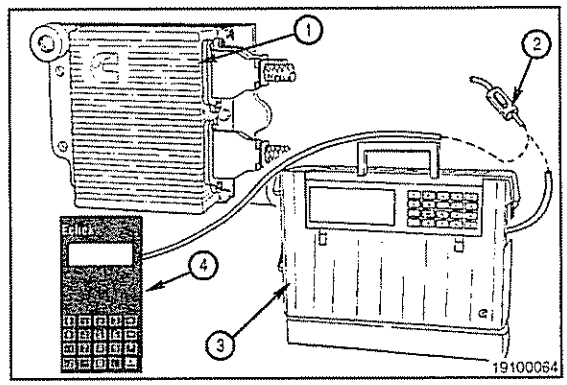
The ECM has a datalink for electronic service tools. Electronic service tools can be used to read and program owner-specified information into the ECM by a Cummins Authorized Repair Location. The electronic service tools can also be used to aid in troubleshooting the engine in the event of a failure by reading and displaying fault codes.

1. ECM
2. Datalink Connector
3. Compulink™
4. Echek™.

The datalink connector is located on the OEM harness and is one of three designs:

- 2-pin Weather Pack
- 6-pin Deutsch
- 8-pin AMP

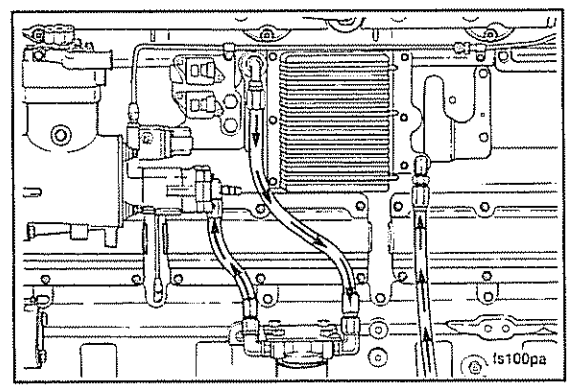
NOTE: All ECM calibration transfers **must** be completed using the engine-mounted datalink, **not** the OEM datalink.

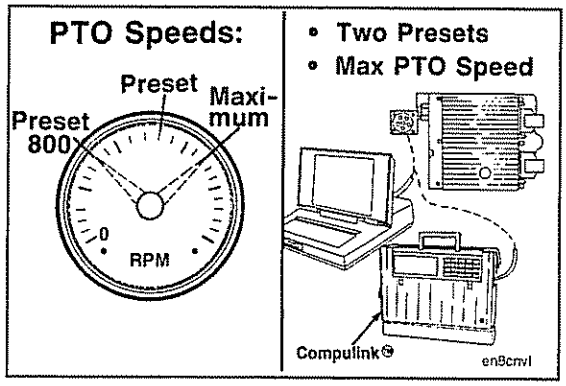


CELECT™ Plus System Fuel Flow

The fuel pump has a pressure regulator assembly and fuel shutoff valve.

The fuel pump pulls the fuel from the vehicle tank through the ECM cooling plate and the fuel filter before it enters the pump.





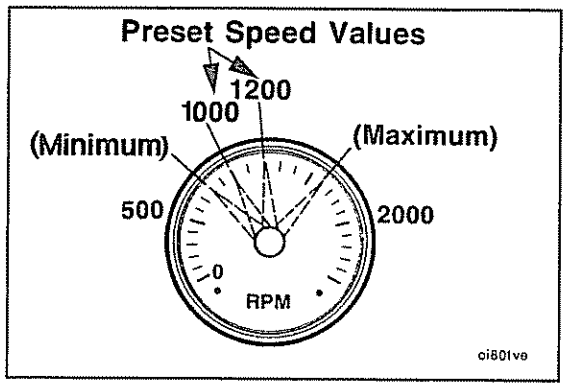
PTO Operation

⚠ CAUTION ⚠

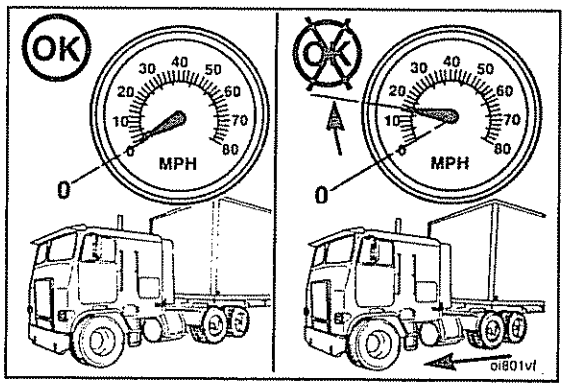
Operating the engine beyond high-idle speed can cause severe engine damage. The engine speed must not exceed 2500 rpm under any circumstances.

The low engine speed limit of the PTO system is permanently set to equal the low-idle speed. There are two preset values, along with a maximum PTO speed, that will be programmed into the ECM.

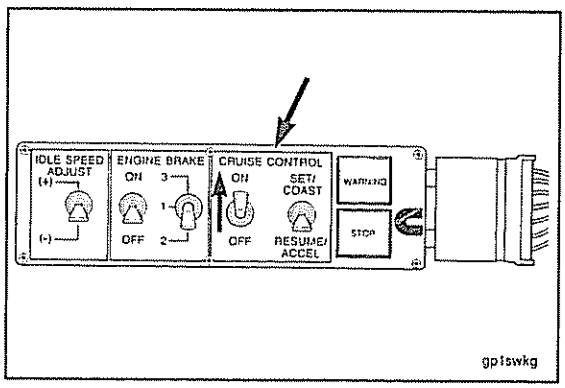
The maximum PTO speed is also dependent upon other programmable parameters, such as the maximum engine speed without a vehicle speed sensor.



The two preset values can be set to any rpm between low idle rpm and maximum PTO speed with an electronic service tool or by a Cummins Authorized Repair Location.



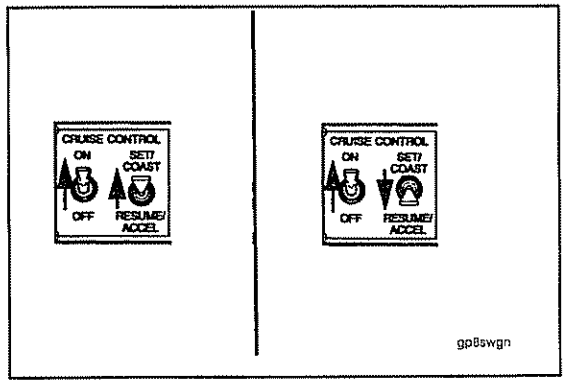
To use the PTO, start the engine and set the speed at idle. The vehicle **must** be stopped for the PTO system to work. The vehicle can move up to 6 mph for certain Cummins-approved applications.



To engage the PTO governor, move the cruise control/PTO on/off switch to the ON position.

NOTE: The cab-mounted controls can have a different appearance depending on the OEM.

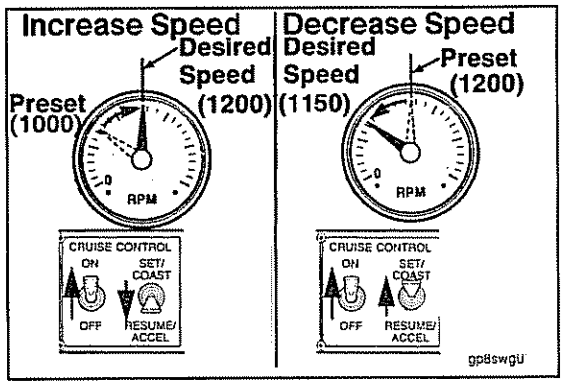
To set the engine speed to the first preset PTO speed, move the cruise control select switch to the SET/COAST position. To set the engine speed to the second preset PTO speed, move the cruise control select switch to the RESUME/ ACCEL position. Once one of these two preset speeds has been selected, the cruise control/PTO on/off switch **must** be turned OFF and back ON again before the other preset speed can be selected.



⚠ CAUTION ⚠

Operating the engine beyond high-idle speed can cause severe engine damage. The engine speed must not exceed 2500 rpm under any circumstances.

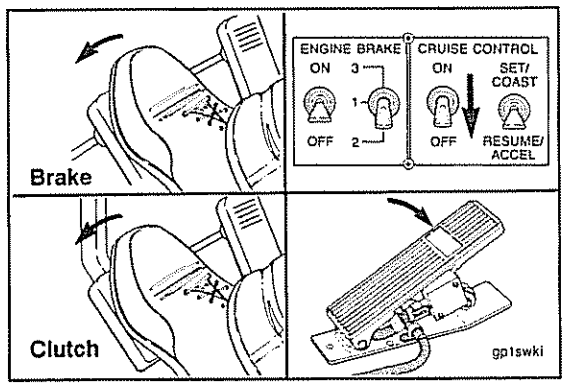
After the engine speed has been set, the speed can be raised or lowered to any point between the minimum and maximum speeds. To increase the engine speed, hold the select switch to the INC position until the engine speed is correct, and then release it. To decrease the engine speed, hold the select switch to the DEC position until the speed is correct, and then release it.



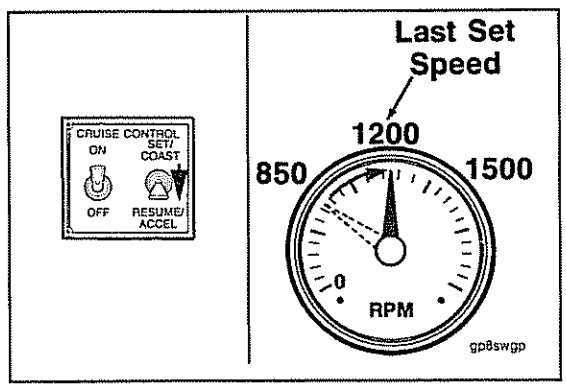
To deactivate the PTO system, do any of the following:

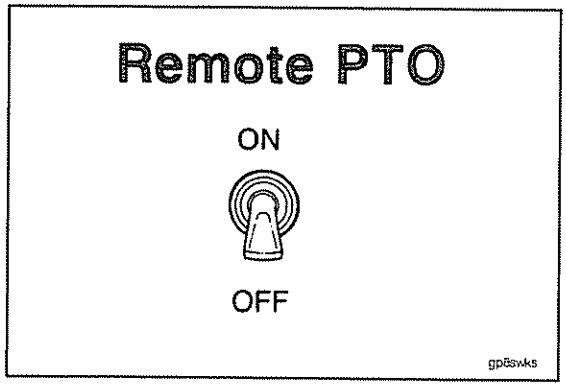
- Depress the brake pedal.
- Activate the trailer brakes.
- Depress the clutch pedal.
- Move the cruise control on/off switch to the OFF position.
- Depress the throttle.

The engine speed will be limited to the programmed maximum PTO speed when the PTO is deactivated by all of the above methods **except** moving the switch to the OFF position.



Move the select switch to the RESUME/ACCEL position to return to the preset RESUME/ACCEL speed. If the vehicle keyswitch or cruise control on/off switch has been turned OFF, the PTO speed **must** be reset.





Remote PTO Operation

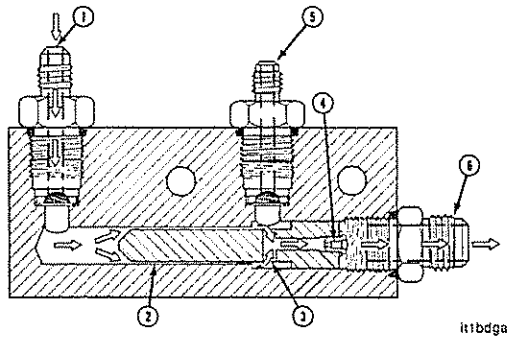
If the remote PTO feature is available, a separate remote switch is used. Remote PTO **only** controls the remote PTO rpm that is adjustable with the use of an electronic service tool. The remote PTO is deactivated **only** by turning the remote switch OFF, or exceeding the maximum mph for PTO. The remote PTO is **not** affected by the brake, throttle, or clutch.

Viscosity Sensor Control

General Information

The lubricating oil viscosity sensor controls the main oil rifle pressure by modifying the oil pressure signal to the lubricating oil pump pressure regulator. The viscosity sensor allows higher than normal main oil rifle pressure with cold viscous oil to improve the oil fill of the STC injector tappets and to provide maximum engine timing advance and white smoke control. When the lubricating oil warms up and becomes less viscous, high pressures are no longer needed to fill the STC tappets. The viscosity sensor then allows main oil rifle pressure to return to normal levels to reduce parasitic horsepower loss.

The viscosity sensor consists of a long annular flow area that creates a large pressure drop with cold viscous oil and virtually no pressure drop with warm, less viscous oil. It also uses an orifice to control flow volume.



1. Main oil rifle pressure
2. Annular flow area
3. Low-pressure area
4. Orifice to control flow volume
5. Modified pressure signal to pressure regulator
6. Return to oil pan.

Lubricating oil rifle pressure will be increased during cold start-up conditions and will return to normal levels as the lubricating oil temperature rises to operating temperatures of 110°C [230°F].

	Oil Pressure at the Main Oil Rilfe	
Oil Temperature °C [°F]	Low Idle kPa [psi]	High Idle kPa [psi]
0 [32]	450 to 690 [65 to 100]	490 to 770 [70 to 110]
21 [70]	350 to 590 [50 to 85]	380 to 660 [55 to 95]
93 [200]	110 [15]	280 to 350 [40 to 50]

Electromagnetic Interference (EMI)

General Information

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

System EMI Susceptibility

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

System EMI Radiation Levels

Your Cummins product has also been designed and tested to emit minimum electromagnetic energy. Testing has shown that the fuel system, when properly installed on vehicles, meets or exceeds by a wide margin Part 15 of the FCC Rules and SAE J1551 specifications. Other accessories should be designed with the proper filtering to reject electromagnetic noise emission from their system. Experience has shown that the electronically controlled fuel system on vehicles will **not** interfere with onboard communication equipment for urban and suburban background electromagnetic noise levels; however, the system, if used with accessories that are **not** installed properly or do **not** utilize adequate filtering designs, can interfere with onboard communications equipment in rural applications where background radio frequency noise levels are very low. If an interference condition is observed, follow the suggestions below to reduce the amount of interference:

1. Locate the receiving antenna as far away from the engine and as high as possible.
2. Locate the receiving antenna as far away as possible from all metal obstructions (exhaust stacks, and so forth).
3. Consult a representative of the accessory supplier in your area to:
   - — 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

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Maintenance Guidelines - General Information

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

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

NOTE: Some of these maintenance procedures require special tools or **must** be done by qualified personnel. These procedures are outlined in the specific manuals as follows:

Procedure	Bulletin No.	Description
Clean and Calibrate the Injectors	3810313	PT® (type D) STC Injector Shop Manual
Clean and Calibrate CELECT™ Plus injectors		Consult your Cummins Authorized Repair Location
Clean and Calibrate the Fuel Pump	3379084	Fuel Pump (PT® type G) Rebuild and Calibrate
Troubleshoot and Repair Engines	3810456	N14 Base Engine and STC Fuel System Troubleshooting and Repair Manual
Troubleshoot and Repair Engines	3666142	Troubleshooting and Repair Manual, N14 Engines
Troubleshoot and Repair Engines	3666084	Troubleshooting and Repair Manual, CELECT™ System L10, M11, and N14 Engines
Troubleshoot and Repair Engines	3666070	Troubleshooting and Repair Manual, CENTRY™ System
Troubleshoot and Repair Engines	3666130	Troubleshooting and Repair Manual, CELECT™ Plus System
Repair and Rebuild Components*	3666071	Engine Shop Manual, N14 Engines

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

If your engine is equipped with a component or an accessory **not** manufactured by Cummins Engine Company, Inc., refer to the component manufacturer's maintenance recommendations. A listing of suppliers' addresses and telephone numbers is provided in Component Manufacturers, Section M.

Tool Requirements

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 No.	Description
3375049	Oil Filter Wrench
3376592	Six Inch-Pound Torque Wrench (to set STC injectors using IBC method)
3163196	Overhead Setting Tool (**Note:** old Part No. ST 669 can be used by adding 7/8 socket Part No. 3163166).
3376807	Coolant and Fuel Filter Wrench
3822524	Belt Tension Gauge, Click Type (v-belts and v-ribbed with 4 or 5 ribs)
3822525	Belt Tension Gauge, Click Type (v-belts and v-ribbed with 6 to 12 ribs)
3824653	STC Injector Puller
3823348	STC Injector Tappet Retaining Tool (IBC method)
3823461	Chip Removal Tool
3823579	CELECT™ Injector Puller
ST-537	Depth Gauge Indicator (turbocharger axial-end clearance)
ST-1138	Burroughs Belt Tension Gauge (v-belts and v-ribbed with 4 or 5 ribs)
ST-1293	Burroughs Belt Tension Gauge (v-belts and v-ribbed with 6 to 12 ribs)

Refer to the appropriate sections for a description of the tools and how to use them.

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

Maintenance Schedule

N14 Industrial Engine Maintenance Schedule: [1]				
Daily	Every 250 Hours or 6 Months[2][4]	Every 1500 Hours or 1 Year[2]	Every 6000 Hours or 2 Years[2]	Every 6000 Hours or 3 Years[2]
Maintenance Check	**Change/Replace**	**Maintenance Check**	**Maintenance Check**	**Maintenance Check**
• Check operator's report. • Check and correct, – Engine oil level. – Coolant level. • Check air intake restriction indicator • Check air intake piping, hoses, and clamps. • Drain air tanks and reservoir. • Inspect the engine for damage, leaks, loose or frayed belts; and listen for unusual noises. • Drain fuel-water separator. • Check marine gear (marine **only**). • Check raw water inlet screens. • Inspect sea water strainer (marine **only**).	• Change lubricating oil[7]. • Change lubricating oil filters[7]. • Change fuel filters. • Change coolant filters. • Replace air compressor element (if eqiupped). • Check engine coolant supplemental coolant additve (SCA) concentration level (if required)[3]. • Check engine wiring for damage. • Inspect sacrificial zinc plugs (marine **only**). • Check and clean crankcase breather and tube. • Check for air intake and exhaust air leaks. • Drain fuel supply tank.	• Adjust valves and Injectors. [5] • Steam-clean engine. • Replace hoses as required. • Check shutterstats and thermatic fans (if equipped). • Check turbocharger mounting nuts. • Check engine oil heater. • Check batteries. • Clean the sea water heat exchanger (marine **only**). • Inspect sea water pump (marine **only**).	• Clean cooling system, and change coolant and antifreeze. • Inspect turbocharger. • Inspect air compressor. • Inspect fan clutch[1]. • Inspect water pump • Inspect fan hub. • Inspect water idler pulley assembly. • Inspect vibration damper.	• Clean and calibrate injectors, fuel pump (PT® **only**).[6]

1. Follow the manufacturer's recommended maintenance procedures for the starter, alternator, generator, batteries, electrical components, engine brake, exhaust brake, charge air cooler, air compressor, air conditioner compressor, and fan clutch. Refer to Section M for addresses and telephone numbers.
2. Perform maintenance at whichever interval occurs first. At each scheduled maintenance interval, perform all previous maintenance checks that are due for scheduled maintenance.
3. Test the SCA concentration level every 6 months unless concentration is over 3 units; then check at every oil drain interval until concentration is below 3 units.
4. For standby generator applications, the recommended oil change interval is 250 hours or 12 months, whichever comes first.
5. Perform at 1500-hour interval. Yearly adjustments are **not** required.
6. Calibration of the CELECT™ Plus fuel pump is **not** required.
7. Refer to Oil Drain Intervals in this section.

Oil Drain Intervals

Use the following table to determine the oil drain interval for your application.

Oil Drain Intervals by Duty Cycle (hours)			
	Heavy	Medium	Light
Fuel Consumption	> 15 gal/hr	11 to 15 gal/hr	< 11 gal/hr
API CF-4	150	175	250
API CG-4	250	275	400
API CH-4	275	350	450
CES20076[1]	325	375	550

Note:

1. Valvoline® Premium Blue® and Premium Blue® 2000 meet CES 20076 standards.

Note: Refer to the lubricating oil filter specifications table in Section V.

Note: Extending the oil and filter change interval beyond the recommendation will decrease engine life due to factors such as corrosion, deposits, and wear.

Typical Duty Cycles by Application		
Heavy	Medium	Light
Air Compressor	Articulated Dump Truck	Crane
Combine	Irrigation Equipment	Rear Dump Truck
Dozer	Generator Sets	
Dragline	Scrapper	
Excavator	Skidder	
Farm Tractors		
Front-End Loader		
Standby Generators		

Note:

The actual duty cycles can vary from the above chart. In those cases, it is necessary to change oil as a function of average fuel consumption. Therefore, select a column based on the representative fuel consumption range.

Page References for Maintenance Instructions

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

Maintenance Record Form

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

Date	km [Miles], Hours or Time Interval	Actual km [Miles] or Hours	Maintenance Check Performed	Check Performed By	Comments

NOTES

Section 3 - Maintenance Procedures at Daily Interval

Section Contents

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Maintenance Procedures - General Information

All checks or inspections listed under the daily maintenance interval **must** also be performed at this time, in addition to those listed under this maintenance interval.

Daily Maintenance Procedures - General Information

Good maintenance begins with day-to-day awareness of the condition of the engine and its systems.

Before starting the engine, check the oil and coolant levels. Look for:

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

Engine Operation Report

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

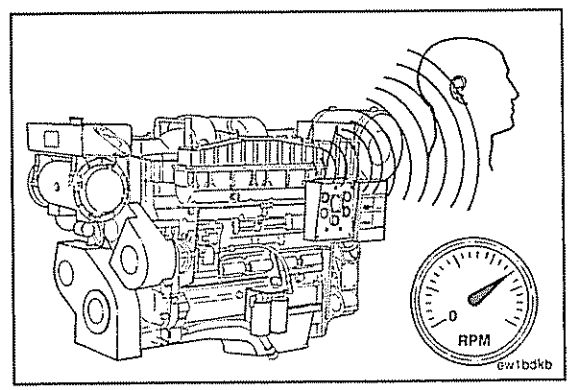
Comparison and intelligent interpretation of the daily report, along with practical follow-up action, will eliminate most failures and emergency repairs.

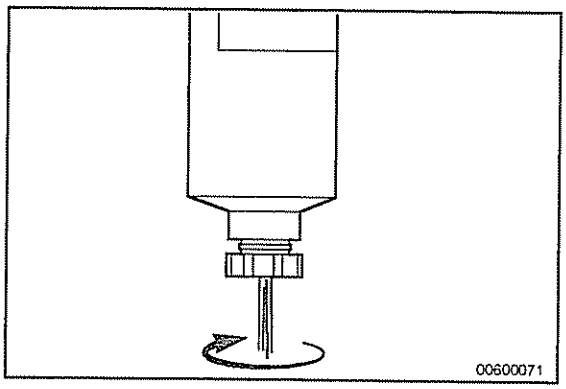
Report to the maintenance department any of the following conditions:

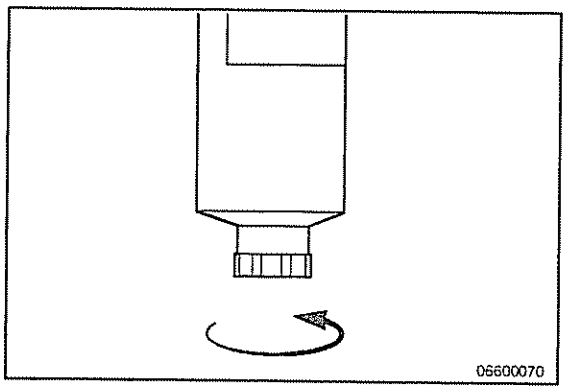
- Low lubricating oil pressure
- Low power
- Abnormal water or oil temperature
- Unusual engine noise
- Excessive smoke
- Excessive use of coolant, fuel, or lubricating oil
- Any fuel, coolant, or lubricating oil leaks.

Unusual Engine Noise

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







Fuel-Water Separator

Drain

NOTE: The water and sediment can contain petroleum products. Please consult the local environmental agency for recommended disposal guidelines.

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

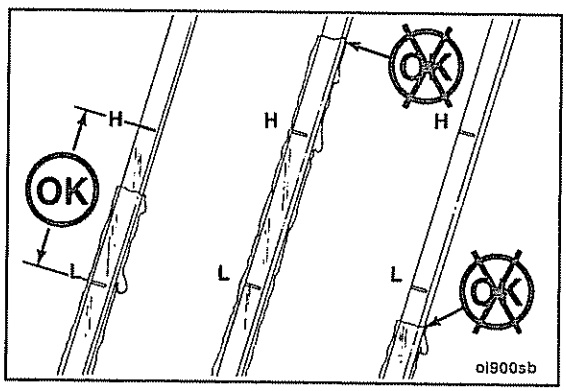
Drain the water and sediment from the separator daily.

Shut off the engine. Use your hand to open the drain valve. Turn the valve **counterclockwise** approximately 3-1/2 turns, or until draining occurs and the valve drops at least 1 inch out of the filter. Drain the filter sump of water 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 it **clockwise** until it is hand-tight.



Lubricating Oil Level

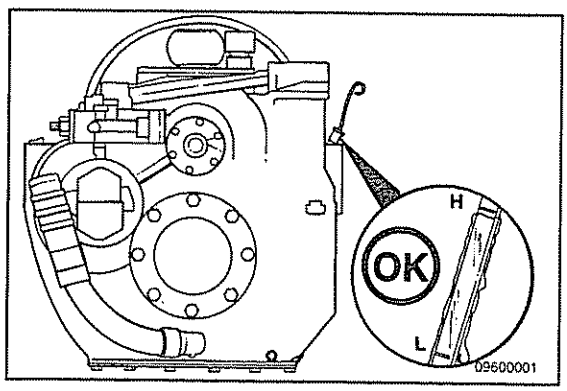
Maintenance Check

NOTE: The engine **must** be level when checking the oil level to obtain a correct measurement.

Shut off the engine for an accurate reading.

Never operate the engine with the oil level below the L (low) mark or above the H (high) mark. Wait at least 10 minutes after shutting the engine off before checking the oil. This allows time for the oil to drain to the oil pan.

Refer to the Lubricating Oil Recommendations/ Specifications in Section V.



Marine Gear

Maintenance Check

Keep the oil level as near to the H (high) mark as possible.

Check the marine gear oil level daily.

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

Different models of marine gears will have the marine gear oil dipstick and fill caps in various locations.

NOTE: The location shown is typical.

Coolant Level

Maintenance Check

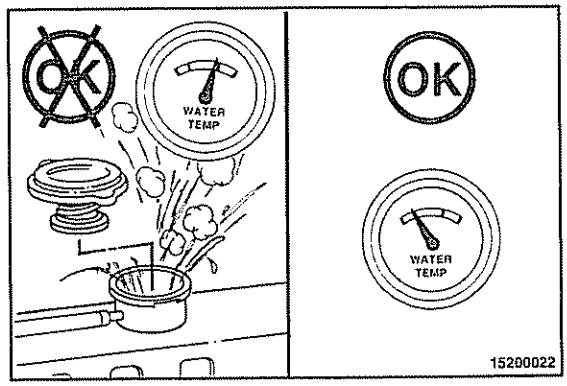
⚠ WARNING ⚠

Do not remove the cooling system pressure cap from a hot engine. Wait until the temperature is below 50°C [120°F] before removing the pressure cap. Failure to do so can result in personal injury from heated coolant spray or steam. Remove the filler cap slowly to relieve coolant system pressure.

⚠ 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.

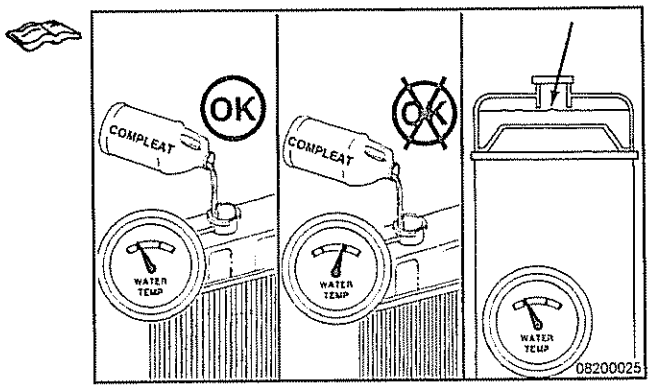
The coolant level **must** be checked daily.



⚠ CAUTION ⚠

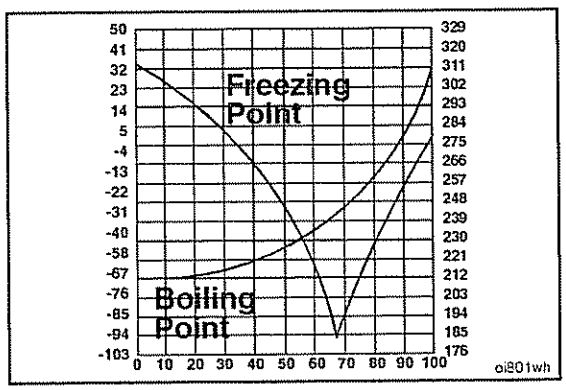
Do not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool to below 50°C [120°F] before adding coolant.

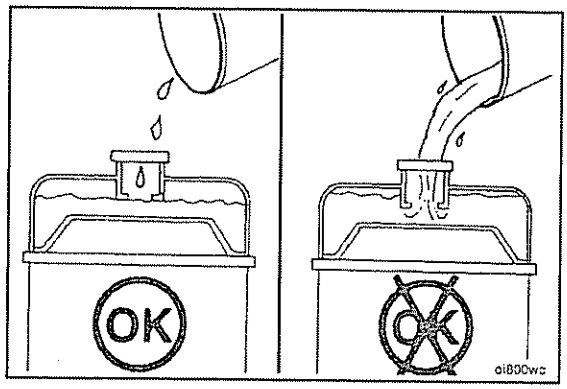
Cummins Engine Company, Inc., recommends using either a 50/50 mixture of good-quality water and a recommended fully formulated antifreeze, or fully formulated coolant when filling the cooling system. The fully formulated antifreeze or coolant **must** meet TMC RP 329 or TMC RP 330 specifications. Refer to the Coolant Recommendations and Specifications in Section V.



Fully formulated antifreeze **must** be mixed with a good-quality water at a 50/50 ratio (40/60-percent working range). A 50/50 mixture of antifreeze and water gives a -36°C [-34°F] freezing point and a boiling point of 110°C [228°F], which is adequate for locations in North America. The actual lowest freezing point of ethylene glycol antifreeze is at 68 percent. Using a higher concentration will raise the freezing point of the solution and increase the possibility of silica gel problems.

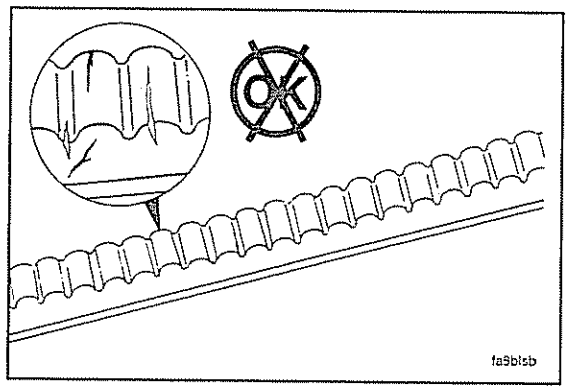
Use ethylene glycol or propylene glycol antifreeze year-round to provide freezing point and boil-over protection.





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

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



Drive Belts

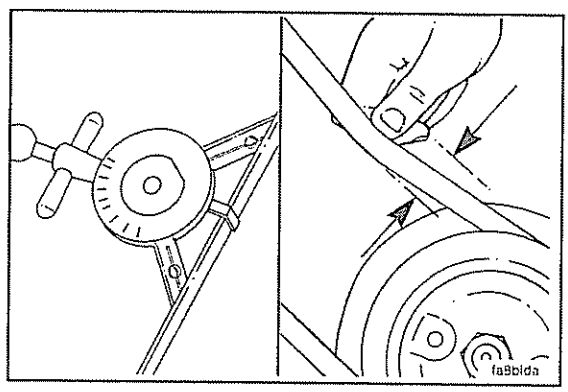
Maintenance Check

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.



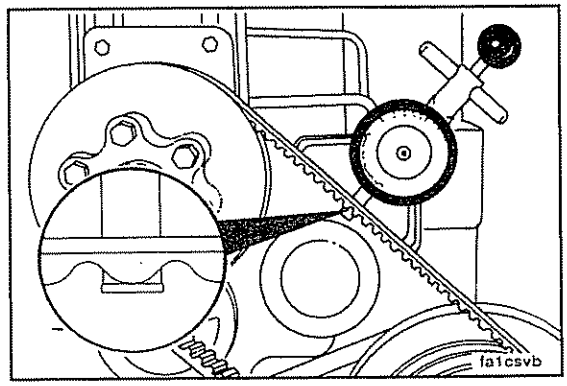
Measure the belt tension in the center span of the pulleys.

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.

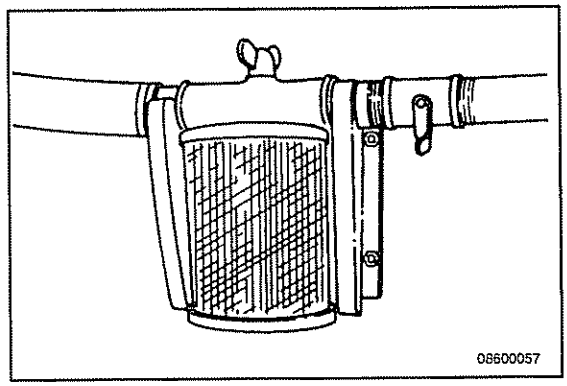


Sea Water Strainer

General Information

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.

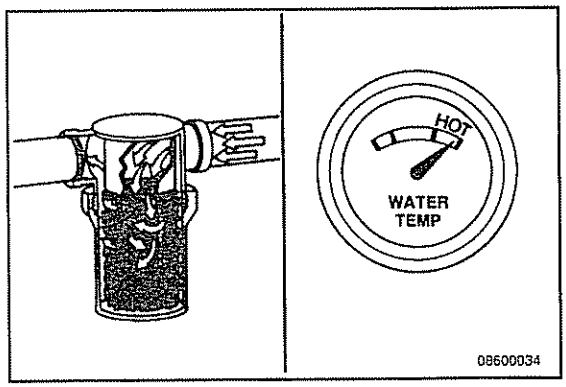
Inspect the sea water strainer daily for any foreign objects that could restrict water flow.



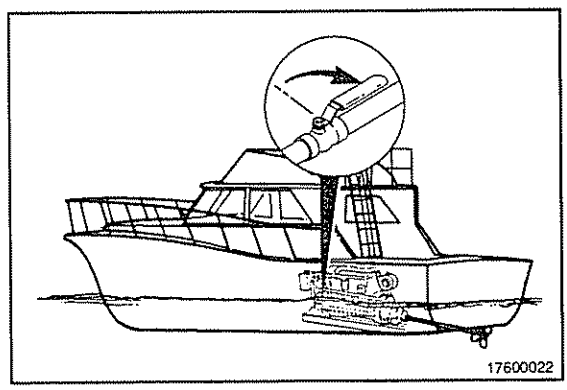
△ CAUTION △

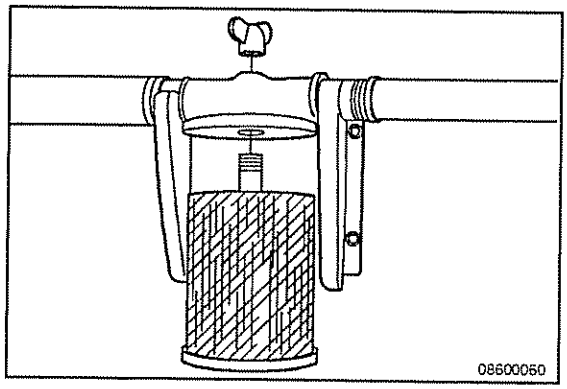
A restricted or clogged sea water strainer can result in hotter than normal, or overheated, engine coolant and marine gear oil temperatures, which can cause damage to the engine or marine gear.

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



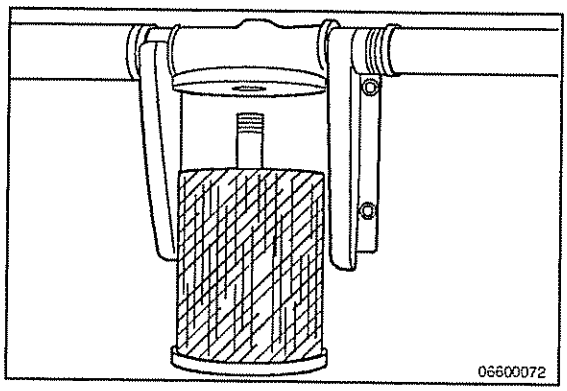
If the sea water strainer is below the water level, close the sea water inlet valves.



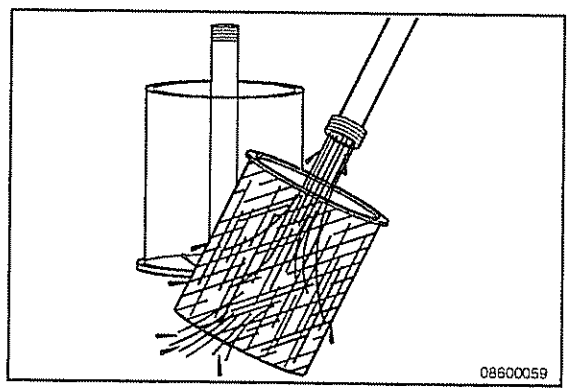


Disassemble

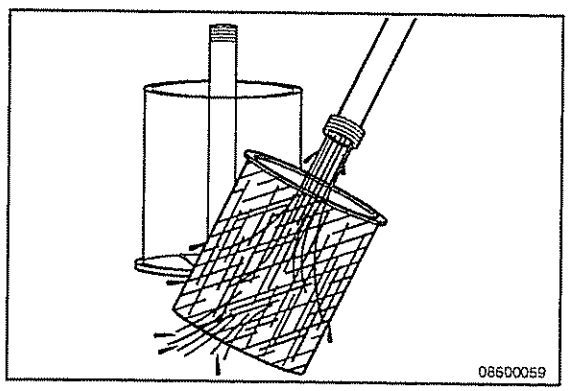
Loosen and remove the sea water strainer wing nut(s), as required.



Remove the sea water strainer assembly.



Remove the sea water strainer basket.



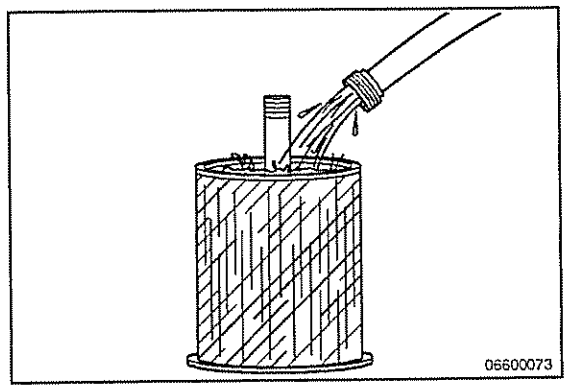
Clean

Empty the debris from the sea water strainer basket.

Clean the sea water strainer with clean water.

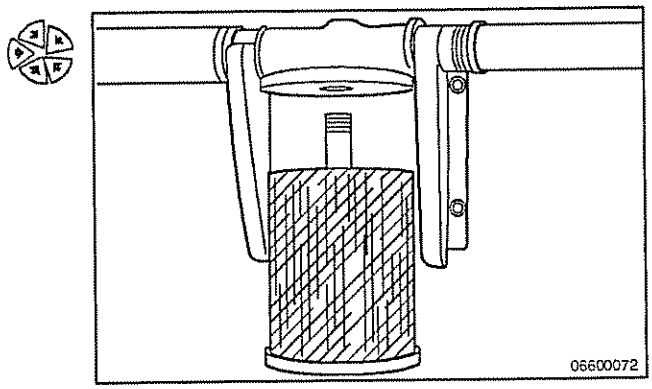
Prime

Prime the sea water strainer with clean water.

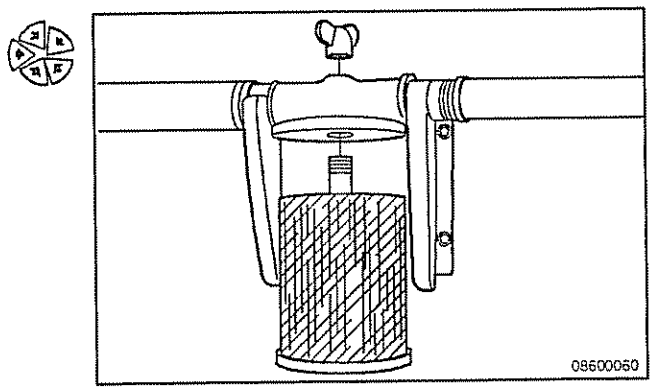


Assemble

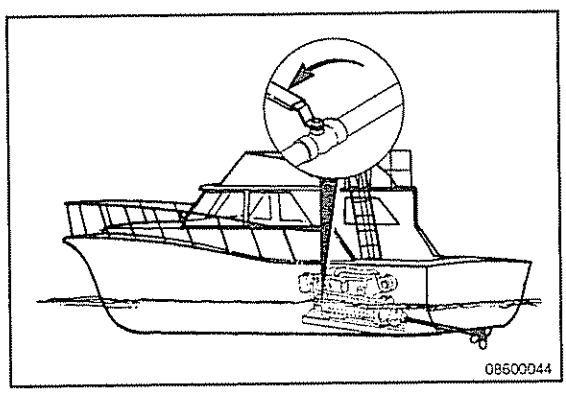
Install the sea water strainer.

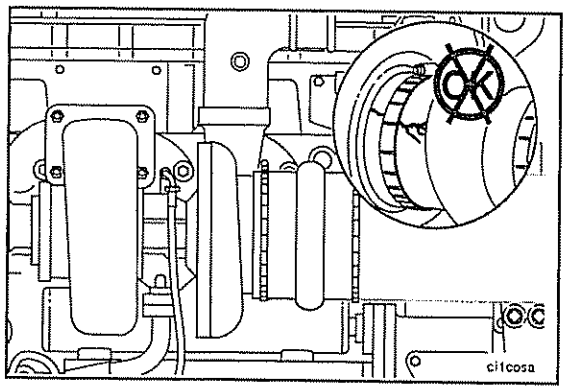


Install and tighten the wing nut(s).



Open the sea water inlet valves.





Air Intake Piping

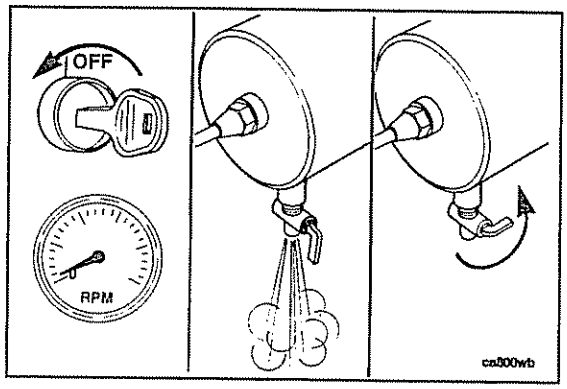
Maintenance Check

Inspect the intake piping daily for cracked hoses, loose clamps, or punctures that can damage the engine.

Tighten or replace parts as necessary to make sure the air intake system does **not** leak.

Torque Value: 8 N•m [71 in-lb]

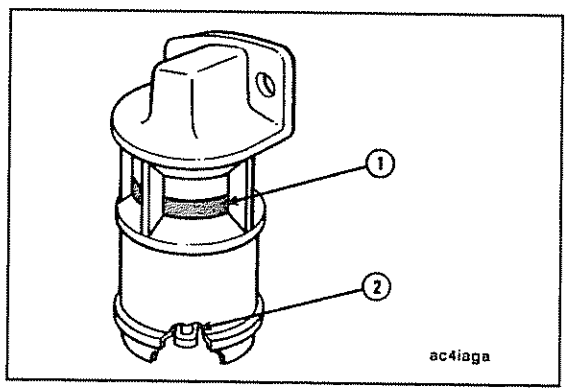
Check for corrosion of the intake system piping under the clamps and hoses. Corrosion can allow corrosive products and dirt to enter the intake system. Disassemble and clean as required.



Air Tanks and Reservoirs

Drain

Open the draincock on the wet tank to drain any moisture accumulated in the air system. If oil is present, the air compressor **must** be checked. Refer to the N14 Troubleshooting and Repair Manual, Bulletin No. 3666142, or contact a Cummins Authorized Repair Location.

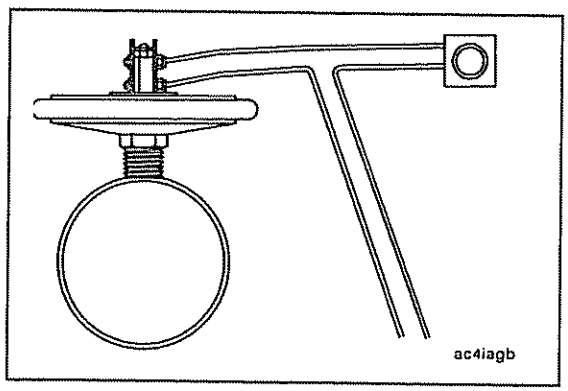


Air Intake Restriction

Mechanical Indicator

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 vehicle 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).

NOTE: Never remove the felt washer from the indicator. The felt washer absorbs moisture.



Vacuum Indicator

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

Air restriction on turbocharged engines **must not** exceed 635 mm H_20 [25 in H_20] or 46 mm Hg [1.8 in Hg] under full-power conditions.

Maintenance Procedures at 250 Hours or 6 Months

Section Contents

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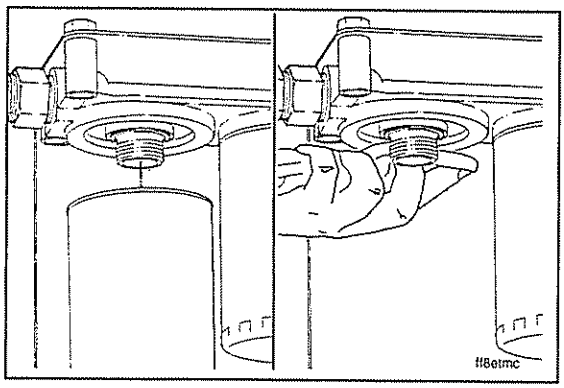
General Information

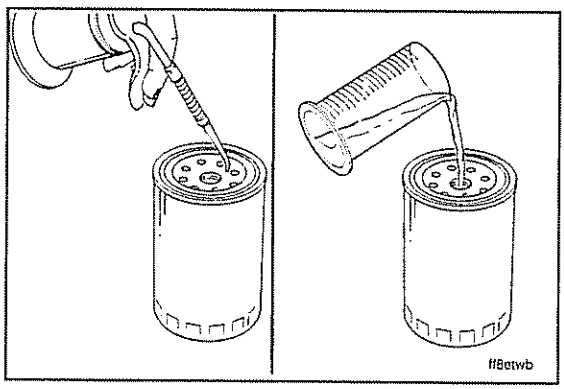
All checks or inspections listed under the previous maintenance intervals **must** also be performed at this time, in addition to those listed under this maintenance interval.



Fuel Filter (Spin-On Type)

Remove

Every 250 hours or 6 months (whichever occurs first), replace the fuel filter(s). Clean the area around the fuel filter head. Remove the fuel filter. Clean the gasket surface of the filter head.



Use the correct filter(s) for your engine. Cummins requires that a fuel-water separator or a fuel filter and water separator be installed in the fuel supply system.

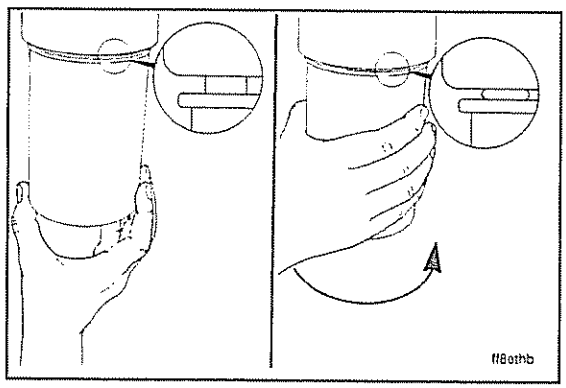
Standard Filter(s)

Cummins Part No. 3315844
Fleetguard® Part No. FF-105

Super Filter (Fuel-Water Separator)

Cummins Part No. 3315843
Fleetguard® Part No. FS-1212

Use clean oil to lubricate the filter seal. Fill the new filter(s) with clean fuel.



Install

⚠ CAUTION ⚠

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

⚠ CAUTION ⚠

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

Install the filter as specified by the filter manufacturer.

Lubricating Oil and Filters

General Information

⚠ WARNING ⚠

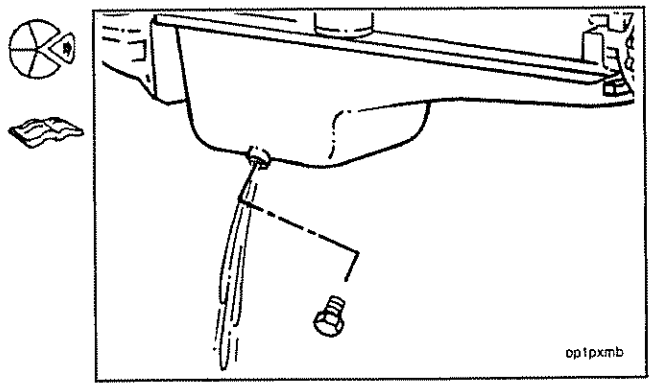
To avoid personal injury, avoid direct contact of hot oil with your skin.

⚠ WARNING ⚠

Some state and federal agencies have determined that used engine oil can be carcinogenic and cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil.

Change the lubricating oil and filters at every oil change interval.

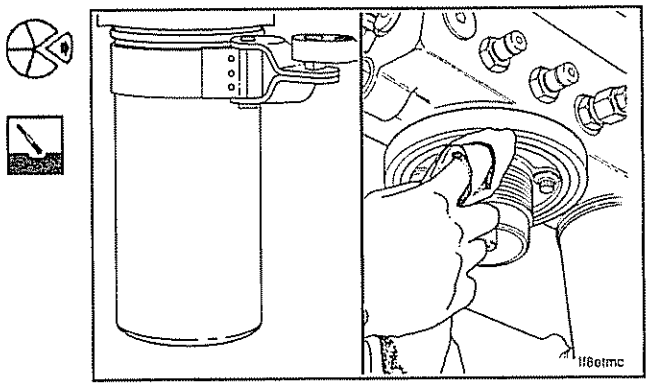
Operate the engine until the water temperature reaches 60°C [140°F]. Shut off the engine. Remove the oil drain plug. Drain the oil immediately to make sure all the oil and suspended contaminants are removed from the engine.



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

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

NOTE: Refer to the Lubricating Oil Drain Interval Chart in section 2.



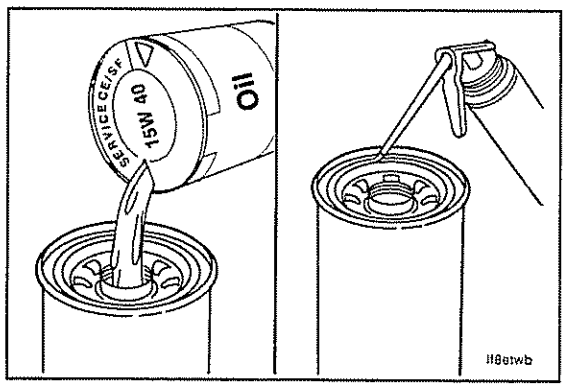
Lubricating Oil Filter (Spin-On)

General Specifications

Cummins Engine Company, Inc. requires a lubricating oil filter(s) be used that meets the specifications given in the table below.

Lubricating Oil Filter Specifications			
Cummins Source Approval Method (SAM)	**Combination (LF3000)/(LF9009) 10,634**	**Full-Flow (LF670) 10,509**	**Bypass (LF777) 10,547**
Flow vs. Restriction • Pressure differential at 40 GPM maximum	21 kPa [3 psi]	21 kPa [3 psi]	N/A
Element Collapse • Pressure differential	1034 kPa [150 psi]	1034 kPa [150 psi]	1034 kPa [150 psi]
Particle Retention • Absolute retention, percent of 40 micrometer and above, minimum	N/A	100%	N/A
• Percent retention of 20 to 30 micrometer	N/A	95%	N/A
Hydrostatic Pressure • Pressure, minimum	1724 kPa [250 psi]	1724 kPa [250 psi]	1724 kPa [250 psi]
Cold Flow vs. Restriction • Pressure differential at 6 GPM maximum	413 kPa [60 psi]	N/A	N/A

NOTE: A Fleetguard LF9009 or equivalent lubricating oil filter must be used for drain intervals beyond 500 hours or 6 months otherwise a Fleetguard LF3000 or equivalent oil filter can be used for drain intervals less than 500 hours or 6 months.



Fill

⚠ CAUTION ⚠

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

⚠ CAUTION ⚠

Fill the oil filter with clean lubricating oil before installing it on the engine. The lack of engine lubrication while the filter is being pumped full of oil is harmful to the engine.

Use the correct oil filter for your engine.

Combination Full-Flow/Bypass Lubricating Oil Filter

Cummins Part No. 3318853

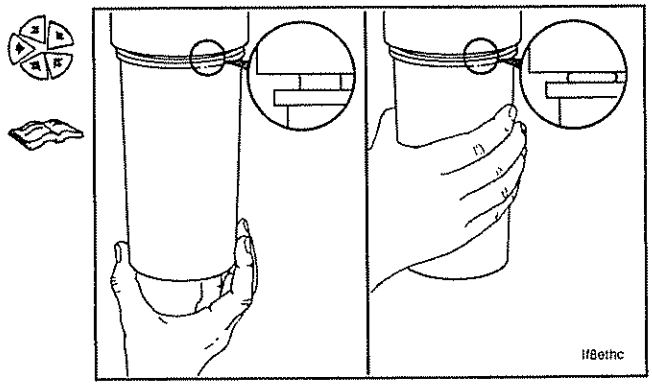
Fleetguard® Part No. LF-3000

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

⚠ CAUTION ⚠

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

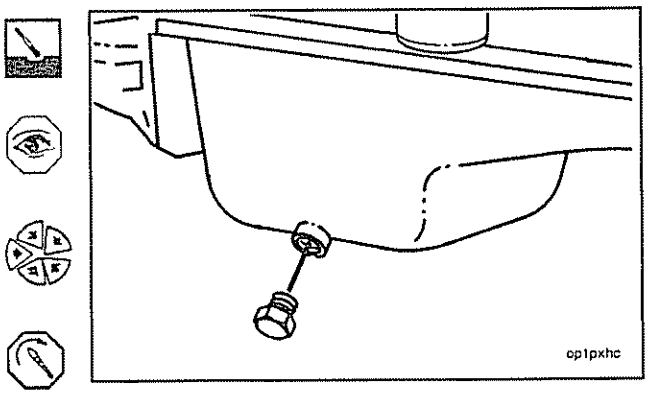
Install the filter as specified by the filter manufacturer.



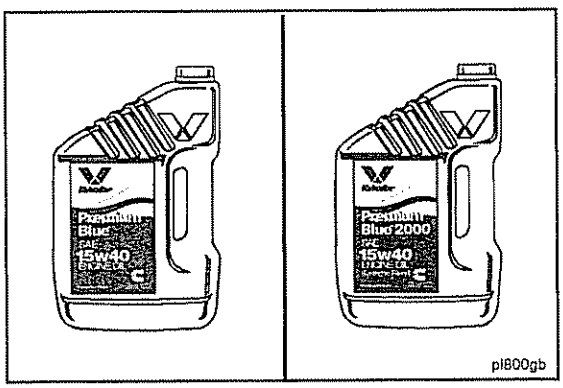
Clean and check the oil drain plug threads and the seal surface.

Install and tighten the oil drain plug.

Torque Value: 88 N•m [65 ft-lb]

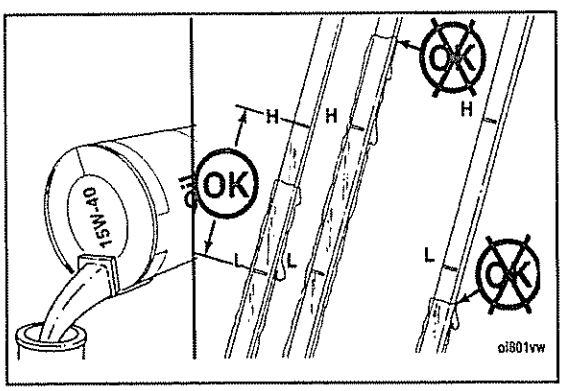


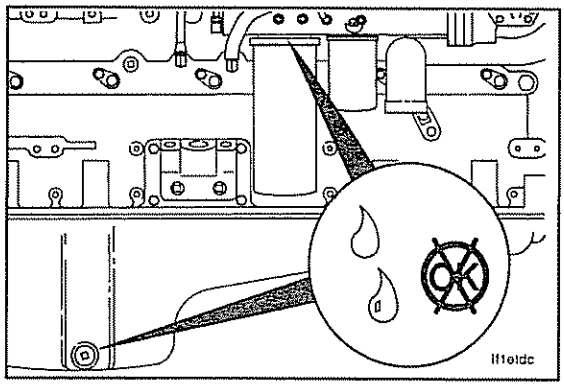
Cummins recommends the use of multiviscosity oil, such as Valvoline® Premium Blue® or Valvoline® Premium Blue® 2000, or equivalent, in Cummins engines. Choose the correct oil for your operating climate as outlined in Section V.



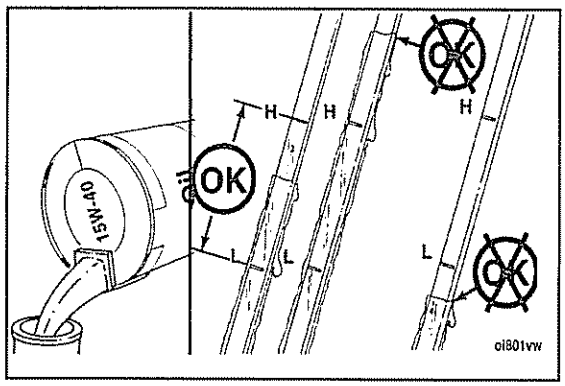
Fill the engine with clean oil to the correct level. Total system capacity, including filter, is 42.0 liters [11.0 U.S. gal].

After an oil change, the engine requires approximately 36.0 liters [9.5 U.S. gallons] to fill the oil pan, and another 2.7 liters [0.7 U.S. gal] to fill the new oil filter.



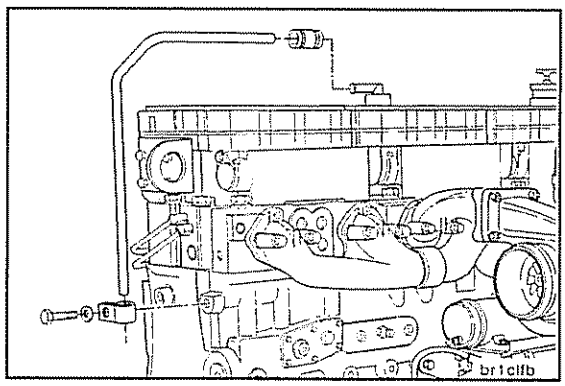


Operate the engine at idle speed to inspect for leaks at the oil filter and the drain plug.



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

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

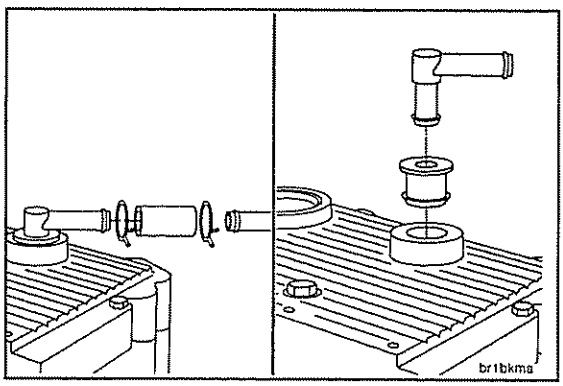


Crankcase Breather Tube

Maintenance Check

Inspect the breather tube for sludge or debris on or in the tube.

Inspect the tube more frequently in icy conditions.



Disassemble

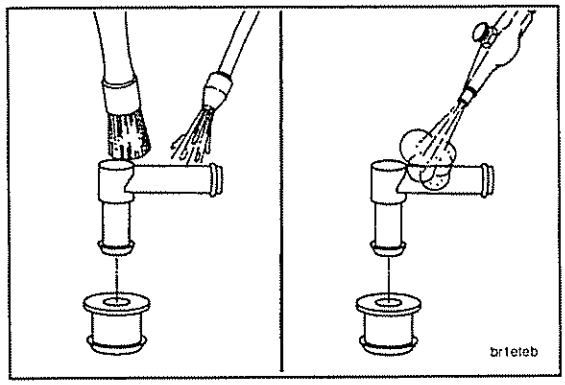
Loosen the hose clamp at the breather vent tube.

Remove the tube support bracket and capscrew.

Disassemble the breather as shown.

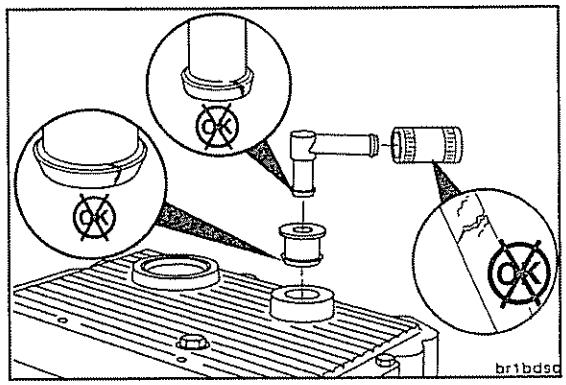
Clean

Use solvent to clean the breather. Dry it with compressed air.



Inspect for Reuse

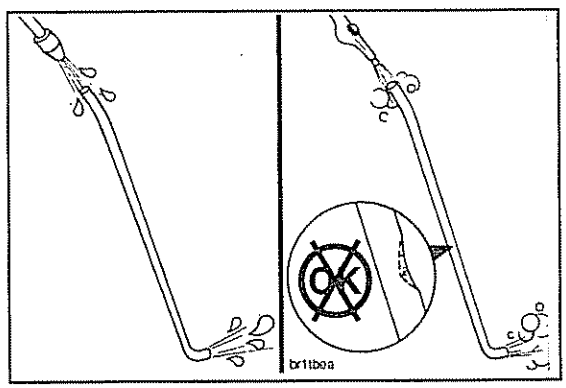
Inspect the breather tube, connector hose, and the rubber gasket for cracks or other damage. Replace if necessary.



Use solvent to clean the inside of the crankcase breather tube, and dry with compressed air.

Use air pressure to blow through the vent tube.

Replace the vent tube if it is clogged.



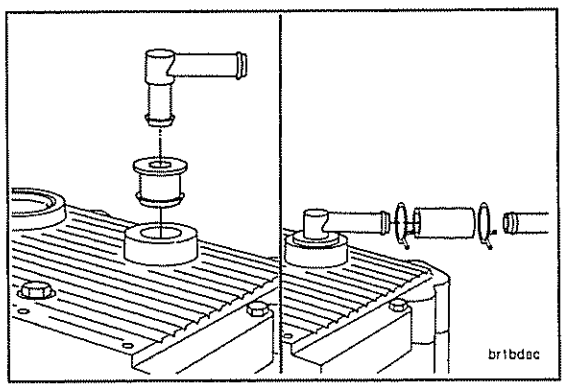
Assemble

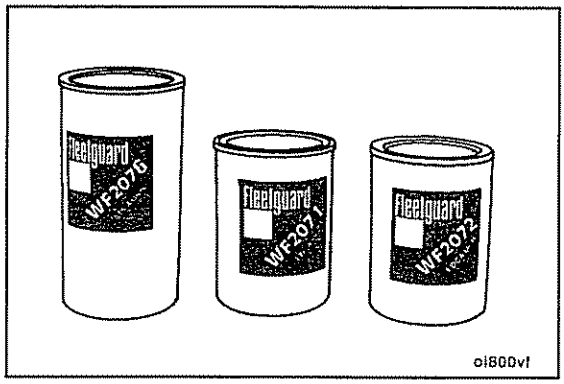
Assemble the breather as shown.

Install the vent tube, the hose, the hose clamps, the brackets, and the capscrews on the engine.

Tighten the bracket capscrew (**not** shown).

Torque Value: 45 N•m [35 ft-lb]



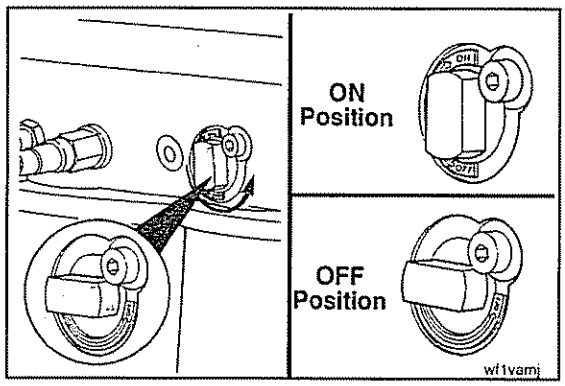


Coolant Filter

Change the coolant filter at every oil and filter change interval.

The correct coolant filter to be used is determined by the total cooling system capacity and the oil drain interval.

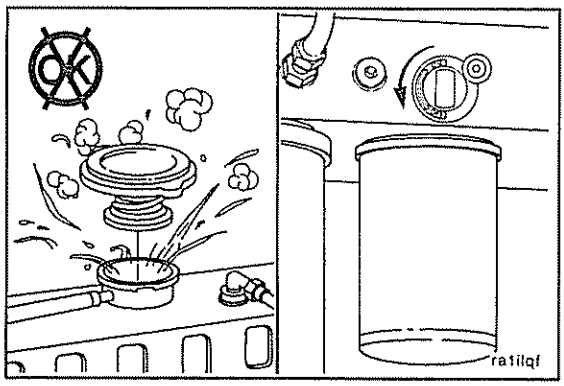
Refer to Coolant Recommendations and Specifications in Section V for the correct filter selection and test procedures.



Remove

A manual shutoff valve is provided to prevent coolant leakage while changing the coolant filter.

With the valve in the vertical position, the coolant flows to and from the coolant filter. In the horizontal position, the coolant flow is cut off to and from the coolant filter.

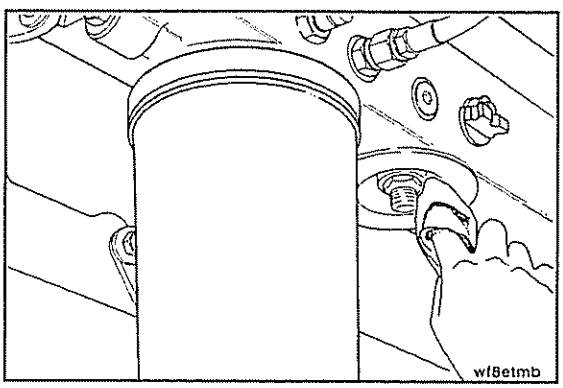


⚠ WARNING ⚠

Do not remove the radiator cap from a hot engine. Hot steam will cause serious personal injury. Remove the coolant system pressure cap, and close the coolant filter head shutoff valve before removing the coolant filter. Failure to do so can cause personal injury from heated coolant spray.

Remove the radiator pressure cap.

Turn the coolant shutoff valve to the OFF position.



Remove and discard the coolant filter. Clean the gasket surface on the filter head.

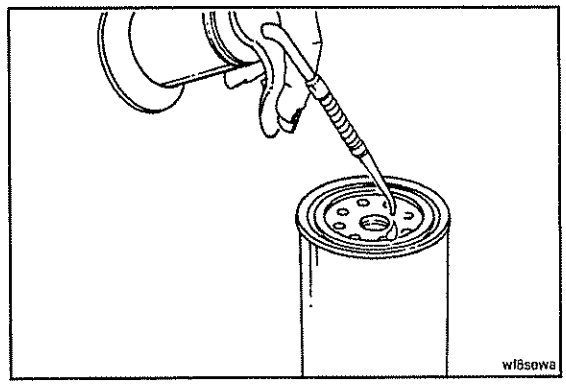
Install

⚠ CAUTION ⚠

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

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

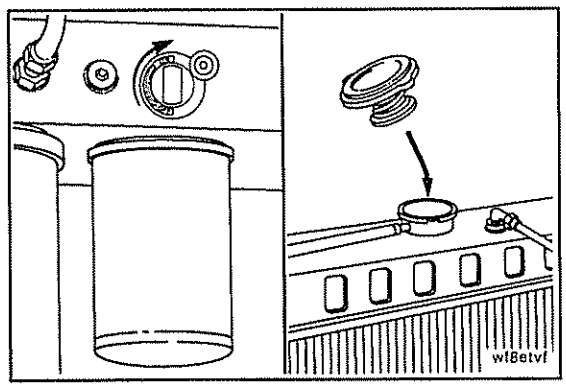
Install the filter as specified by the manufacturer.



⚠ CAUTION ⚠

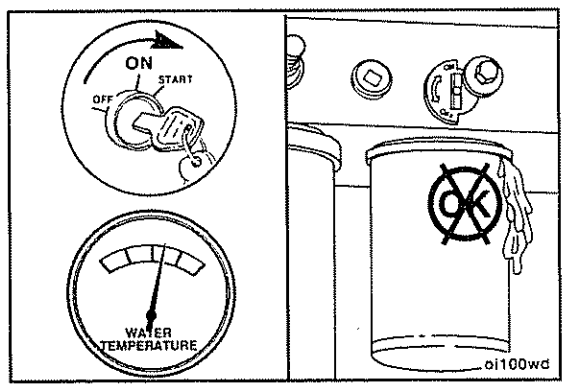
Severe engine damage will result if the shutoff valve is left closed.

After the filter has been changed, open the shutoff valve and install the radiator pressure cap.



Operate the engine until the coolant temperature is above 82°C [180°F], and check for coolant leaks.

After a minimum of 30 minutes of operation, check the coolant level and top off as needed with premixed coolant.



Supplemental Coolant Additive (SCA)

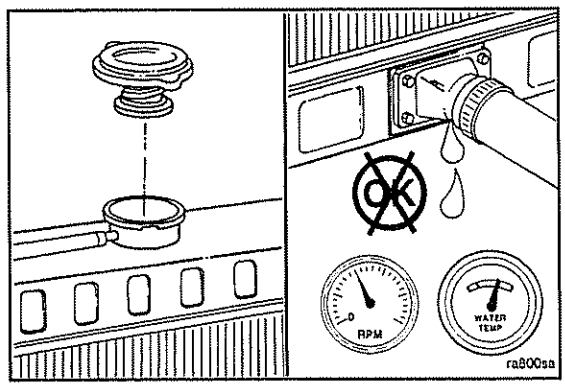
Maintenance Check

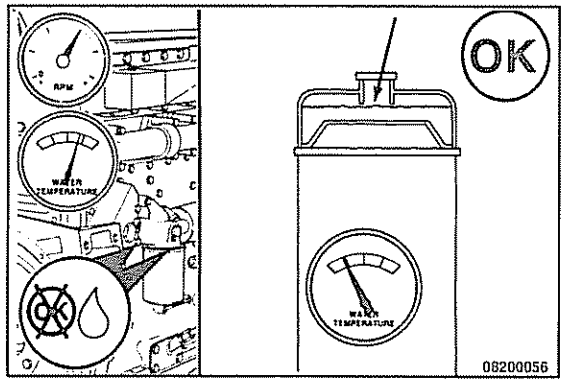
⚠ WARNING ⚠

Check the coolant level only when the engine is stopped. Wait until the coolant temperature is below 50°C [120°F] before removing the pressure cap. Failure to do so can cause personal injury from heated coolant spray.

Operate the engine, and check for coolant leaks.

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



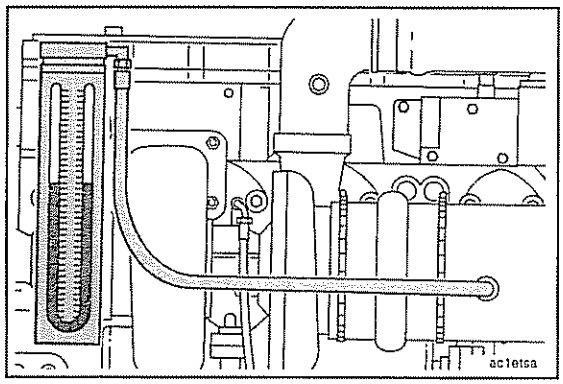


⚠ WARNING ⚠

Check the coolant level only when the engine is stopped. Wait until the coolant temperature is below 50°C [120°F] before removing the pressure cap. Failure to do so can cause personal injury from heated coolant spray.

Use Fleetguard® coolant test kit, CC2602, to check the concentration level. Instructions are included with the test kit.

Refer to Coolant Recommendations and Specifications in Section V for more information.

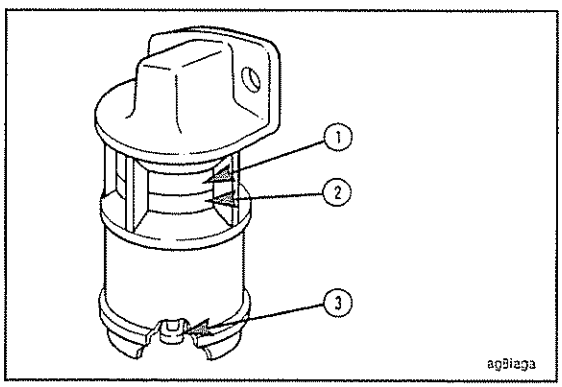


Air Cleaner Restriction

Maintenance Check

Every 250 hours or 6 months (whichever comes first). Check the air cleaner restriction. Maximum intake air restriction is 64 cm H_2O [25.0 in H_2O].

The engine **must** be operated at maximum horsepower rpm and full load to check maximum intake air restriction. Replace or clean the air cleaner element when the restriction reaches the maximum allowable limit.

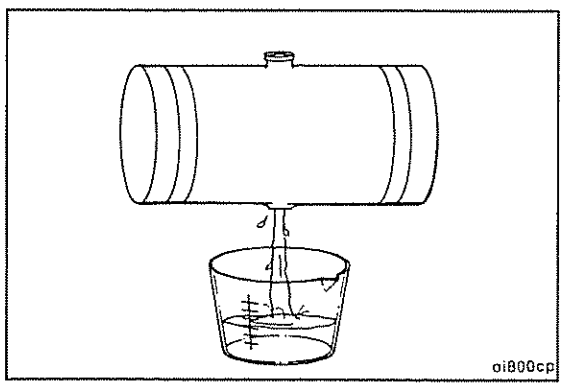


NOTE: Never operate the engine without an air cleaner. Intake air **must** be filtered to prevent dirt and debris from entering the engine and causing premature wear.

Follow the air cleaner element manufacturer's information or instructions to replace the air cleaner element.

Check the air cleaner service indicator, if equipped. Change the filter element when the red indicator flag (2) is at the raised position in the window (1).

After the air cleaner has been serviced, reset the button (3) in the end of the service indicator.



Fuel Supply Tanks

Drain

NOTE: The water and sediment drained from the fuel supply tank(s) contain fuel. Please consult the local environmental agency for recommended disposal guidelines.

Drain the water and sediment from the fuel supply tank(s). Drain the fuel tank(s) of water until clear fuel is visible.

Air Compressor Air Cleaner Element

Maintenance Service

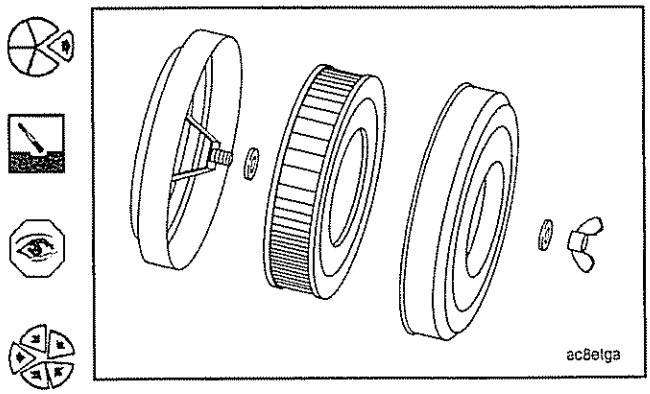
Cummins

Two-Cylinder

Remove the wing nut that secures the cover to the housing. Remove the cover and the element. Clean the cover and the housing with a clean cloth. Inspect air cleaner cover and housing for signs of corrosion. Inspect the rubber gasket on the center bolt. Replace if damaged.

NOTE: Air cleaner cover and housing corrosion can allow debris and unfiltered air to enter the air compressor intake. This will cause premature air compressor failure.

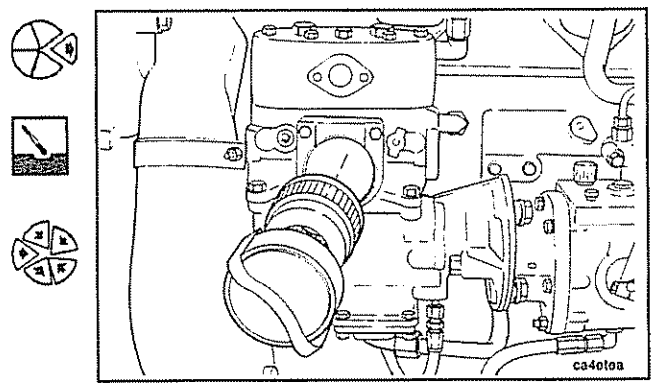
Install a new element, Fleetguard® Part No. AF-251 or Cummins Part No. 256837, in the front cover and assemble over the center bolt. Use your fingers to install and tighten the wing nut.



Bendix-Westinghouse

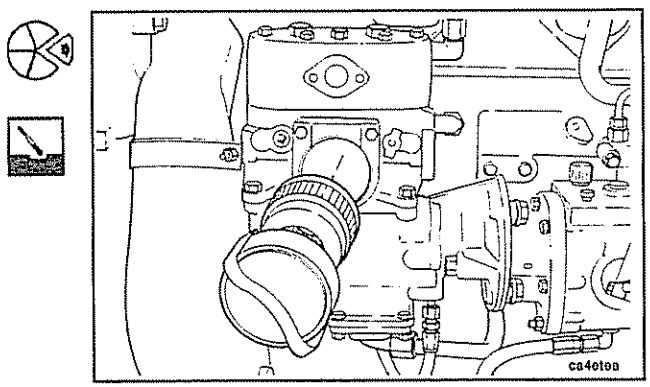
Paper Element

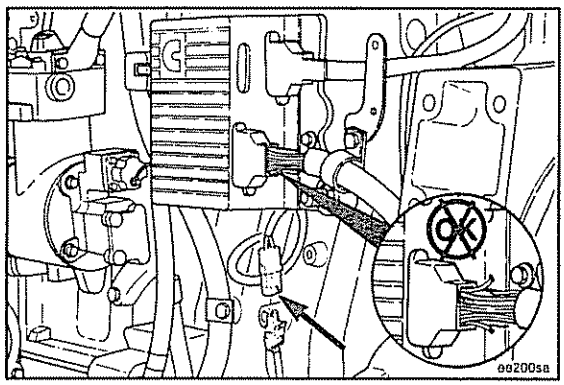
Remove the breather cover and element. Clean by reverse flushing with compressed air. Assemble on the compressor. Discard the element if it is damaged or can **not** be cleaned.



Sponge Element

Remove the breather from the air compressor. Disassemble the breather, wash all metal parts in solvent, and blow-dry with compressed air. Wash the element in solvent. Remove all solvent from the element. Dip the element in clean engine oil and squeeze excess oil from the element.





Engine Wiring Harness

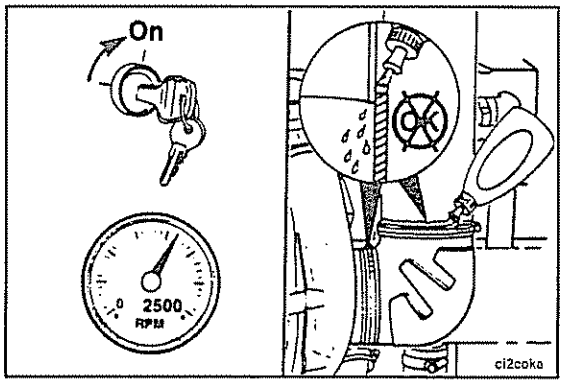
Maintenance Check

CELECT™ Plus

⚠ WARNING ⚠

Never touch the wiring connections when the keyswitch is turned on. Electrical shock can result.

Check all wire connections and wiring harness for damage. Faulty wiring can cause improper engine operation and poor performance.

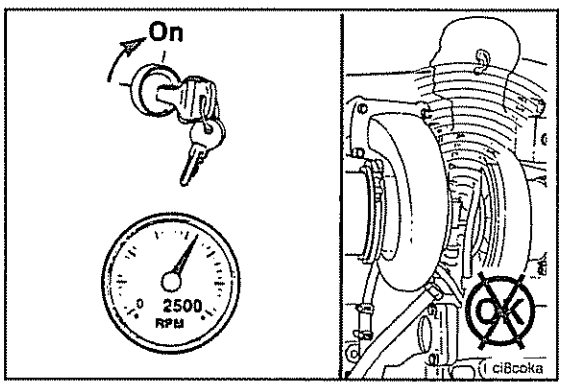


Air Leaks, Air Intake and Exhaust Systems

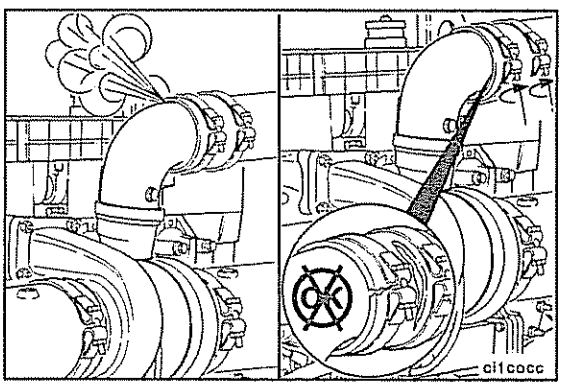
Maintenance Check

Operate the engine at high idle, and use a solution of soapy water to spot intake air leaks.

If an air leak exists, the soap bubbles will be drawn in with the air.



Operate the engine at high idle, and check for air leaks. Listen for whistling noise caused by high-pressure air leaks.



The noise can be caused by an air leak from the following:

Turbocharger-to-charge-air-cooler (CAC) elbow connection.

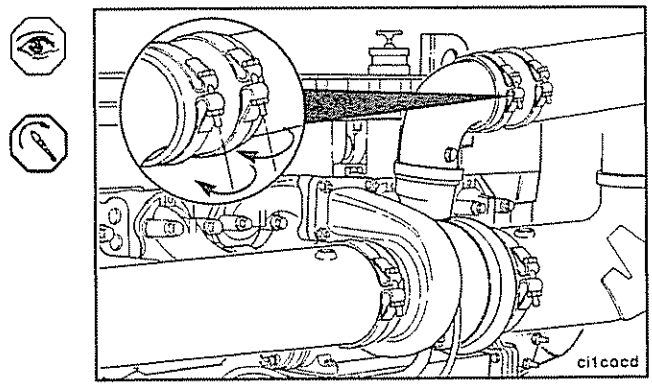
- Inspect the connection and o-ring seal for damage.
- Tighten the v-band clamps.

Torque Value: 8.5 N•m [75 in-lb]

Any CAC piping or connecting hose.

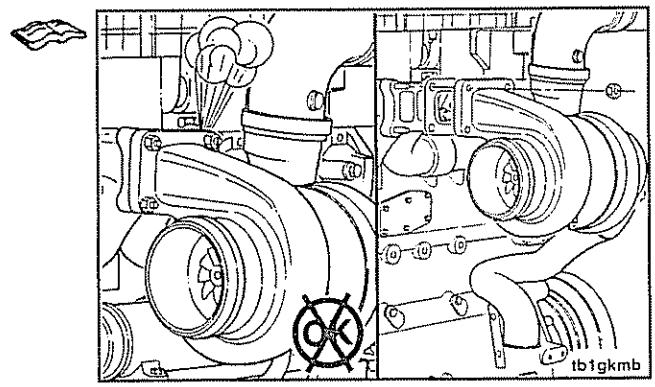
- Inspect the hose and piping for damage.
- Tighten the hose clamps.

Torque Value: 8.5 N•m [75 in-lb]



Turbocharger-to-exhaust-manifold mounting gasket.

- Replace the gasket. Refer to Section A for turbocharger removal and installation.

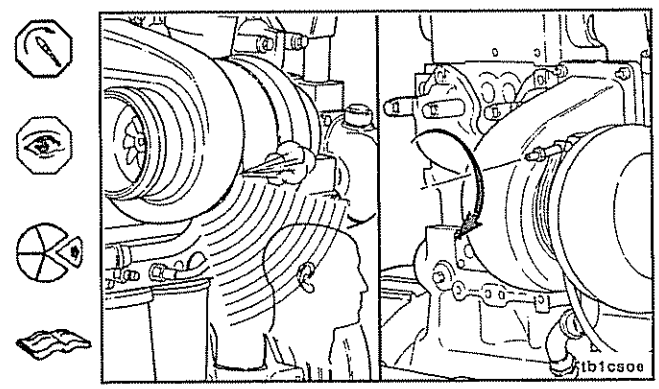


Turbine housing sealing surface air leak.

- Tighten the v-band clamp.

Torque Value: 8.5 N•m [75 in-lb]

- Check for an air leak.
- If an air leak is still present, remove and replace the turbocharger. Refer to Section A for turbocharger removal and installation, or contact a Cummins Authorized Repair Location.

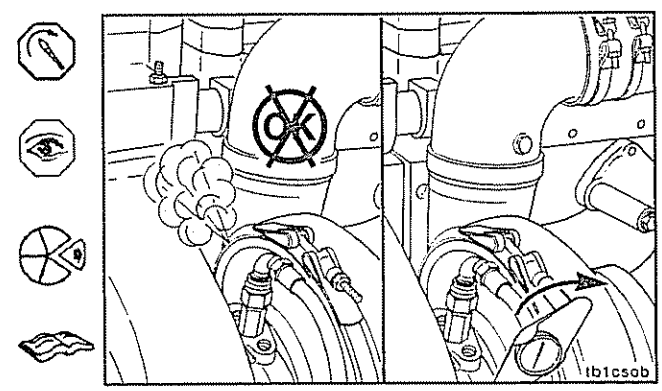


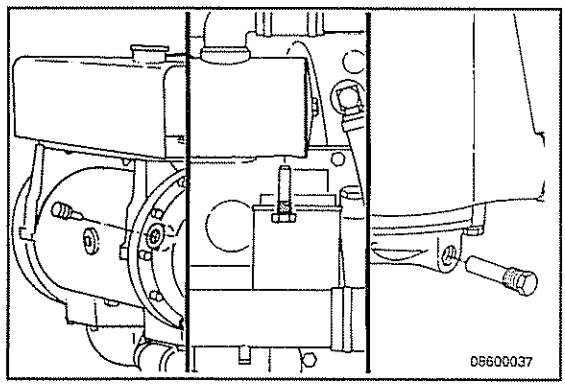
Compressor housing sealing surface air leak.

- Tighten the v-band.

Torque Value: 8.5 N•m [75 in-lb]

- Check for an air leak.
- If an air leak is still present, remove and replace the turbocharger. Refer to Section A for turbocharger removal and installation, or contact a Cummins Authorized Repair Location.

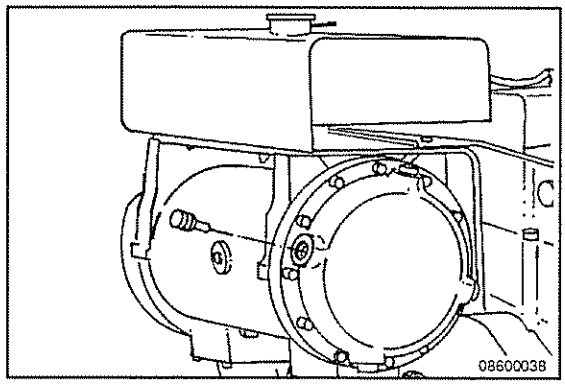




Sacrificial Plug

General Information

Shown are the standard sacrificial zinc plug locations.



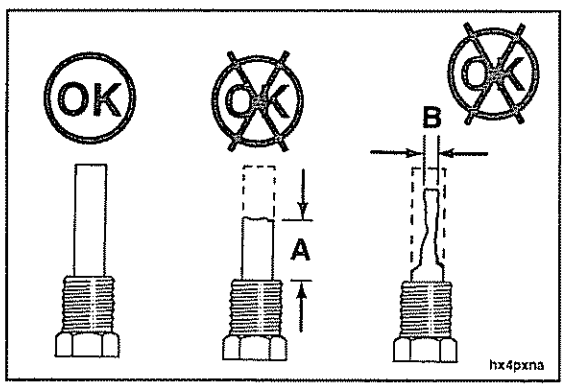
Remove

⚠ CAUTION ⚠

In some cases it is necessary to hold the welded fitting on the heat exchanger with an additional wrench to prevent damage to the exchanger.

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

Remove the sacrificial zinc plug(s).



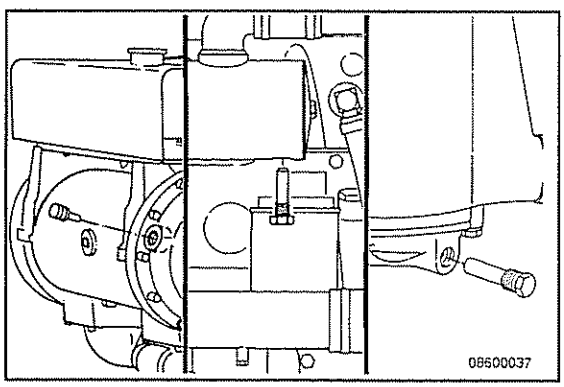
Inspect for Reuse

Inspect the sacrificial zinc plug(s).

Measure the length of all zinc plugs in the heat exchanger. Replace them if they are 50 percent or more eroded.

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

Sacrificial Zinc Plug Erosion Limits			
	mm		in
A	19	MIN	0.750
New	51	MAX	2
B	6.4	MIN	0.250
New	16	MAX	0.625



Install

Install and tighten the sacrificial zinc plug(s).

Torque Value: 47 N•m [35 ft-lb]

Maintenance Procedures at 1500 Hours or 1 Year

Section Contents

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General Information

General Information

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

Overhead Set

Adjust

NOTE: Read the entire procedure for overhead set before attempting to perform this operation.

NOTE: Disconnect the battery cables before performing this operation.

Valves and injectors **must** be correctly adjusted for the engine to operate efficiently. Valve and injector adjustment **must** be performed using the values listed in this section.

Adjust the valves and injectors at each 1500-hour or 1-year interval, and check adjustment after any major repair.

CELECT™ Plus
Valve and Injector Adjustment Values
CELECT™ Plus Injector Adjustments: Bottom and Back Out Two Flats (120 degrees).

	mm		in
Intake Valve			
	0.35	MAX	0.014
Exhaust Valve			
	0.68	MAX	0.027

If valve and injector adjustment is checked during trouble-shooting or before the, 1500-hour or 1-year scheduled maintenance interval, adjustment is **not** required if measurements are within the recheck limits.

Refer to Specification, Section V.

CELECT™ Plus
Valve and Injector Lash Recheck Limits

	mm		in
Intake Valve			
	0.10to 0.41	MAX	0.004to 0.016
Exhaust Valve			
	0.46to 0.76	MAX	0.018to 0.032
CELECT™ Plus Injector			
	0.51to 2.04	MAX	0.020to 0.080

The preferred method of performing normal valve and STC injector overhead adjustment is to use the outer base circle (OBC) method where the crush of the injector plunger to cup is set by tightening the injector rocker lever adjusting screw to a prescribed torque.

STC
Valve and Injector Adjustment Values
STC Injector Adjustment (OBC Method): 125 in-lb

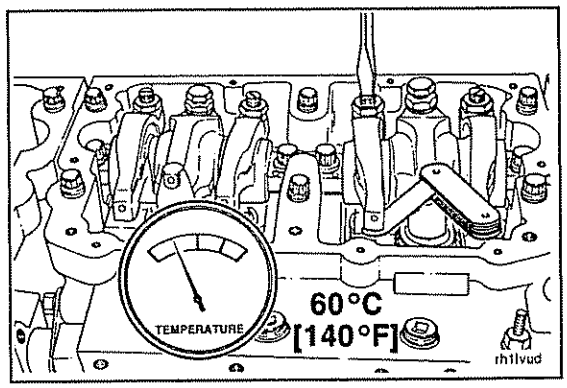
	mm		in
Intake Valve			
	0.35	MAX	0.014
Exhaust Valve			
	0.68	MAX	0.027

Injector

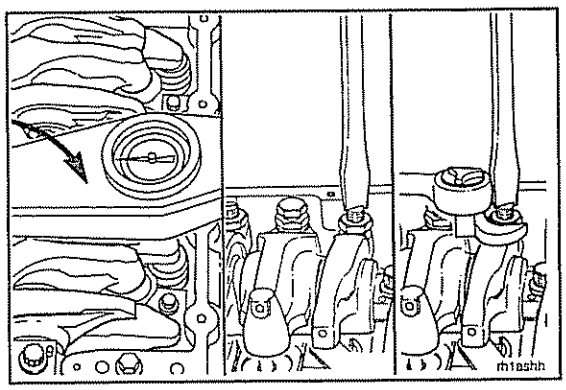
Adjust

STC Engines - OBC Method

All overhead (valve and injector) adjustments **must** be made when the engine is cold (any stabilized coolant temperature at 60°C [140°F] or below).



NOTE: After an engine rebuild or any major repair where the injector setting **must** be disturbed, set all the valves and injectors.



NOTE: Refer to Injector - Removal, Section 7, for information on rocker housing cover removal and installation, engine brake removal and installation, and rocker lever shaft removal and installation.

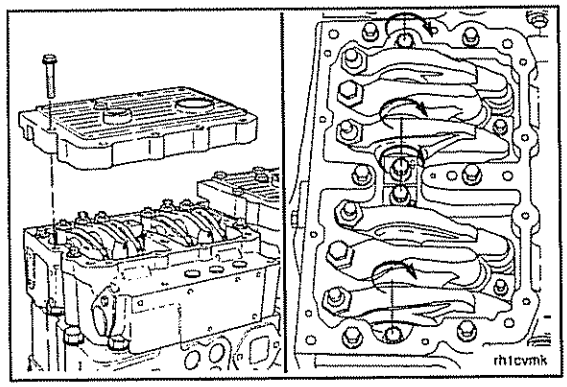
Remove the rocker housing covers. The rocker housing cover gaskets can be used again if they are **not** damaged.

NOTE: Do **not** use solvent to clean the rocker housing cover gasket. Solvent will damage the o-ring material and cause it to swell.

Remove the engine brakes, if applicable.

Tighten the rocker lever shaft capscrews.

Torque Value: 156 N•m [115 ft-lb]

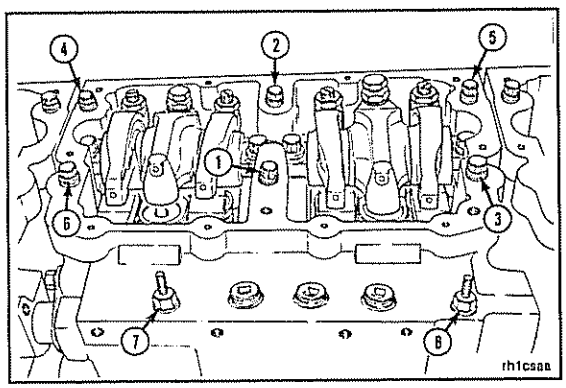


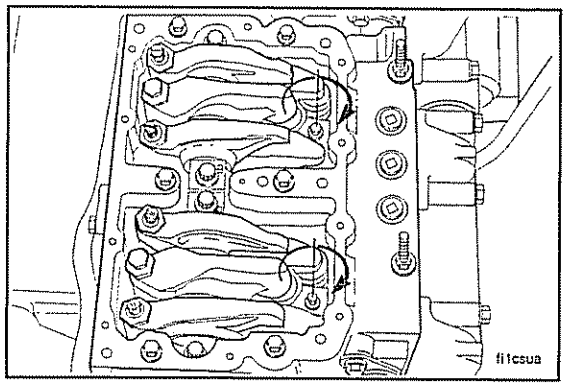
Tighten the rocker housing capscrews in the sequence shown (1 through 6).

Torque Value: 115 N•m [85 ft-lb]

Tighten the rocker housing capscrews in the sequence shown (7 and 8).

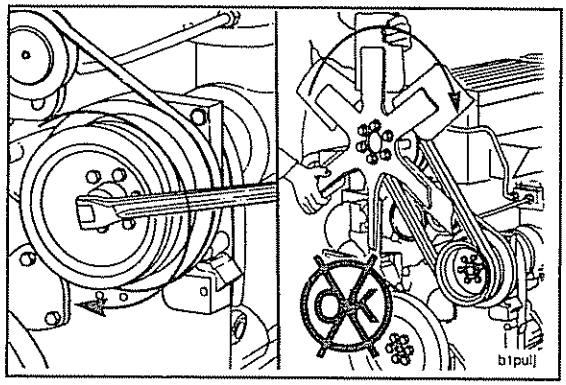
Torque Value: 45 N•m [35 ft-lb]





Tighten the injector hold-down capscrews.

Torque Value: 54 N•m [40 ft-lb]

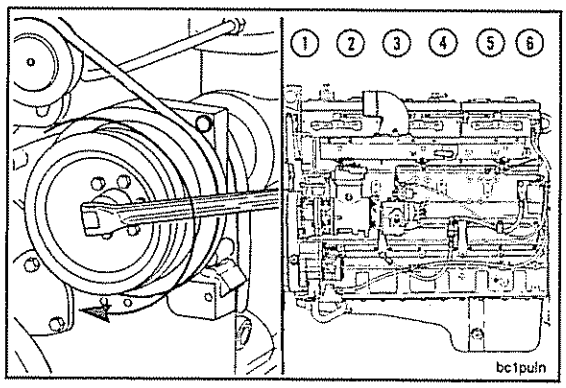


The valve set marks are located on the accessory drive pulley. The marks align with a pointer on the gear cover.

⚠ WARNING ⚠

Do not pull or pry on the fan to rotate the engine manually. To do so can damage the fan blades. Damaged fan blades can cause premature fan failures, that can result in serious personal injury or property damage.

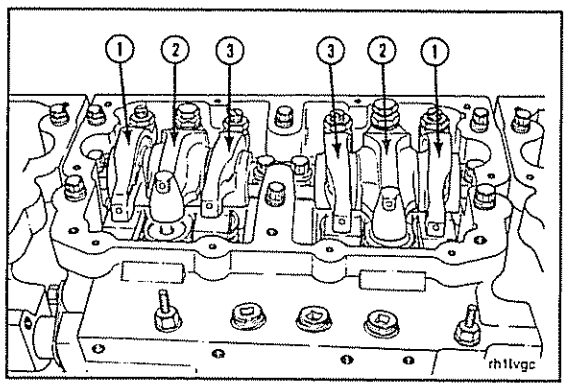
Use the accessory driveshaft to rotate the crankshaft.



The crankshaft rotation is **clockwise** when viewed from the front of the engine.

The cylinders are numbered from the front end of the engine.

The engine firing order is 1-5-3-6-2-4.



Each cylinder has three rocker levers:

- The exhaust rocker levers (1)
- The injector rocker levers (2)
- The intake rocker levers (3).

The two levers closest to the center of each rocker housing are the intake rocker levers. The two levers closest to the ends of the rocker housing are the exhaust rocker levers.

Using the outer base circle (OBC) method, the valves and the injectors on the same cylinder are adjusted at the same index mark on the accessory drive pulley.

Two crankshaft revolutions are required to adjust all the valves and the injectors.

NOTE: It is important to adjust the injector first, before adjusting the valves on a cylinder, when using the OBC overhead set procedure.

STC Engine Outer Base Circle (OBC) Injector and Valve Adjustment Sequence

Bar Engine in Direction of Rotation	Pulley Position	Set Cylinder Injector	Set Cylinder Valve
Start	B	5	5
Advance to	C	3	3
Advance to	A	6	6
Advance to	B	2	2
Advance to	C	4	4
Advance to	A	1	1

Firing Order: 1-5-3-6-2-4

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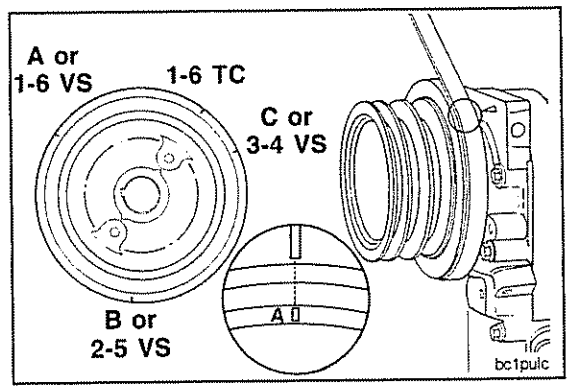
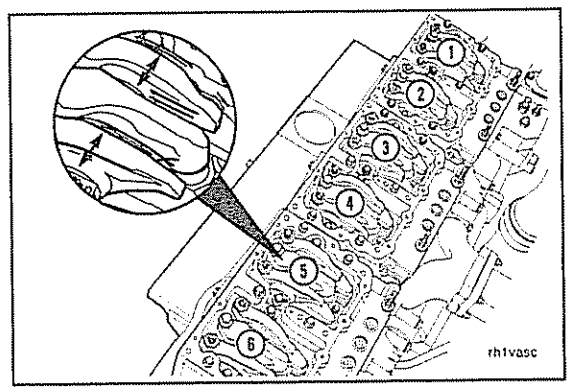
Rotate the accessory drive in the direction of engine rotation. The accessory drive will rotate **clockwise**, on a right-hand engine, when looking at the front of the engine. Align the "B" or "2-5 VS" mark on the accessory drive pulley with the pointer on the gear cover.



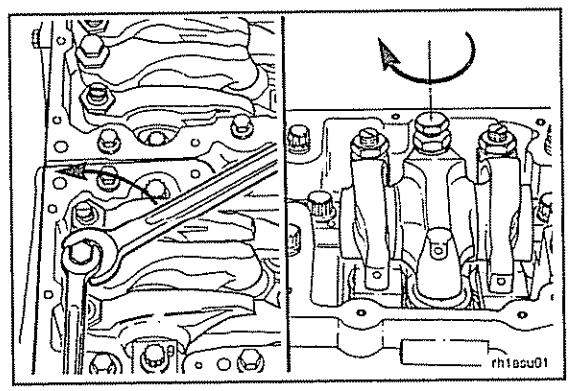
Check the valve rocker levers on cylinder No. 5 to see if both the intake and exhaust valves are closed.

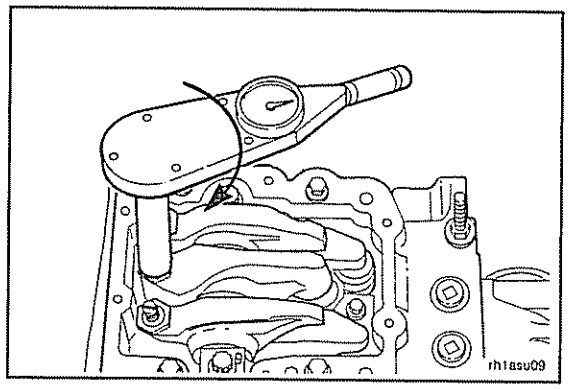
NOTE: Both the intake and exhaust valves are closed when both rocker levers are loose and can be moved from side to side. If both valves are **not** closed, rotate the accessory drive one complete revolution; and align the "B" mark with the pointer again.

If the valve rocker lever adjusting screws have been loosened and **not** yet adjusted, watch the valve push tubes as the engine rolls upon the "B" mark. Both valve push tubes will have moved to the downward (valve closed) position if the engine is on the correct stroke.



Loosen the locknut on the injector adjusting screw on cylinder No. 5.





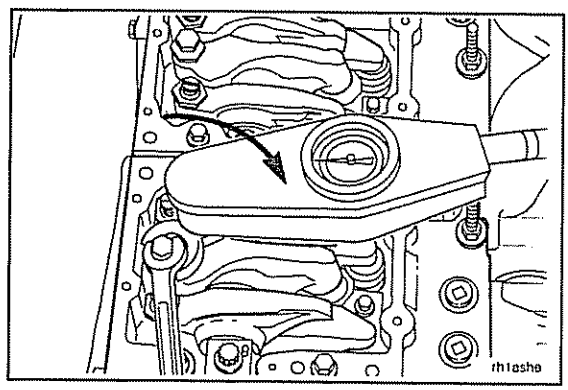
⚠ CAUTION ⚠

An overtightened setting on the injector adjusting screw will produce increased stress on the injector train and the camshaft injector lobe, that can result in engine damage.

Use a dial-type torque wrench to tighten the injector rocker lever adjusting screws to the specified torque. If the screw causes chattering during setting, repair the screw and lever as required.

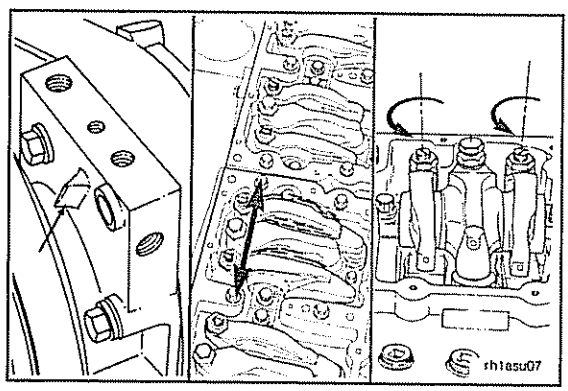
Hold the torque wrench in a position that allows you to look in a direct line at the dial. This is to make sure that you read the dial accurately.

Torque Value: 14 N•m [125 in-lb]



Hold the adjusting screw in this position. The adjusting screws **must not** turn when the locknut is tightened. Tighten the locknut.

Torque Value: 65 N•m [50 ft-lb]

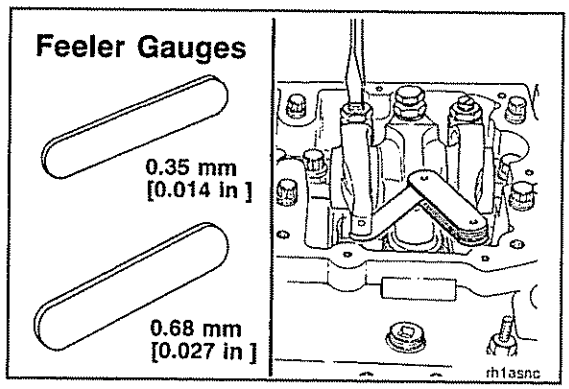


Valve, Cylinder Head

Adjust

STC

With the "B" set mark aligned with the pointer on the gear cover and both valves closed on cylinder No. 5, loosen the locknuts on the intake and the exhaust valve adjusting screws.



Select a feeler gauge for the correct valve lash specification.

Valve Lash Specifications

Intake	Exhaust
0.35 mm [0.014 in]	0.68 mm [0.027 in]

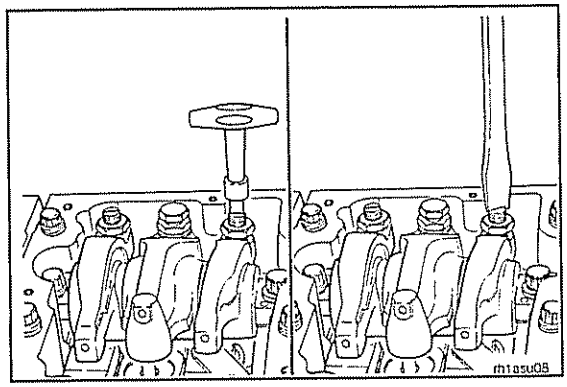
Insert the feeler gauge between the top of the crosshead and the rocker lever nose.

Two different methods for establishing valve lash clearance are described below. Either method can be used; however, the torque wrench method has proven to be the most consistent.

- **Torque Wrench Method:** Use the inch-pound torque wrench, Part No. 3376592, (normally used to set preload on STC injectors), and tighten the adjusting screw.

Torque Value: 0.56 to 0.68 N•m [5 to 6 in-lb]

- **Feel Method:** Tighten the adjusting screw until a slight drag is felt on the feeler gauge.



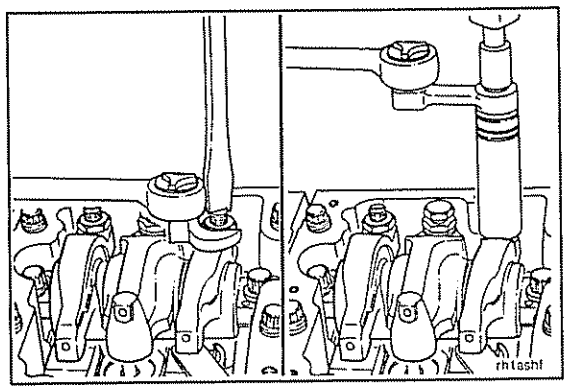
Hold the adjusting screw in this position. The adjusting screw **must not** turn when the locknut is tightened. Tighten the locknut.

With torque wrench adapter, Part No. 3163196.

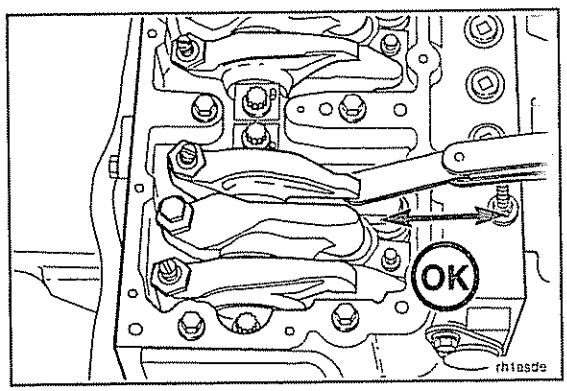
Torque Value: 55 N•m [40 ft-lb]

Without adapter.

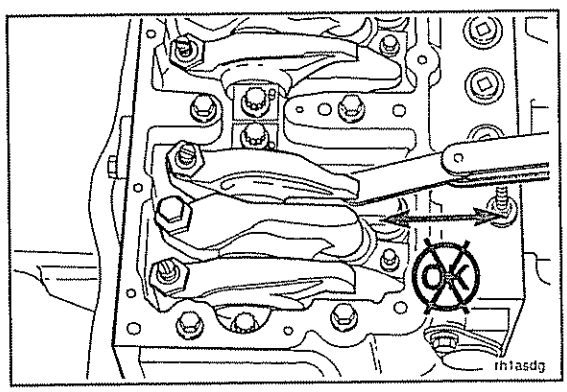
Torque Value: 65 N•m [50 ft-lb]

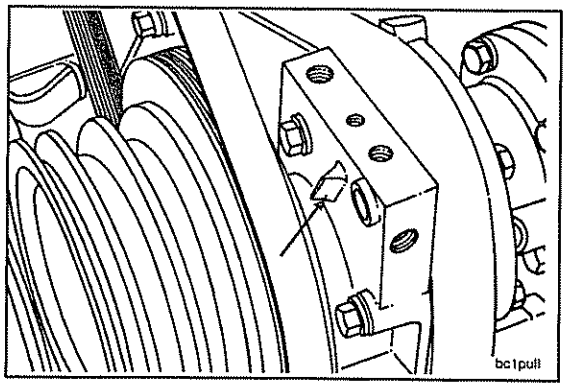


After tightening the locknut to the correct torque value, check to make sure the feeler gauge will slide backward and forward between the crosshead and the rocker lever with **only** a slight drag.



If using the feel method, attempt to insert a feeler gauge that is 0.03 mm [0.001 in] thicker between the crosshead and the rocker lever pad. The valve lash is **not** correct when a thicker feeler gauge will fit.





After adjusting the injector on cylinder No. 5 and the valves on cylinder No. 5, rotate the accessory drive; and align the next valve set mark with the pointer.

STC Engine Outer Base Circle (OBC) Injector and Valve Adjustment Sequence

Bar Engine in Direction of Rotation	Pulley Position	Set Cylinder Injector	Set Cylinder Valve
Start	B	5	5
Advance to	C	3	3
Advance to	A	6	6
Advance to	B	2	2
Advance to	C	4	4
Advance to	A	1	1

Firing Order: 1-5-3-6-2-4

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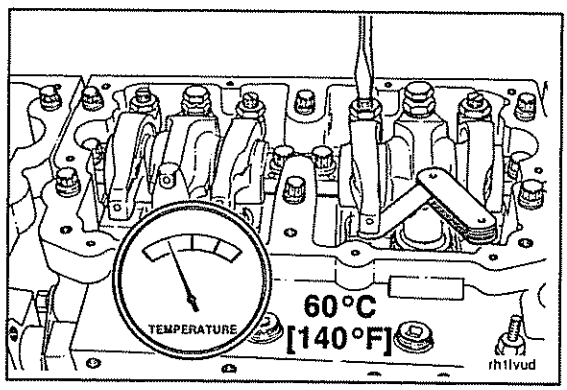
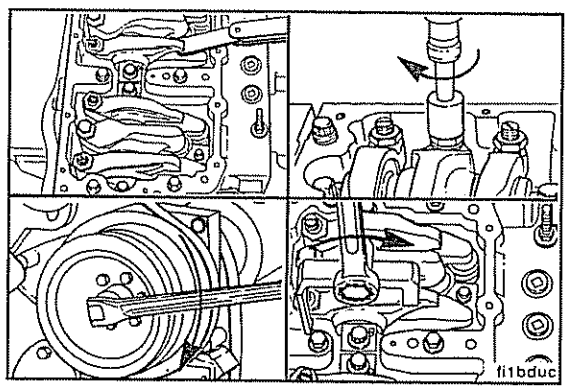
Adjust the appropriate injector and valves following the Injector and Valve Adjustment Sequence Chart.

Repeat the process to adjust all injectors and valves correctly.



CELECT™ Plus

All overhead (valve and injector) adjustments **must** be made when the engine is cold (any stabilized coolant temperature at 60°C [140°F] or below).



NOTE: After an engine rebuild or any major repair where the injector setting **must** be disturbed, set all the valves and injectors.

CELECT™ Plus injectors will provide acceptable engine performance with lash (OBC) anywhere from 0.51 to 2.04 mm [0.020 to 0.080 in]. The procedure for CELECT™ Plus injector reset will produce lash between 0.51 and 0.74 mm [0.020 and 0.029 in]. Under normal operation, there should **never** be a reason to readjust CELECT™ Plus injectors for excessive lash between scheduled maintenance intervals.

NOTE: Refer to Injector - Removal, Section 7, for information on rocker housing cover removal and installation, engine brake removal and installation, and rocker lever shaft removal and installation.

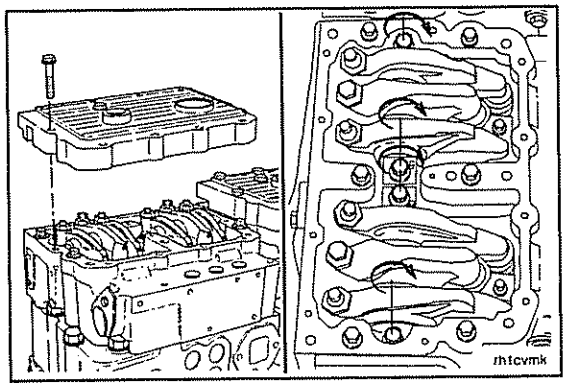
Remove the rocker housing covers. The rocker housing cover gaskets can be used again if they are **not** damaged.

NOTE: Do **not** use solvent to clean the rocker housing cover gasket. Solvent will damage the o-ring material and cause it to swell.

Remove the engine brakes, if applicable.

Tighten the rocker lever shaft capscrews.

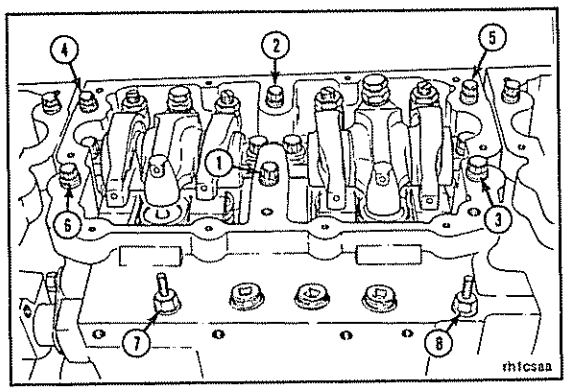
Torque Value: 155 N•m [115 ft-lb]



Tighten the rocker housing capscrews in the sequence shown (1 through 6).

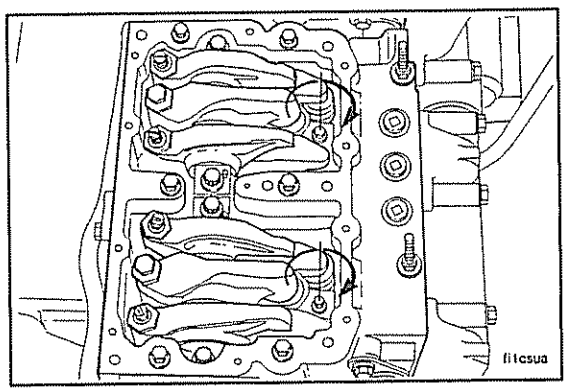
Tighten the rocker housing capscrews in the sequence shown (7 and 8).

Torque Value:		
1 Through 6	115 N•m	[85 ft-lb]
Torque Value:		
7 and 8	45 N•m	[35 ft-lb]



Tighten the injector hold-down capscrews.

Torque Value: 40 N•m [30 ft-lb]

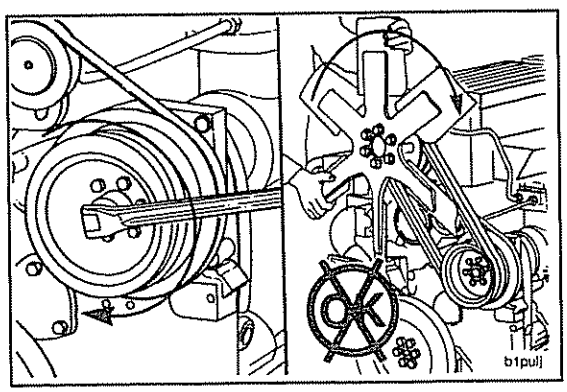


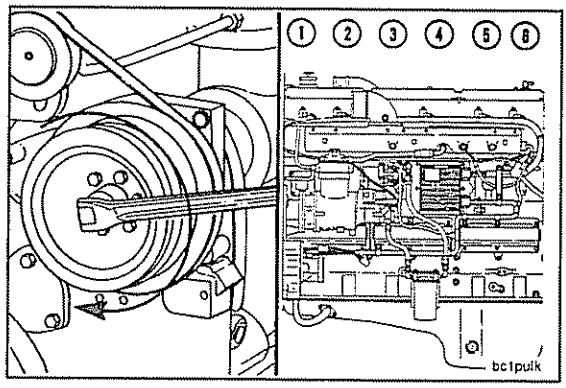
⚠ WARNING ⚠

Do not pull or pry on the fan to rotate the engine manually. To do so can damage the fan blades. Damaged fan blades can cause premature fan failures, that can result in serious personal injury or property damage.

The valve set marks are located on the accessory drive pulley. The marks align with a pointer on the gear cover.

Use the accessory driveshaft to rotate the crankshaft.

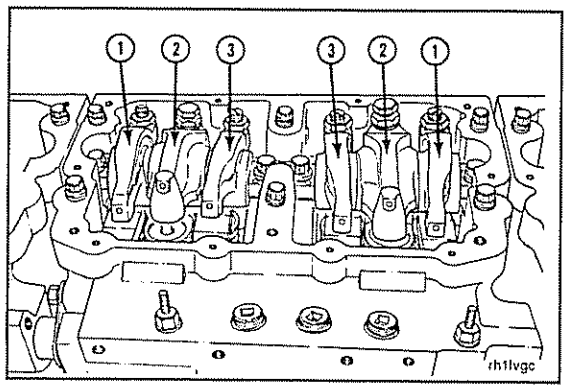




The crankshaft rotation is **clockwise** when viewed from the front of the engine.

The cylinders are numbered from the front end of the engine.

The engine firing order is 1-5-3-6-2-4.



Each cylinder has three rocker levers. The rocker lever nearest to the center of the housing is the intake lever.

- The exhaust rocker levers (1)
- The injector rocker levers (2)
- The intake rocker levers (3).

The two levers closest to the center of each rocker housing are the intake rocker levers. The two levers closest to the ends of the rocker housing are the exhaust levers.

CELECT™ Plus Engines
Injector and Valve Adjustment Sequence

Bar Engine in Direction of Rotation	Pulley Position	Set Cylinder Injector	Set Cylinder Valve
Start	A	1	1
Advance to	B	5	5
Advance to	C	3	3
Advance to	A	6	6
Advance to	B	2	2
Advance to	C	4	4

Firing Order: 1-5-3-6-2-4

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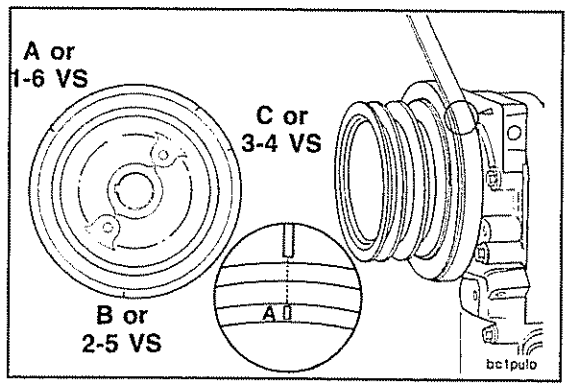
The valves and the injectors on the same cylinder are adjusted at the same index mark on the accessory drive pulley.

One pair of valves and one injector are adjusted at each pulley index mark **before** rotating the accessory drive to the next index mark.

Two crankshaft revolutions are required to adjust all the valves and the injectors.

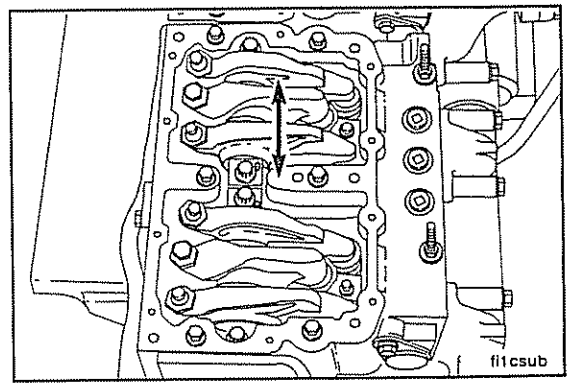


Rotate the accessory drive in the direction of engine rotation. The accessory drive will rotate **clockwise**, on a right-hand engine, when looking at the front of the engine. Align the "A" or "1-6 VS" mark on the accessory drive pulley with the pointer on the gear cover.

Check the valve rocker levers on cylinder No. 1 to see if both valves are closed.

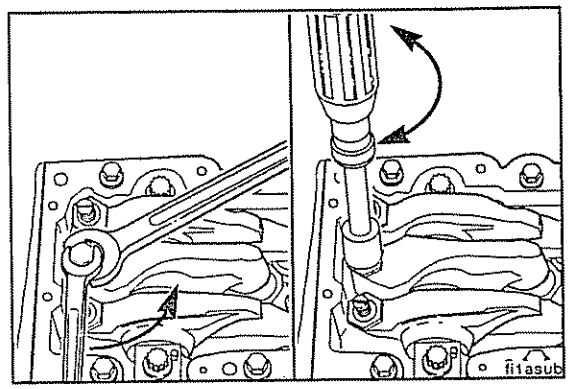
NOTE: Both valves are closed when both rocker levers are loose and can be moved from side to side. If both valves are **not** closed, rotate the accessory drive one complete revolution; and align the "A" mark with the pointer again.

If the valve rocker lever adjusting screws have been loosened and **not** yet adjusted, watch the valve push tubes as the engine rolls upon the "A" mark. Both valve push tubes will have moved to the downward (valve closed) position if the engine is on the correct stroke.



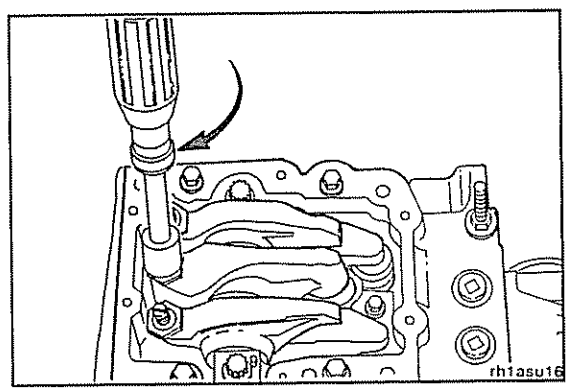
Loosen the injector adjusting screw locknut on cylinder No. 1. Bottom the injector plunger by tightening and loosening the adjusting screw three or four times to remove the fuel.

NOTE: When removing the excess fuel, do **not** apply crush to the injector timing plunger by further tightening the adjusting screw after the plunger is bottomed.



Tighten the adjusting screw on the injector rocker lever until the plunger just touches bottom.

NOTE: Do **not** apply crush to the injector plunger by further tightening the adjusting screw. Doing so will result in an incorrect injector lash setting and can cause excessive injection train wear.

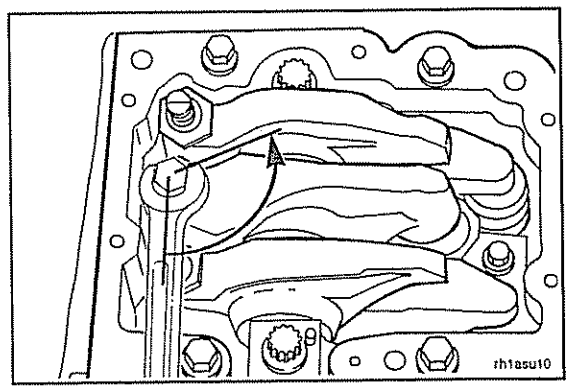


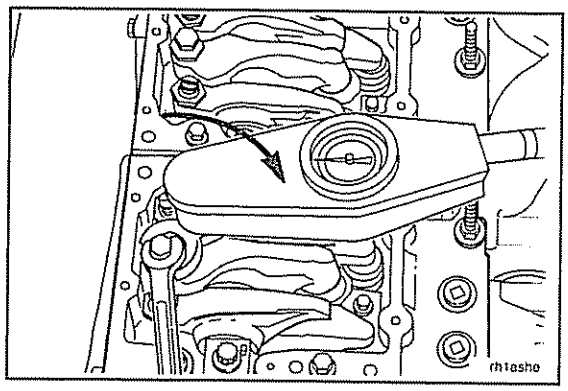
⚠ CAUTION ⚠

After bottoming the CELECT™ Plus injector, make sure to back out the adjusting screw two flats (120 degrees), or damage to the injector will result.

Back out the adjusting screw on the injector rocker lever two flats (120 degrees).

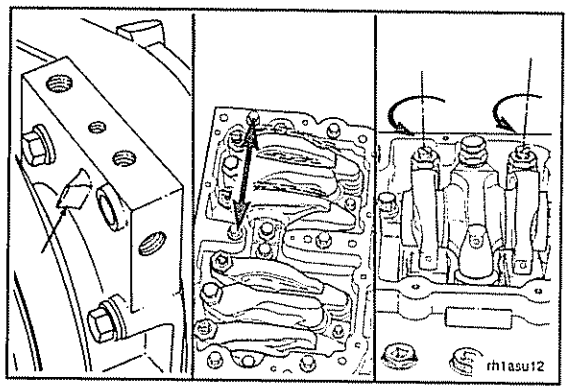
NOTE: Two flats will provide 0.56-mm [0.022-in] lash. The specification is 0.51 to 0.74-mm [0.020 to 0.029-in] lash.





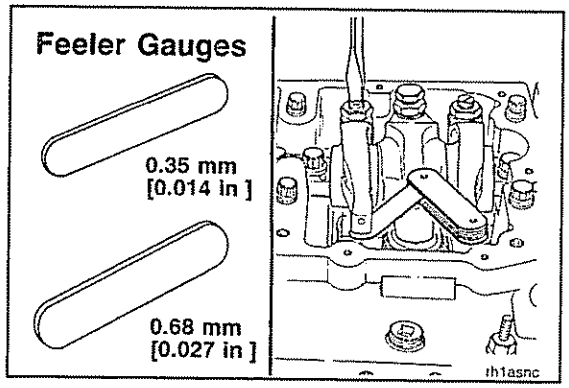
Hold the adjusting screw and tighten the locknut.

Torque Value: 65 N•m [50 ft-lb]



After setting the injector on a given cylinder, set the valves on the same cylinder.

With the "A" set mark aligned with the pointer on the gear cover and both valves closed on cylinder No. 1, loosen the locknuts on the intake and the exhaust valve adjusting screws.

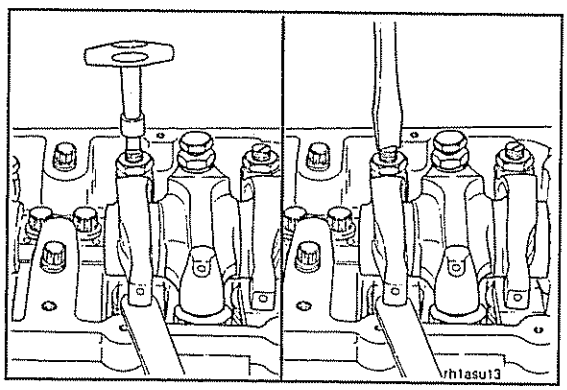


Select a feeler gauge for the correct valve lash specification.

Valve Lash Specifictions

Intake	Exhaust
0.35 mm [0.014 in]	0.68 mm [0.027 in]

Insert the feeler gauge between the top of the crosshead and the rocker lever pad.



Two different methods for establishing valve lash clearance are described below. Either method can be used; however, the torque wrench method has proven to be the most consistent.

- **Torque Wrench Method:** Use the inch-pound torque wrench, Part No. 3376592, (normally used to set preload on STC injectors), and tighten the adjusting screw.

Torque Value: 0.56 to 0.68 N•m [5 to 6 in-lb]

- **Feel Method:** Tighten the adjusting screw until a slight drag is felt on the feeler gauge.

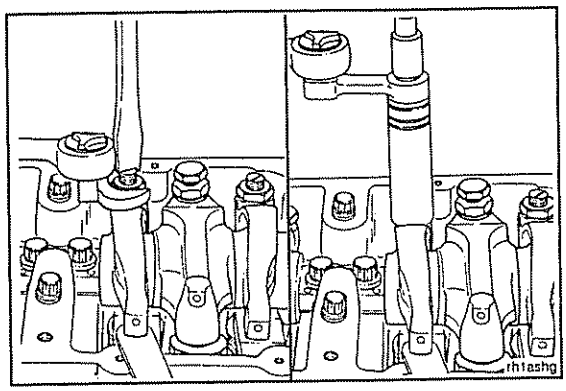
Hold the adjusting screw in this position. The adjusting screw **must not** turn when the locknut is tightened.

Torque Value:

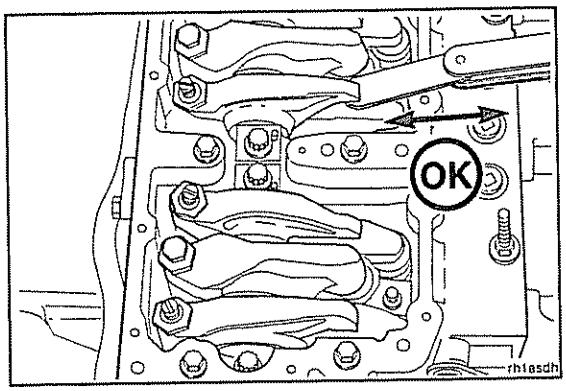
Without Torque Wrench Adapter	65 N•m	[47 ft-lb]

Torque Value:

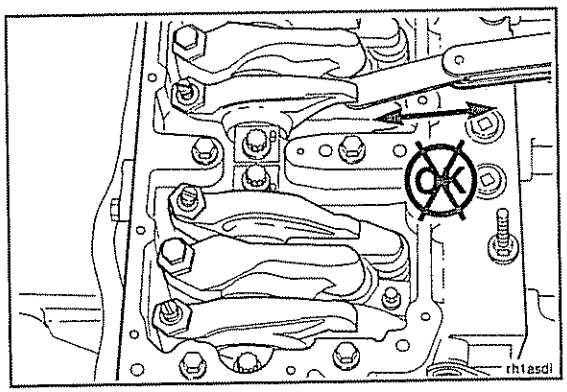
With Torque Wrench Adapter, Part No. 3163196:	55 N•m	[40 ft-lb]



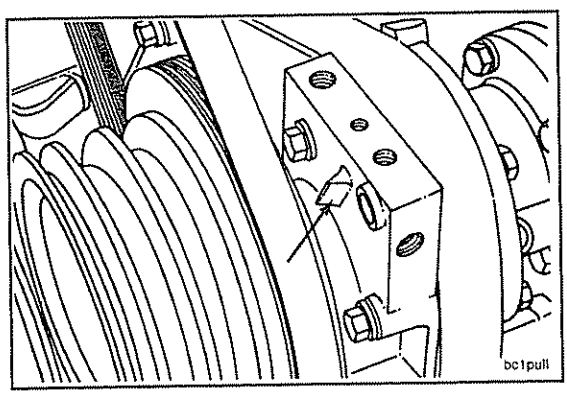
After tightening the locknut to the correct torque value, check to make sure the feeler gauge will slide backward and forward between the crosshead and the rocker lever with **only** a slight drag.



If using the feel method, attempt to insert a feeler gauge that is 0.03 mm [0.001 in] thicker between the crosshead and the rocker lever pad. The valve lash is **not** correct when a thicker feeler gauge will fit.



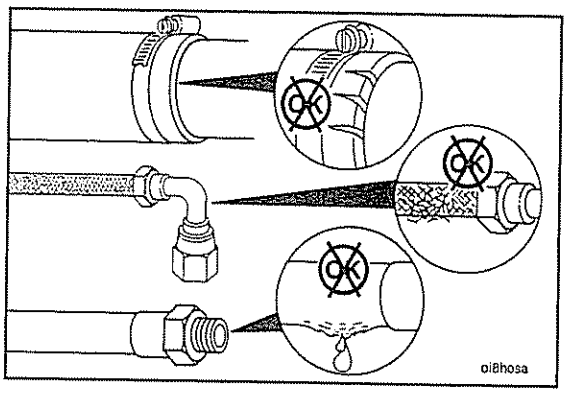
After adjusting the injector on cylinder No. 1 and the valves on cylinder No. 1, rotate the accessory drive; and align the next valve set mark with the pointer.



CELECT™ Plus Engines Injector and Valve Adjustment Sequence			
Bar Engine in Direction of Rotation	Pulley Position	Set Cylinder Injector	Valve
Start	A	1	1
Advance to	B	5	5
Advance to	C	3	3
Advance to	A	6	6
Advance to	B	2	2
Advance to	C	4	4
Firing Order: 1-5-3-6-2-4			00110012

Adjust the appropriate injector and valves following the Injector and Valve Adjustment Sequence Chart.

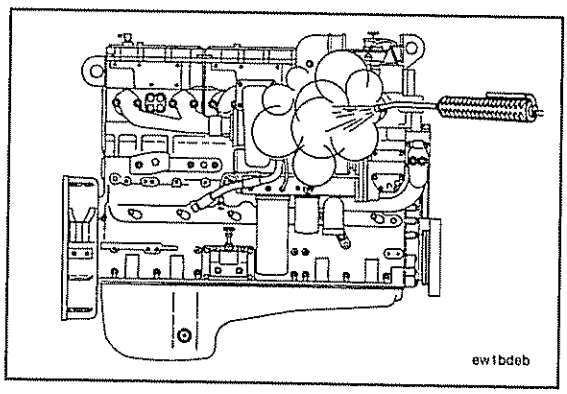
Repeat the process to adjust all injectors and valves correctly.



Flexible Hose

Maintenance Check

Annually inspect the cooling system hoses and hose connections for leaks or deterioration. Particles of deteriorated hose can be carried through the cooling system and slow or partially stop circulation.



Engine Assembly

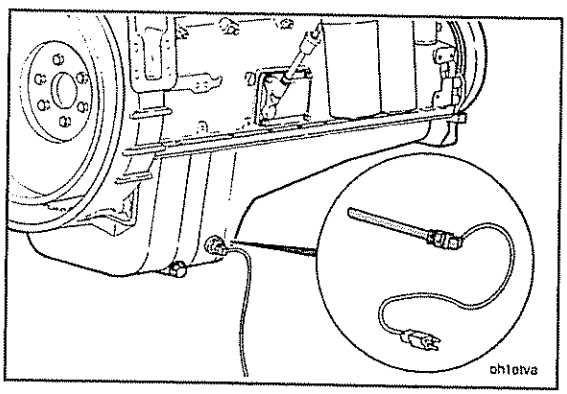
Steam Cleaning

⚠ WARNING ⚠

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

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

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



Engine Oil Heater

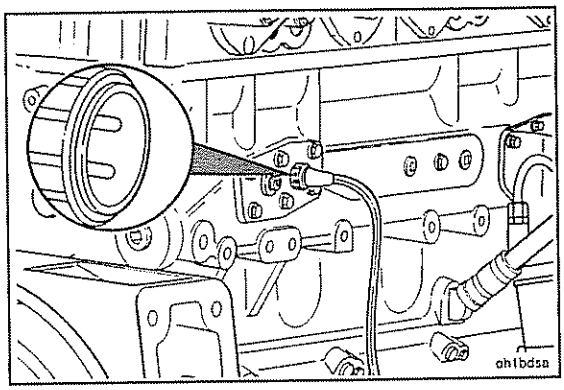
Maintenance Check

- Oil pan heater.

Check for proper operation. Inspect for loose connections, frayed wires, and oil leaks. Repair or replace as needed.

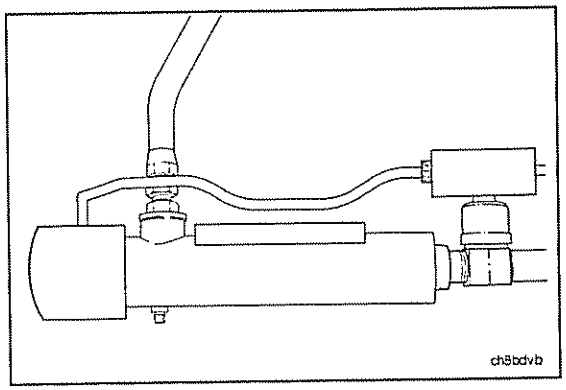
- Block heater.

Check for proper operation. Inspect for loose connections, frayed wires, and oil leaks. Repair or replace as needed.



- Engine preheater (coolant).

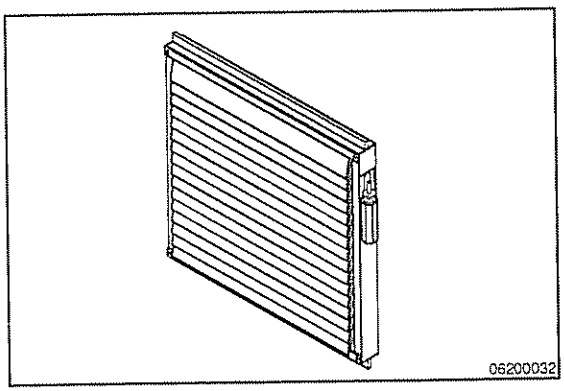
Check for proper operation. Inspect for loose connections, frayed wires, and coolant leaks. Clean alkali and sludge out of the unit. Clean scale from the copper heating element with a wire brush.



Radiator Shutter Assembly

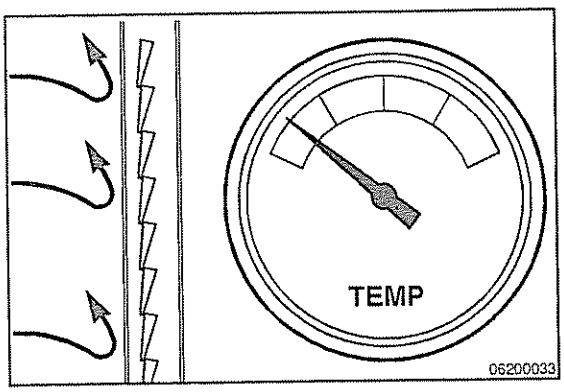
Maintenance Check

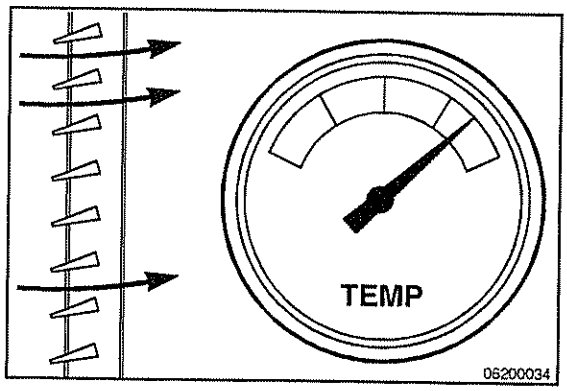
Check the shutters and the thermatic fan every 1500 hours.



Check the shutters in the closed position to be sure they are completely closed.

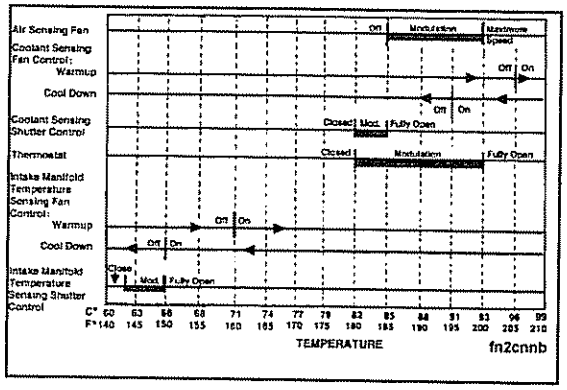
NOTE: If the shutters are **not** closed, refer to the manufacturer's instructions.



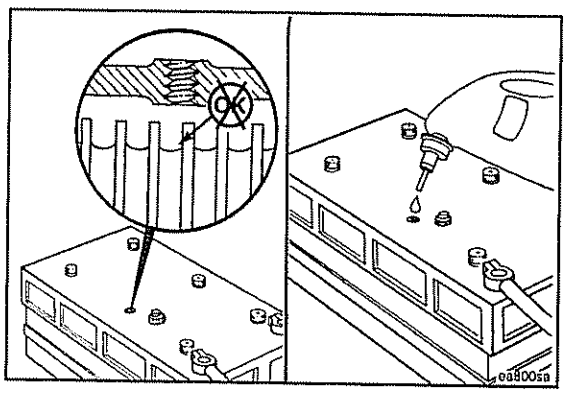


Be sure the shutters open completely at the desired temperature setting.

NOTE: If the shutters are **not** open, refer to the manufacturer's instructions.



Shutters and thermatic fans **must** be set to operate in the same temperature range as the thermostat with which they are used. Refer to the Thermal Control Settings chart in Section 1.



Batteries

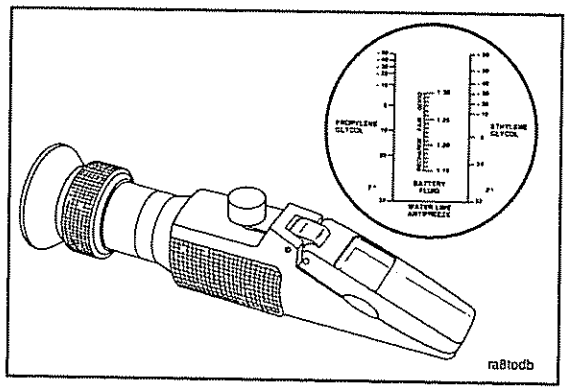
Maintenance Check

⚠ WARNING ⚠

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

If conventional batteries are used, remove the cell caps or covers, and check the electrolyte (water and sulfuric acid solution) level. Fill each battery cell with distilled water. Refer to the manufacturer's specifications.

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



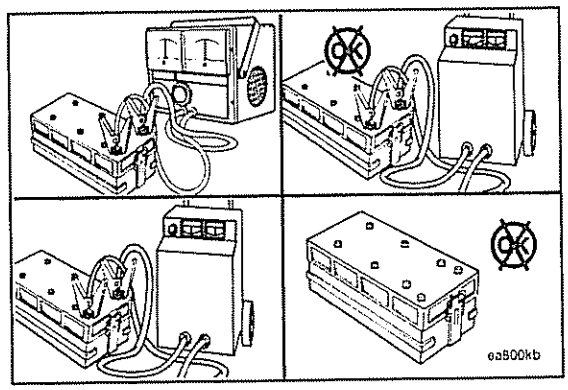
Use the Fleetguard® refractometer, Part No. CC-2800, to check the condition of the battery.

Refer to the battery fluid column in the refractometer to determine the state of charge of each battery cell.

Use a battery tester to 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 will **not** maintain a charge.



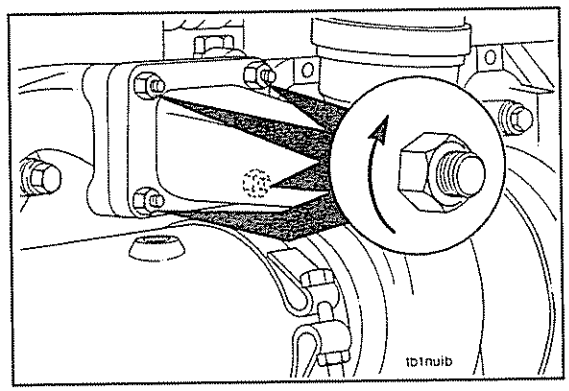
Turbocharger

Maintenance Check

Check the turbocharger mounting nuts annually.

Tighten the mounting nuts.

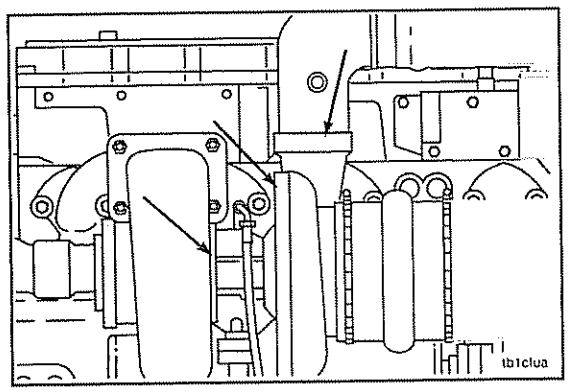
Torque Value: 48 N•m [35 ft-lb]



Check the v-band clamps. Tighten the clamps:

- Discharge/elbow
- Compressor housing
- Turbine housing.

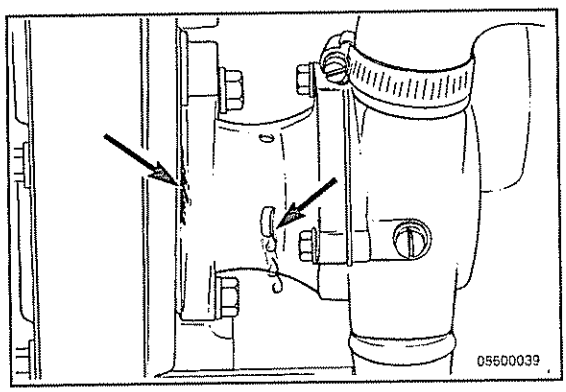
Torque Value: 8 N•m [75 in-lb]

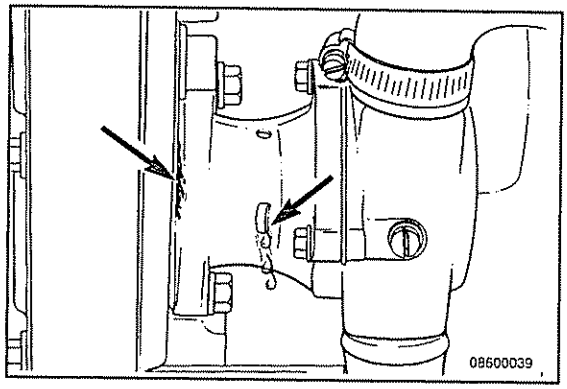


Sea Water Pump

Maintenance Check

Inspect the sea water pump for evidence of water or oil indicating seal leakage.

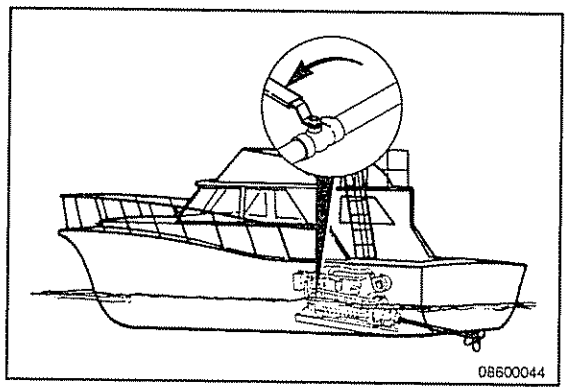




Inspect the inlet and outlet connections for leakage.

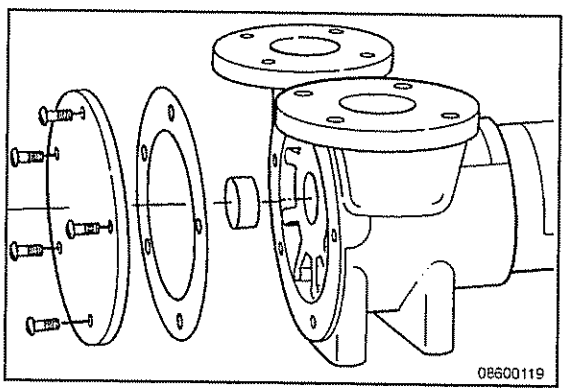
Inspect the housing's mating area for leakage.

Inspect the pump-to-block mating area for oil leakage.

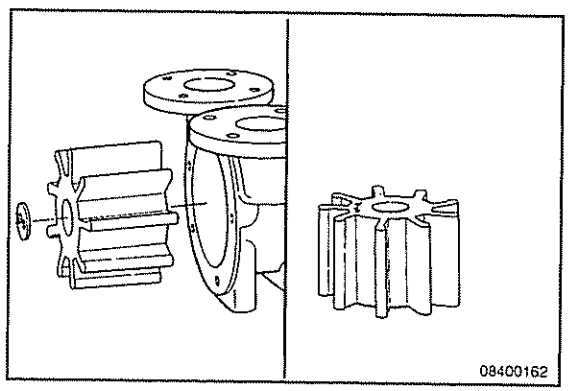


Remove

Shut off the sea water inlet valve.



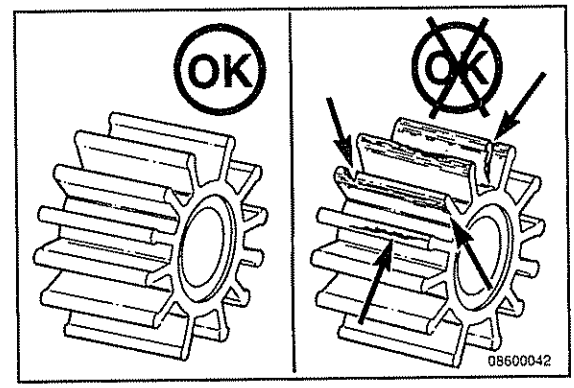
Remove the screws, cover, and gasket from the sea water pump housing.



NOTE: Note the rotation of the impeller before removing.

Remove the spline seal and impeller.

Inspect for Reuse



⚠ CAUTION ⚠

If the impeller has failed, the heat exchanger must be flushed. Impeller debris can also drop into the pump inlet opening. Make sure all debris is flushed before installing the new impeller.

Inspect for damage such as rips, tears, or chunks of material missing.

Replace as necessary.

Clean the impeller housing.

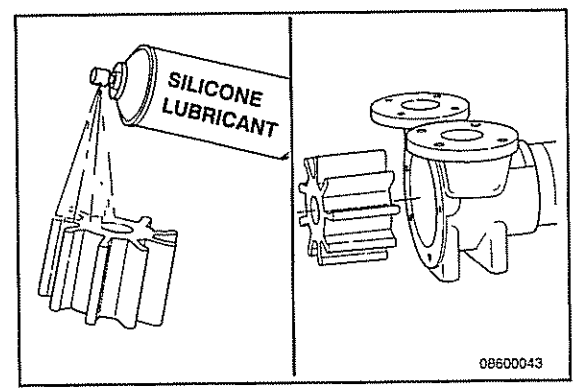
Remove any old gasket from the pump housing and cover plate.

Check the housing for cracks or other damage.

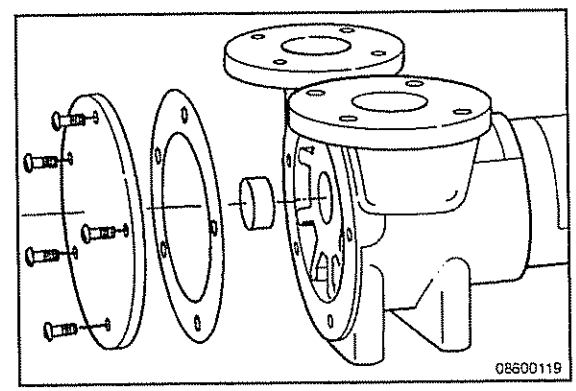
Install

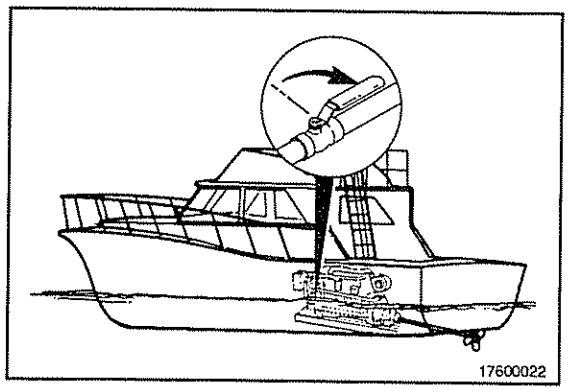
NOTE: If installing the used impeller, note that the impeller is returned to the housing with the same rotation as when it was removed.

Use clean glycerin, silicone spray, or nonpetroleum-base lubricant to lubricate the impeller before installing it into the housing.

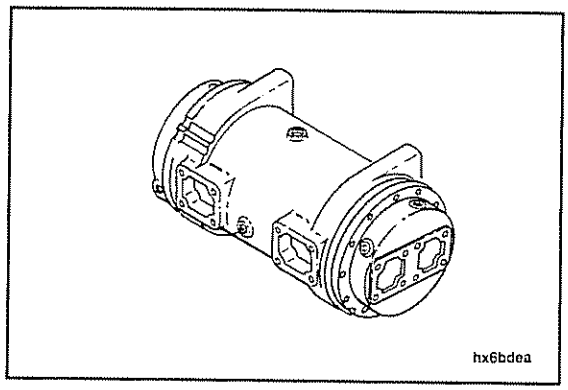


Install the cover plate and a new gasket if necessary.





Open the sea water inlet valve.



Sea Water Heat Exchanger

Clean

Backflush the sea water passages of the heat exchanger.

Maintenance Procedures at 6000 Hours or 2 Years

Section Contents

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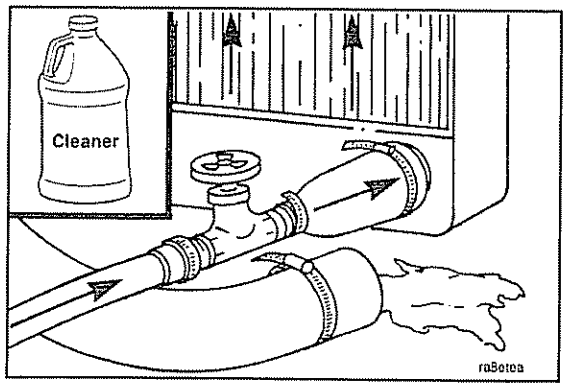
General Information

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



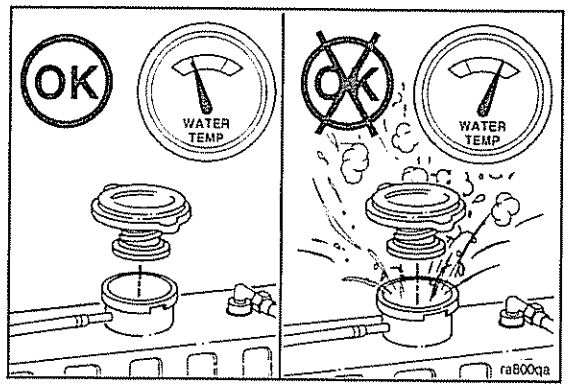
Cooling System

Clean

⚠ CAUTION ⚠

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

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

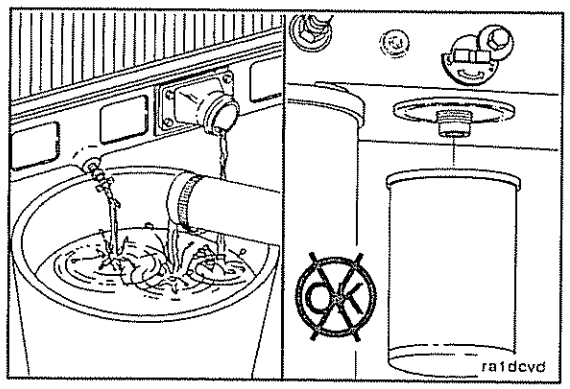


⚠ WARNING ⚠

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap. Failure to do so can cause personal injury from heated coolant spray.

NOTE: The performance of RESTORE™ is dependent on time, temperature, and concentration levels. An extremely scaled or flow-restricted system, for example, can require higher concentrations of cleaners, higher temperatures, or longer cleaning times or the use of RESTORE PLUS™. RESTORE™ can be safely used up to twice the recommended concentration levels; RESTORE PLUS™ **must** be used **only** at its recommended concentration level. Extremely scaled or fouled systems can require more than one cleaning.

RESTORE™ CC2610 (1 gallon)
RESTORE™ CC2611 (5 gallons)
RESTORE™ CC2612 (55 gallons)
RESTORE PLUS™ CC2638 (1 gallon)



NOTE: Engine coolant and RESTORE™ **must** be disposed of in a responsible manner. Please consult the local environmental agency for recommended disposal guidelines.

Drain the cooling system. Do **not** allow the cooling system to dry out. RESTORE™ will **not** be as effective if the cooling system is allowed to dry.

Do **not** remove the coolant filter.

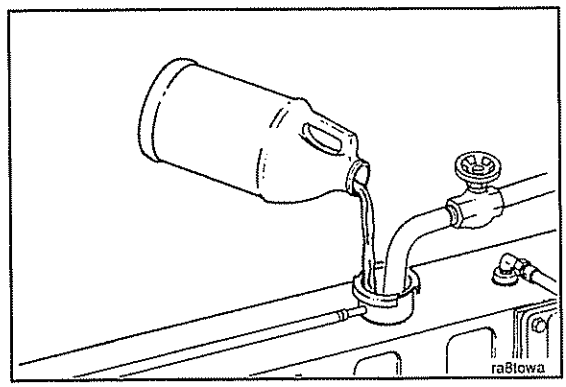
⚠ WARNING ⚠

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

⚠ CAUTION ⚠

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

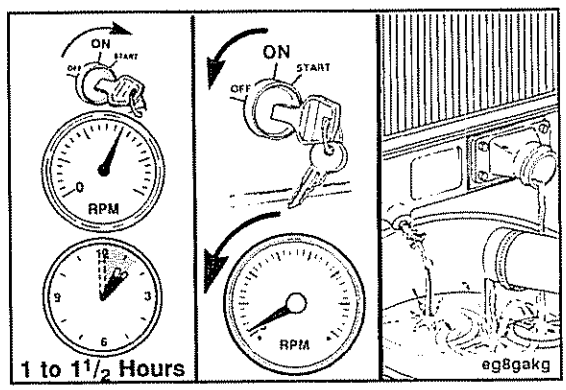
Immediately add 3.8 liters [1 gal] of Fleetguard® RESTORE™, RESTORE PLUS™, or equivalent for each 38 to 57 liters [10 to 15 gal] of cooling system capacity, and fill the system with plain water.



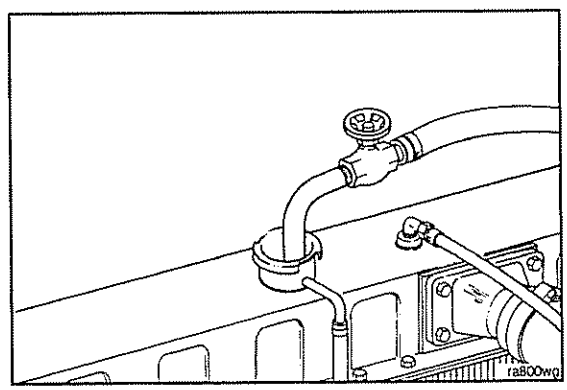
Turn the heater temperature switch to high to allow maximum coolant flow through the heater core. The blower does **not** have to be on.

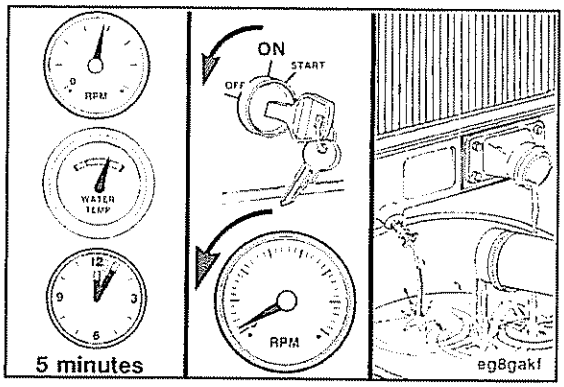
Operate the engine at normal operating temperatures (at least 85°C [185°F]) for 1 to 1-1/2 hours.

Shut off the engine, and drain the cooling system.



Fill the cooling system with clean water to flush the cooling system.

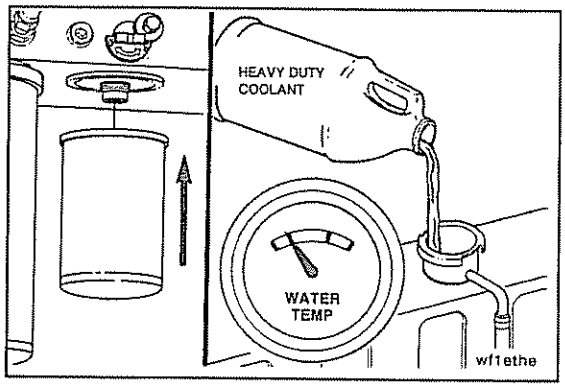




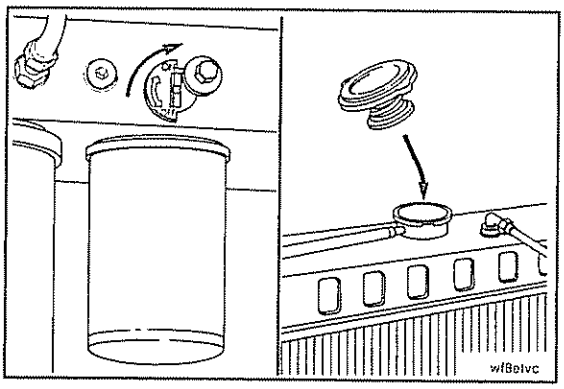
Operate the engine at high idle for 5 minutes with the coolant temperature above 85°C [185°F].

Shut the engine off, and drain the cooling system.

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



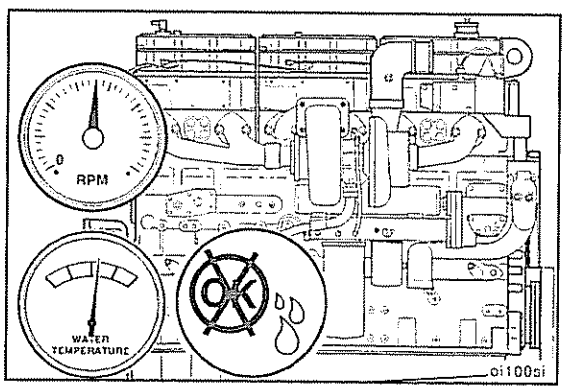
Fill the cooling system with heavy-duty coolant. Heavy-duty coolant is defined as a correct mixture of good-quality water, low-silicate antifreeze, and supplemental coolant additives. Refer to Section V for the correct way to mix heavy-duty coolant. Install the correct service filter. Refer to the supplemental coolant additives Service Filter Selection Chart in Section V.



⚠ CAUTION ⚠

Engine damage will result if the valve is left closed.

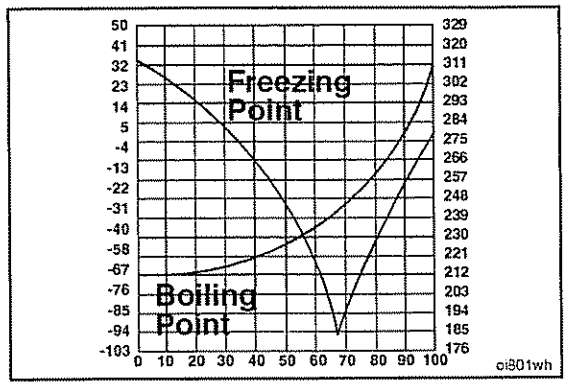
Open the shutoff valve, and install the coolant system pressure cap.



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

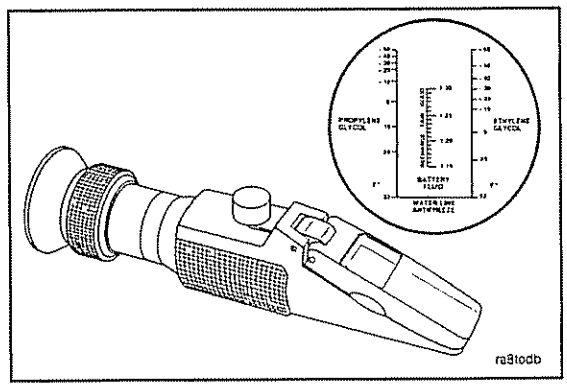
Low-silicate antifreeze **must** be mixed with quality water at a 50/50 ratio (40- to 60-percent working range). A 50/50 mixture of antifreeze and water gives a -34°F freezing point and a boiling point of 228°F, that is adequate for locations in North America. The actual lowest freezing point of ethylene glycol antifreeze is at 68 percent. Using higher concentrations of antifreeze will raise the freezing point of the solution and increase the possibility of a silica gel problem.

Refer to Section V for Coolant Recommendations and Specifications.

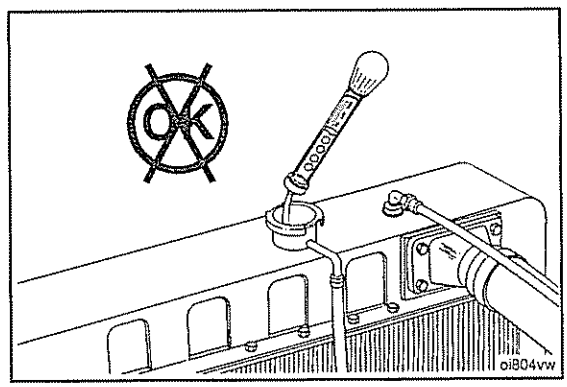


The Fleetguard® refractometer, Part No. C2800, provides a reliable and easy-to-read measurement of freezing point protection and glycol (antifreeze) concentration.

The freezing point protection **must** be checked if coolant is added to the cooling system. Refer to the manufacturer's instructions for correct operation.



Using floating ball hydrometers will give incorrect readings.



Fan Hub, Belt Driven

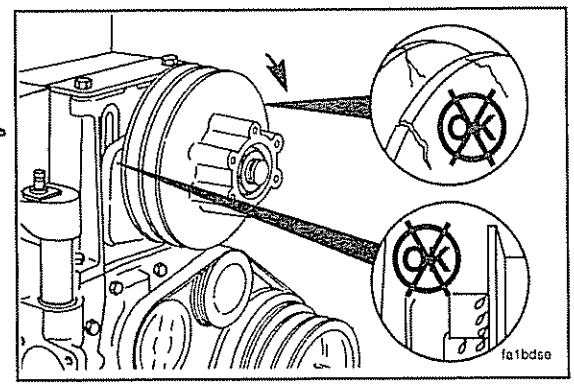
Maintenance Check

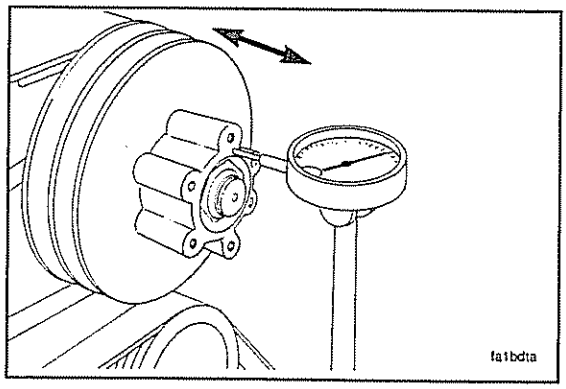
Inspect the fan hub for the following:

- Freedom of rotation
- Cracks
- Grease seal leakage.

Repair or replace the fan hub if the fan hub does **not** rotate freely or if there is evidence of cracks or grease seal leakage.

Refer to the N14 Troubleshooting and Repair Manual, Bulletin No. 3666142, or contact a Cummins Authorized Repair Location for removal and replacement instructions.

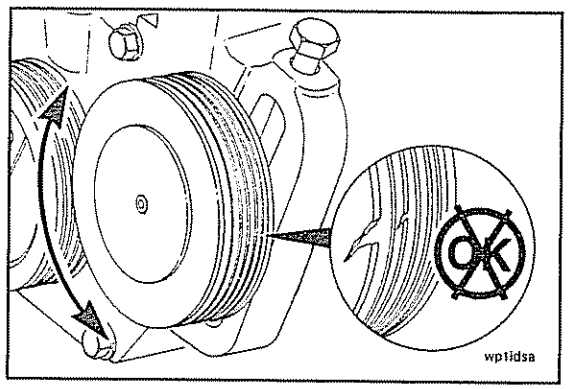




Measure the fan hub **end clearance**. Fan hubs with step-bore shafts and no bearing spacers **must** be 0.08 to 0.25-mm [0.003 to 0.010-in] end clearance.

Fan hubs with through-bore shafts with inner and outer bearing spacers **must** be 0.08 to 0.41-mm [0.003 to 0.016-in] end clearance.

Replace the fan hub if the end clearance is **not** within these specifications. Refer to the Troubleshooting and Repair Manual, N14 Series Engines (STC, CELECT™, CELECT™ Plus model), Bulletin No. 3666142, or contact a Cummins Authorized Repair Location for removal and replacement instructions.



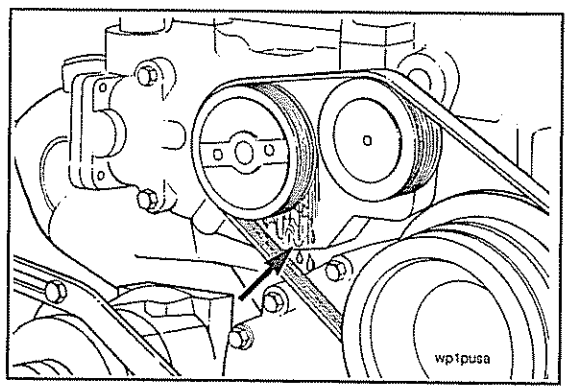
Water Pump Idler Assembly

Maintenance Check

Inspect the water pump idler pulley assembly for the following:

- Freedom of rotation
- Cracked, chipped, or broken pulley grooves.

Repair or replace the idler pulley assembly if it does **not** rotate freely or if damage is found. Refer to the Troubleshooting and Repair Manual, N14 Series Engines (STC, CELECT™, CELECT™ Plus model), Bulletin No. 3666142, or contact a Cummins Authorized Repair Location for removal and replacement instructions.



Water Pump

Maintenance Check

△ CAUTION △

When replacing a water pump, use only pumps specified for the N14; engine damage will occur if water pumps from the 88NT or any other Big Cam® engine models are installed on the N14.

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

NOTE: A streak or chemical buildup is **not** justification for water pump replacement. If a continuous water leak, i.e., a stream or drip is indicated, replace the water pump with a new or rebuilt unit as necessary. Refer to the Troubleshooting and Repair Manual, N14 Series Engines (STC, CELECT™, CELECT™ Plus model), Bulletin No. 3666065, for removal and replacement instructions.

Turbocharger

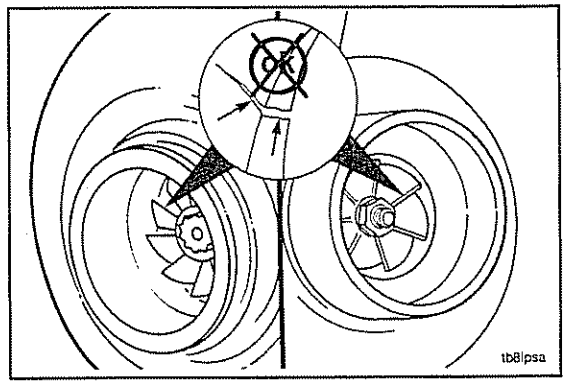
Inspect

Remove the air intake and the exhaust piping.

Check for damaged or cracked compressor or turbine blades.

Make sure the turbocharger shaft spins freely.

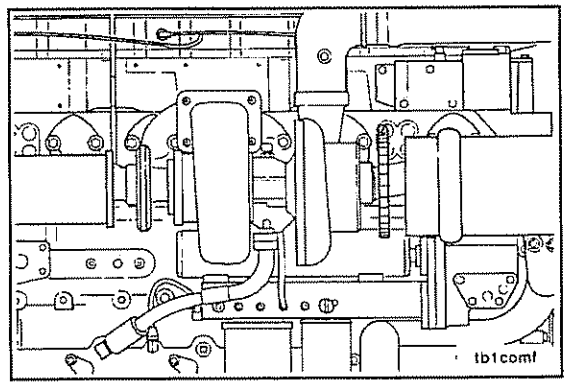
NOTE: If inspections or dimensional checks indicate a problem, contact a Cummins Authorized Repair Location for assistance. Refer to the model number on the turbocharger dataplate.



Turbocharger Axial Clearance

Maintenance Check

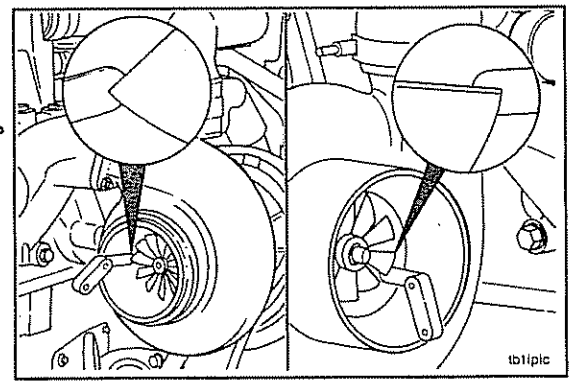
Remove the intake and the exhaust piping from the turbocharger.



Use a narrow-width feeler gauge to measure the radial clearance (side to side).

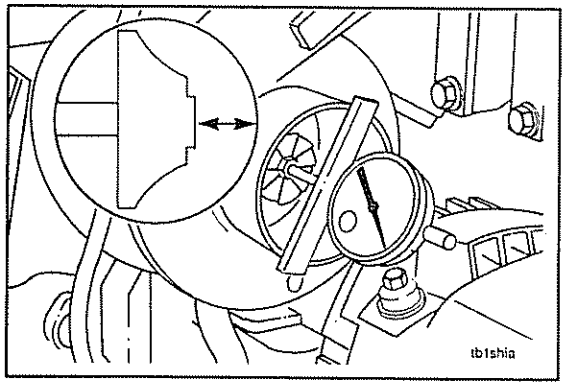
NOTE: Hold the shaft toward the feeler gauge to check this dimension.

Rebuild or replace the turbocharger if the radial clearance is greater than specified. Refer to the Troubleshooting and Repair Manual, N14 Series Engines (STC, CELECT™, CELECT™ Plus model), Bulletin No. 3666065, for removal procedures. Refer to the Turbocharger Rebuild Manual for rebuild procedures.



Radial Clearance (Side to Side)

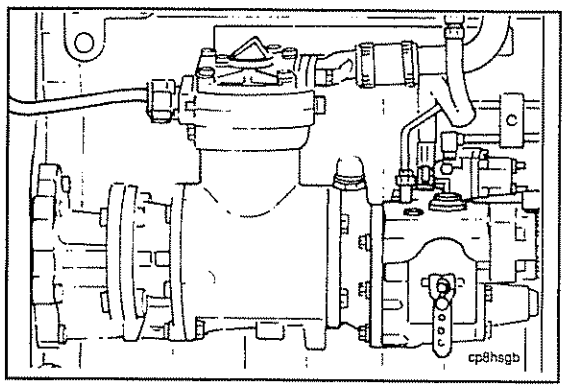
Turbocharger	Dimension	
Model No	Minimum	Maximum
BHT3C		
Compressor Impeller	0.18 mm [0.007 in]	0.46 mm [0.018 in]
Turbine Wheel	0.25 mm [0.010 in]	0.53 mm [0.021 in]



Measure axial clearance (end to end), using dial depth gauge, Part No. ST-537.

Rebuild or replace the turbocharger if axial clearance is greater than specified. Refer to the N14 Troubleshooting and Repair Manual, Bulletin No. 3666065, for removal procedures. Refer to the Turbocharger Rebuild Manual for rebuild procedures.

Turbocharger Model No.	Dimension	
	Minimum	Maximum
BHT3C	0.03 mm [0.001 in]	0.10 mm [0.004 in]

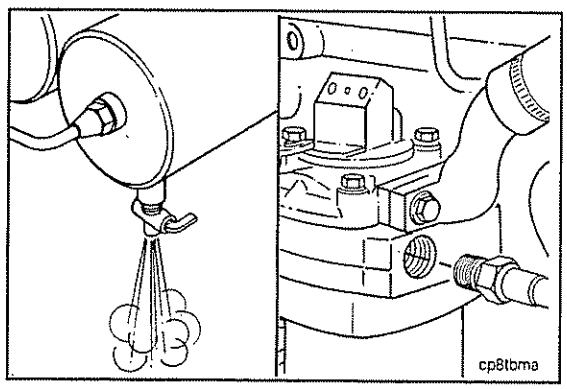


Air Compressor Carbon Buildup

Maintenance Check

Complete air compressor inspection is required every 6000 hours or 2 years.

NOTE: All air compressors have a small amount of oil carryover that lubricates the piston rings and moving parts. When this oil is exposed to normal air compressor operating temperatures over time, it will form varnish or carbon deposits. If the following inspections are **not** done, the air compressor piston rings will be affected by high operating temperatures and pressures and will **not** seal correctly.

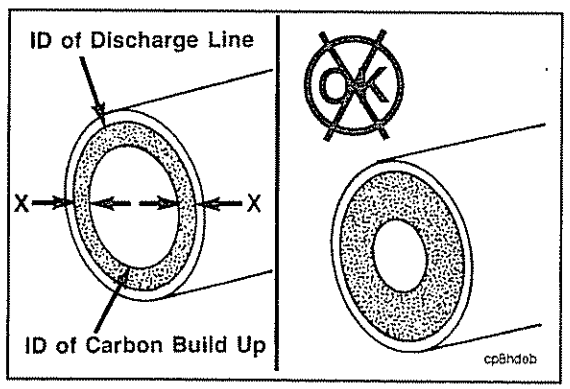


Air Compressor Discharge — Inspection

⚠ WARNING ⚠

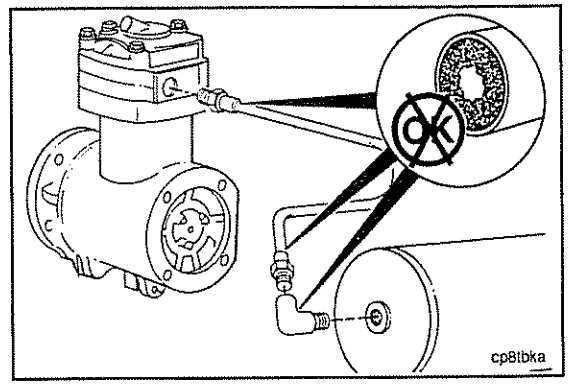
Wear appropriate eye protection and face protection when using compressed air. Improper use can cause bodily injury from flying debris and dirt.

Drain the air system wet tank to release the system air pressure. Remove the air discharge line from the air compressor.

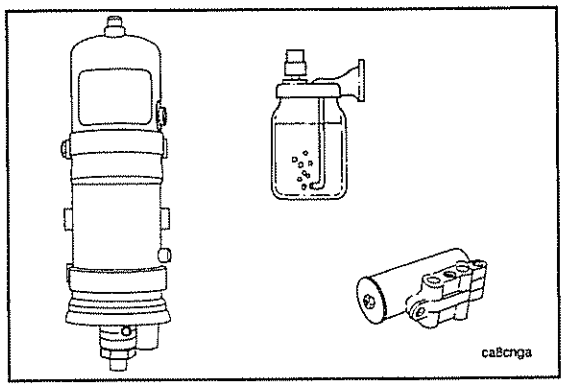


Measure the total carbon deposit thickness inside the air discharge line as shown. If the total carbon deposit (X + X) exceeds 2 mm [1/16 in], clean and inspect the cylinder head, the valve assembly, and the discharge line. Replace if necessary. Refer to the Master Repair Manual, Holset® Air Compressors, Bulletin No. 3666121, or contact your Cummins Authorized Repair Location.

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

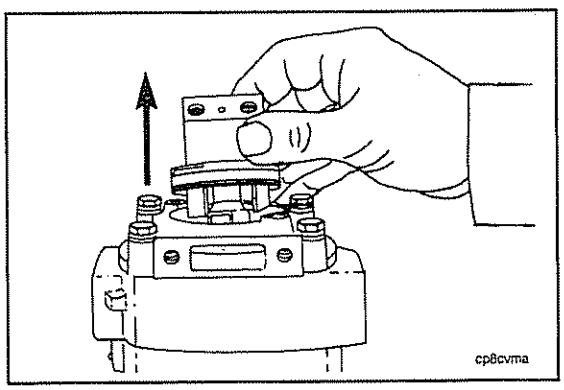


Air Compressor Intake — Inspection

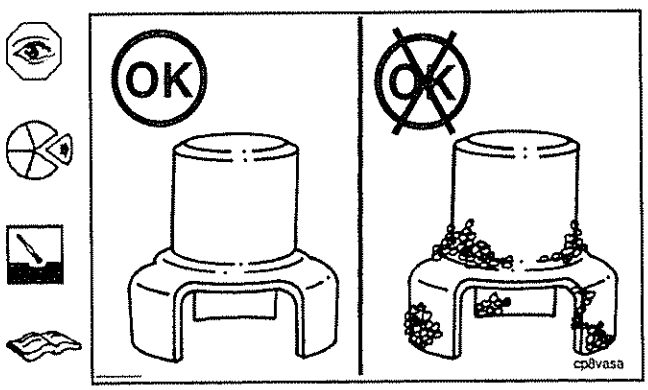
⚠ WARNING ⚠

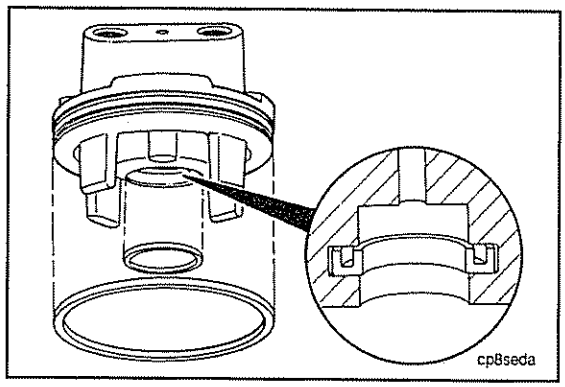
Hold the unloader valve down when removing the capscrews. Personal injury can result from the sudden release of the spring-loaded unloader valve.

Remove the capscrews, the lock washers, and the flat washers that secure the unloader valve assembly to the cylinder head cover. Remove the unloader valve assembly and the spring from the cylinder head and the cover.



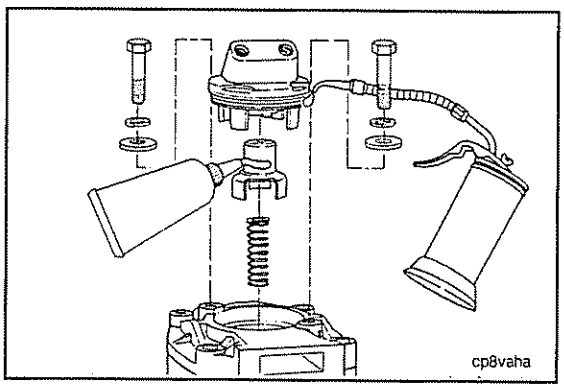
Inspect the unloader valve for carbon buildup. If carbon or heavy varnish is present, remove, clean, and inspect the compressor head and the valve assembly. Replace parts as necessary. Refer to the Master Repair Manual, Holset Air Compressors, Bulletin No. 3666121, or contact your Cummins Authorized Repair Location.





If the unloader valve is clean or **only** lightly varnished, install a new o-ring on the unloader body and a new rectangular seal inside the unloader body cavity.

NOTE: The open side of the rectangular seal **must** face the top of the unloader body.

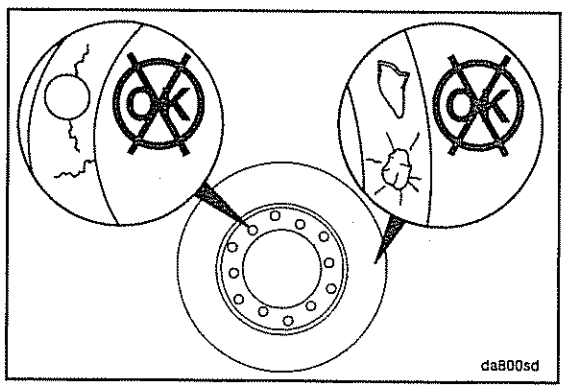


⚠ CAUTION ⚠

Exceeding the torque specifications on these capscrews can permanently distort the compressor cover, causing premature cover gasket leaks.

Lubricate the unloader cap with anti-seize compound. Lubricate the unloader body o-ring with engine oil. Assemble the unloader assembly to the cylinder head cover. Tighten the capscrews.

Torque Value: 14 N•m [124 in-lb]



Vibration Damper

Maintenance Check

Viscous Vibration Damper

⚠ CAUTION ⚠

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

Vibration dampers have a limited service life. The damper **must** be replaced after 576,000 km [360,000 mi] or 15,000 hours of service.

NOTE: Do **not** repair or balance a viscous damper in the field.

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

If any variations or deformations are detected, refer to the Troubleshooting and Repair Manual, N14 Series Engine (STC, CELECT™, CELECT™ Plus), Bulletin No. 3666142, for inspection procedures.

Maintenance Procedures at 6000 Hours or 3 Years

Section Contents

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Injector

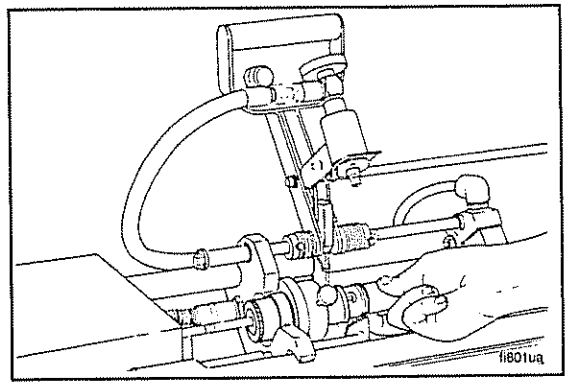
Clean

PT® (STC Engines Only)

Every 6000 hours or 3 years (whichever comes first), clean and calibrate/check the injectors.

NOTE: Calibration requires special equipment and **must** be done at a Cummins Authorized Repair Location.

Injectors can be correctly removed for cleaning and calibration by following the removal procedure. Once removed, take the injectors to a Cummins Authorized Repair Location for cleaning and calibration.

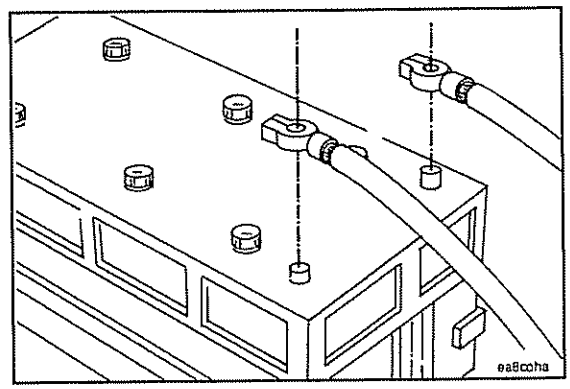


Remove

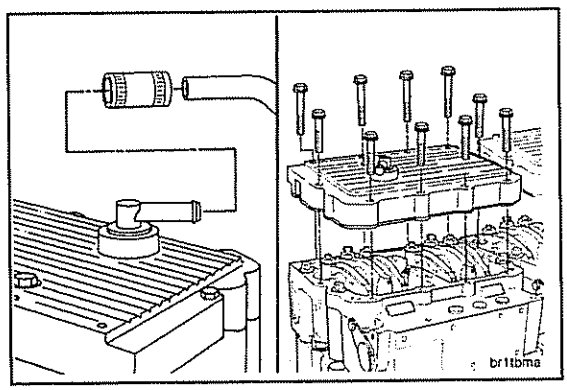
⚠ WARNING ⚠

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

Disconnect the battery cables before removing or installing the injectors.



Remove the crankcase breather tube.

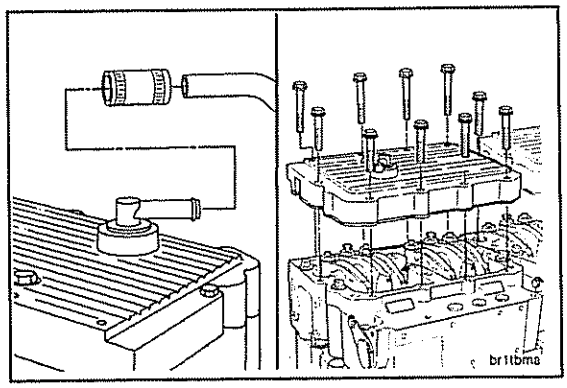


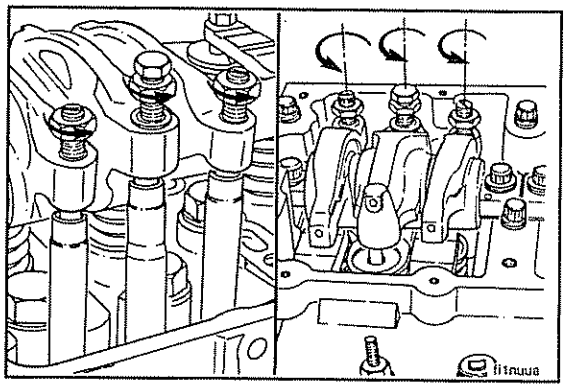
Remove the 10 capscrews and washers from each rocker lever cover.

Remove the rocker housing cover gaskets.

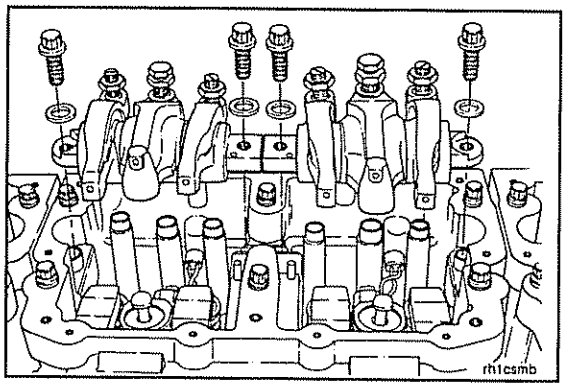
NOTE: The rocker lever cover gasket can be used again if it is **not** damaged. Do **not** discard it.

NOTE: Do **not** use solvent to clean the rocker housing cover gasket. Solvent will damage the o-ring material and cause it to swell.





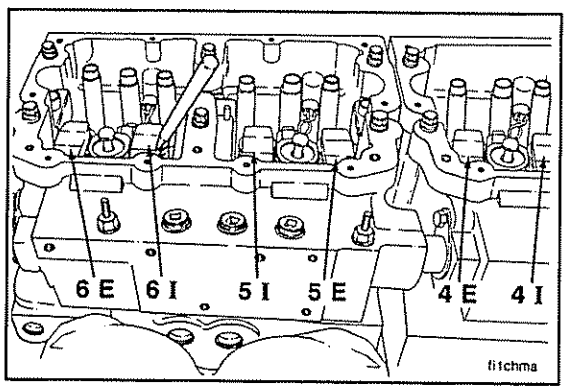
Loosen the valve and injector locknuts and adjusting screws.



Remove the rocker lever shaft capscrews.

Remove the rocker lever shaft assembly.

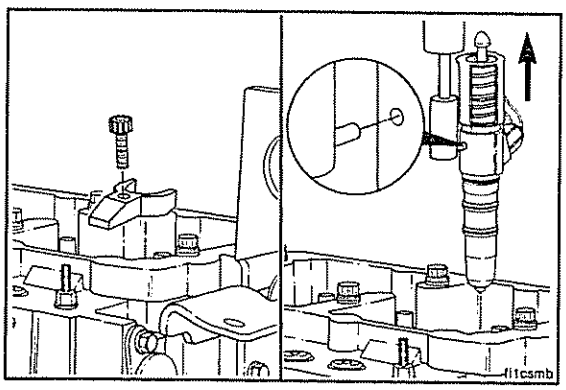
NOTE: Hold the shaft at both ends so that the rocker levers do **not** slide off.



NOTE: Mark the crossheads appropriately so they can be installed in the same location and orientation during the installation procedure.

Remove the crossheads.

NOTE: Excessive crosshead wear can result if the crossheads are **not** installed in their original locations. The larger hole on the underside of the crosshead **must** be oriented toward the exhaust side of the engine.



Remove the injector hold-down clamp capscrew.

Remove the injector and hold-down clamp.

- Use injector puller, Part No. 3822697, to remove STC injectors. Install the puller into the threaded hole on top of the injector.

NOTE: If the injector pullers mentioned above are **not** available, carefully use a pry bar. Pry upward on the injector against the cylinder head.

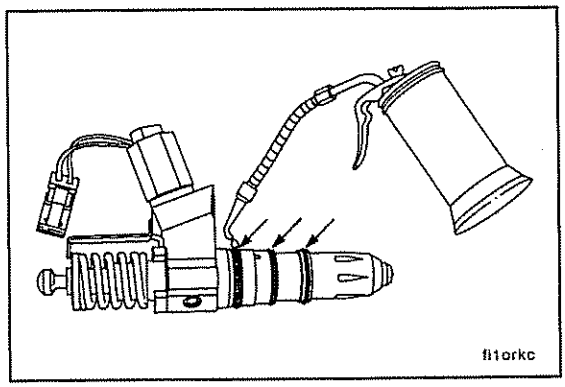
Install

NOTE: When installing injectors for reuse, new o-rings **must** be installed on the injector.

NOTE: The CELECT™ Plus injectors require three different injector o-rings. The o-rings are color-coded as follows:

Top o-ring - Black
Center o-ring - Brown
Bottom o-ring - Black with a white identification dot.

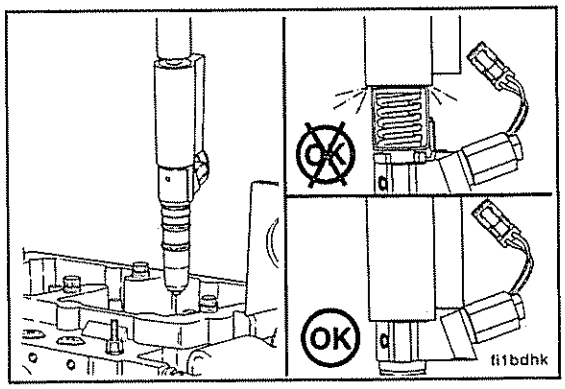
Lubricate the o-rings with lubricating oil just before installation.



⚠ CAUTION ⚠

Do not strike the top stop spring cage when installing CELECT™ Plus injectors.

Use the CELECT™ Plus injector puller/installer, Part No. 3823579, to install the injector into the cylinder head injector bore with the injector solenoid valve facing the intake side of the engine.

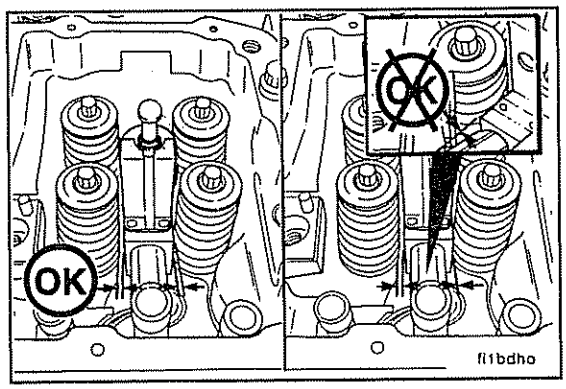


⚠ CAUTION ⚠

Do not strike or pry on the solenoid. Otherwise, injector damage will occur.

After partial installation of the injector, take precautions to center the solenoid valve between the valve springs. Avoid contact with the spring coils. If the injector is contacting a valve spring, use a screwdriver to position the injector again.

Continue driving the injector into the bore using the puller/installer, Part No. 3823579.

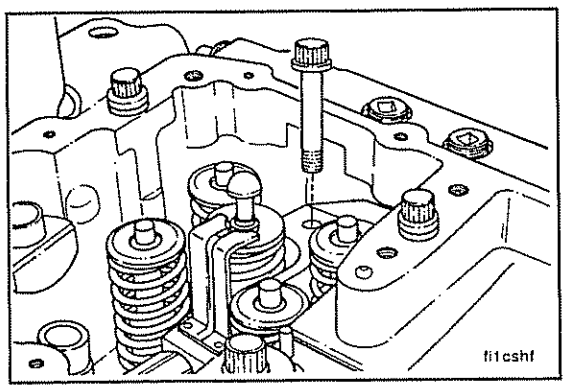


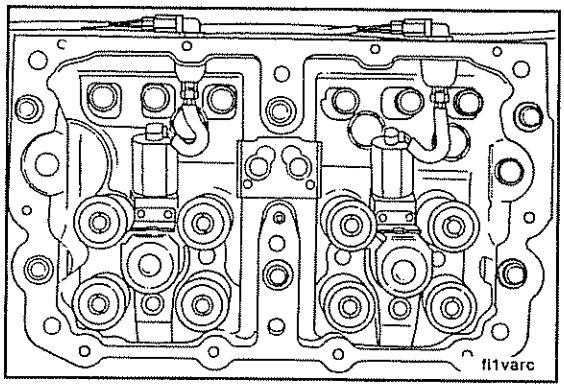
⚠ CAUTION ⚠

The injector must be fully seated before installing the hold-down clamp. The hold-down clamp can not pull the injector into the bore. Engine damage can occur if the injector is not fully seated.

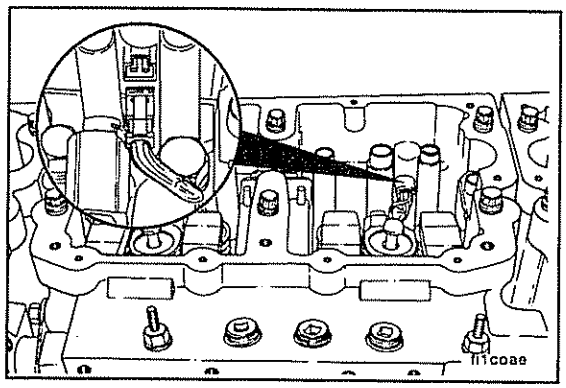
Install the hold-down clamp capscrew.

Torque Value: 41 N•m [30 ft-lb]

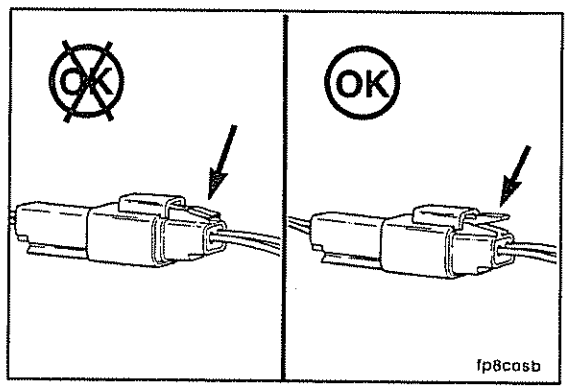




Take care to route the injector solenoid leads to avoid contact with the valve and injector push tubes.

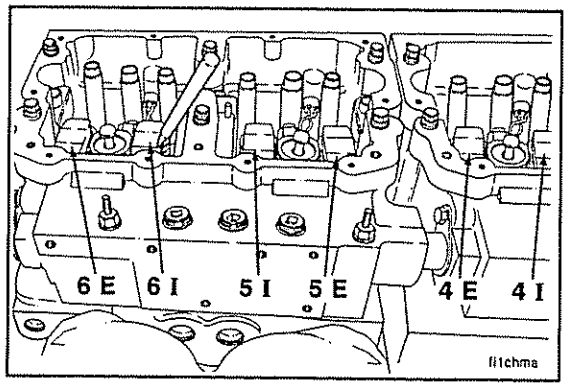


Connect the injector solenoid leads to the pass-through connector in the rocker housing. Push the lead into the connector until a "snap" is heard.



Check the wire connector to make sure the connector is properly locked in position.

If the wire connector will **not** lock into position properly, refer to the CELECT™ Plus Fuel System Troubleshooting and Repair Manual, Bulletin No. 3666130.



NOTE: Install the crossheads into their original location to prevent excessive wear.

⚠ CAUTION ⚠

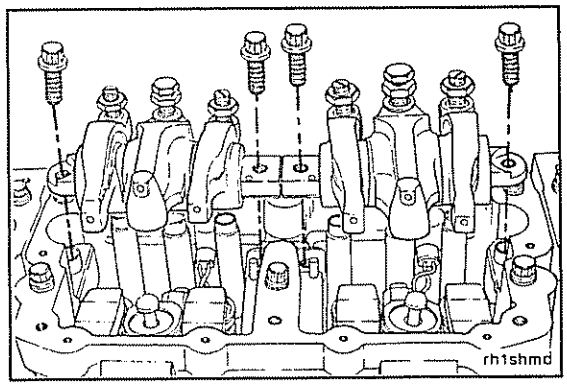
Loosen the valve and injector rocker lever adjusting screws before installing the rocker lever shaft assembly. Otherwise, engine damage will occur.

Install the rocker lever shaft assembly. Make sure both ends of the rocker lever shaft are properly located on the dowel alignment pins in the rocker housing.

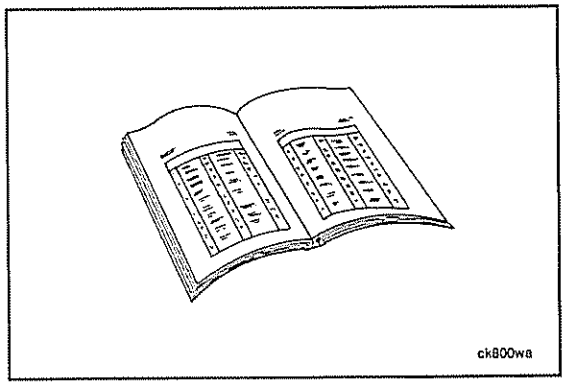
Install the two rocker lever shaft capscrews.

Tighten the capscrews alternately and evenly to the specified torque value.

Torque Value: 156 N•m [115 ft-lb]



Set the valves and injectors. Refer to the procedure Overhead Adjustment in Section 6.

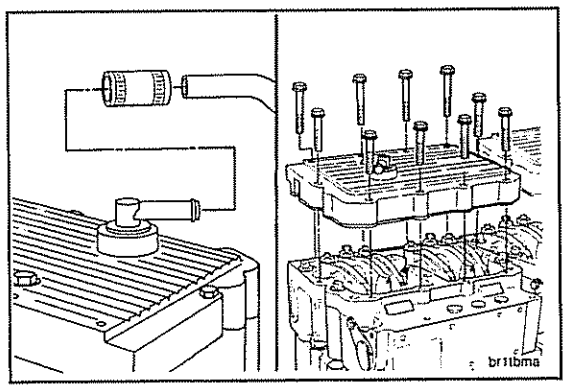


Install the reusable rocker lever cover gaskets.

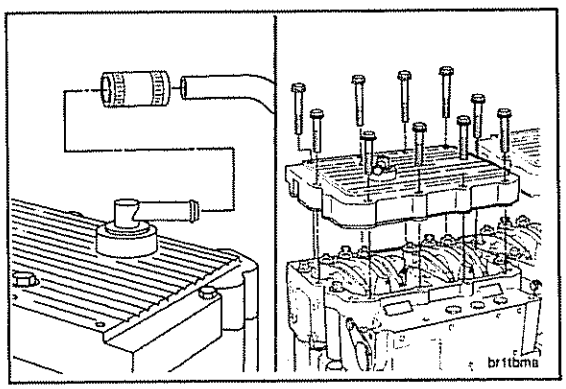
Install the rocker lever covers.

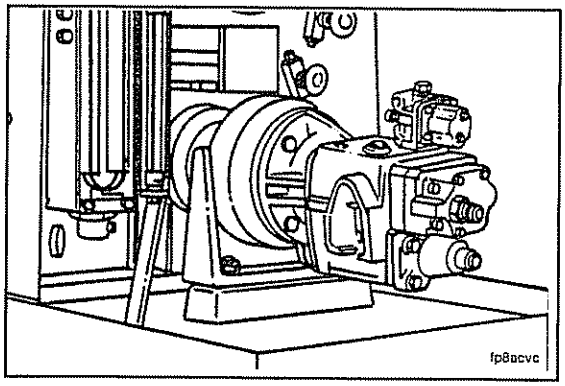
Install the 10 capscrews and washers to each rocker lever cover.

Torque Value: 12 N•m [106 in-lb]



Install the crankcase breather.





Fuel Pump

Clean

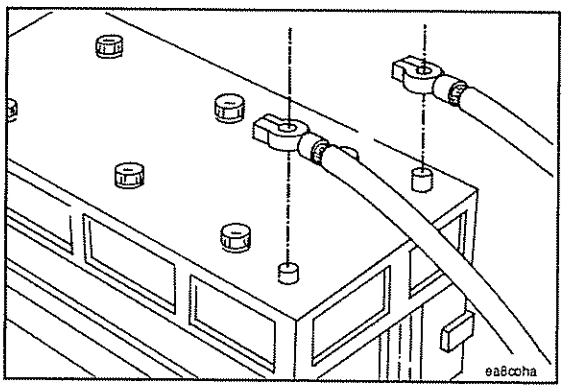
PT® (STC Engines Only)

NOTE: Calibration of CELECT™ Plus fuel pump is **not** required.

Every 6000 hours or 3 years (whichever comes first), clean and calibrate the fuel pump.

NOTE: Calibration requires special equipment and **must** be done at a Cummins Authorized Repair Location.

The fuel pump can be correctly removed for cleaning and calibration by the following procedure. Once removed, take the fuel pump to a Cummins Authorized Repair Location for cleaning and calibration.

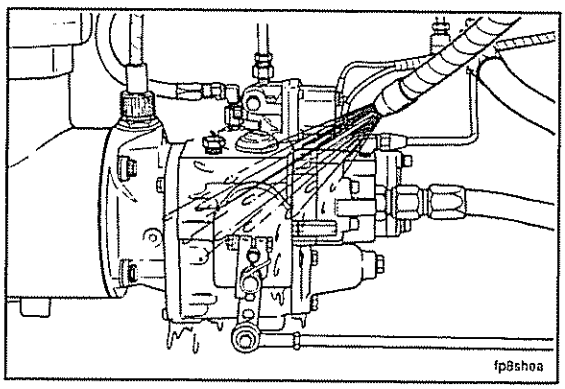


Remove

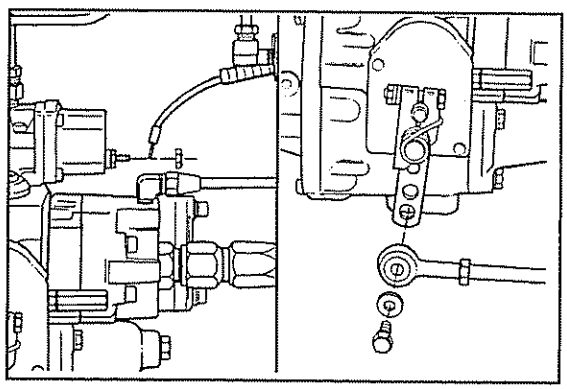
⚠ WARNING ⚠

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

Disconnect the battery cables.



Clean the fuel pump and the surrounding area before removing it from the engine.



Remove the wire from the fuel shutoff valve.

Remove the linkage and the return springs from the throttle lever.

Remove the fuel tubing and AFC air signal line:

Gear pump cooling drain (1)

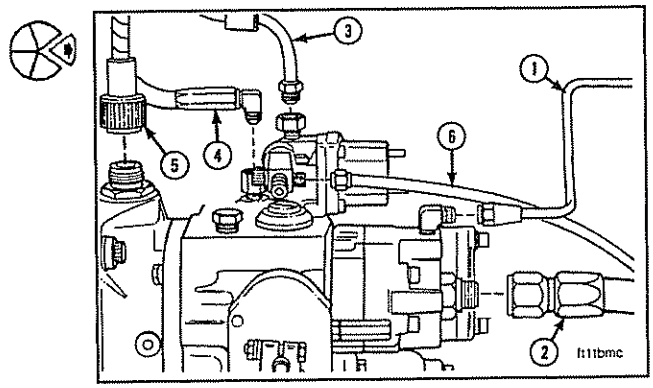
Fuel inlet supply line (2)

Fuel rail pressure line (3)

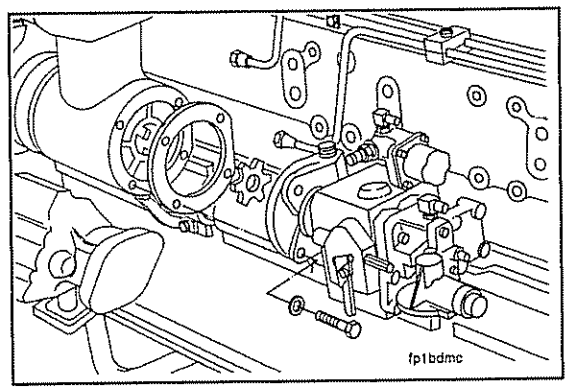
AFC air signal line (4)

Tachometer cable (5)

Fuel pressure sensing line (to STC valve) (6).



- Remove the four fuel pump mounting capscrews and the fuel pump.
- Remove the spider coupling.



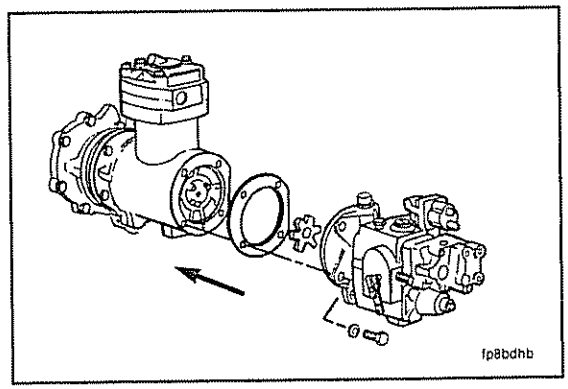
Install

Install the fuel pump drive spider coupling.

Use a new gasket to install the fuel pump.

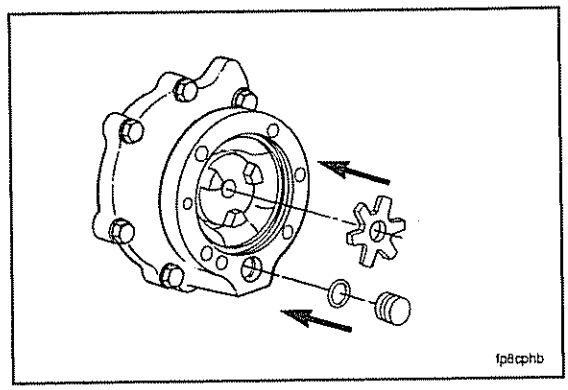
Install the four fuel pump mounting capscrews.

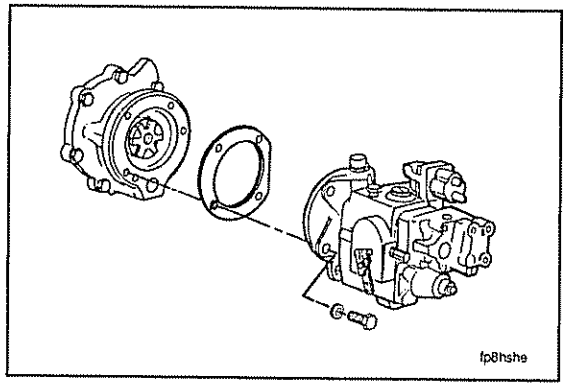
Torque Value: 45 N•m [33 ft-lb]



If the fuel pump is installed to the accessory drive housing (no compressor), install the new o-ring on the accessory drive oil drain plug. Install the plug in the accessory drive housing (if used).

Install the fuel pump drive spider coupling.

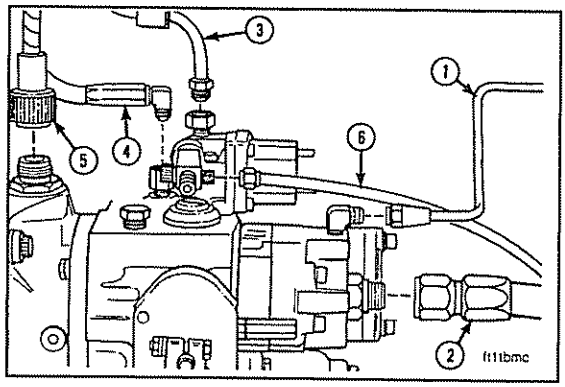




Use a new gasket to install the fuel pump.

Install and tighten the mounting capscrews to the accessory drive.

Torque Value: 45 N•m [33 ft-lb]



Install the AFC air signal line and fuel tubing:

Gear pump cooling drain (1)

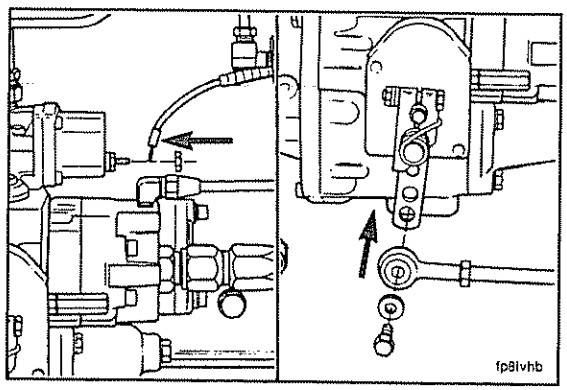
Fuel inlet supply (2)

Fuel rail pressure line (3)

AFC air signal line (4)

Tachometer cable (5)

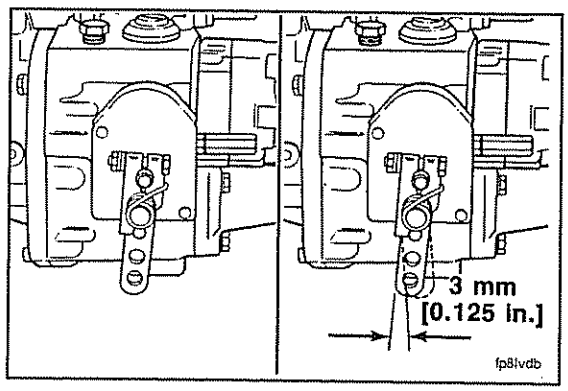
Fuel pressure sensing line (to STC valve) (6).



Install the electric wire to the fuel shutoff valve.

NOTE: The wire connection nut and ground post nut **must** be clean and tight.

Install the linkage to the throttle lever.



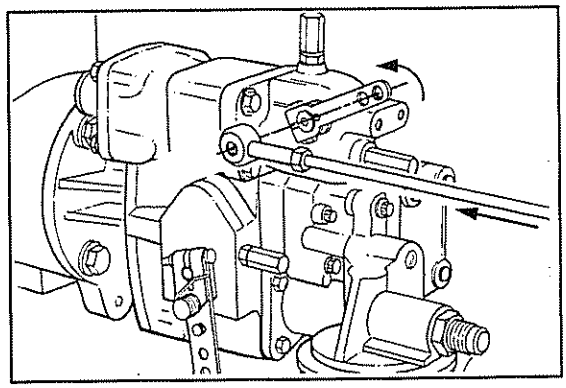
NOTE: Do **not** make any adjustments to the throttle stop screws. If the throttle does **not** break over correctly, adjust the throttle lever or linkage.

Make sure the throttle linkage is adjusted so the throttle lever breaks over 3 to 6 mm [1/8 to 1/4 in] when the lever is in the full-throttle position.

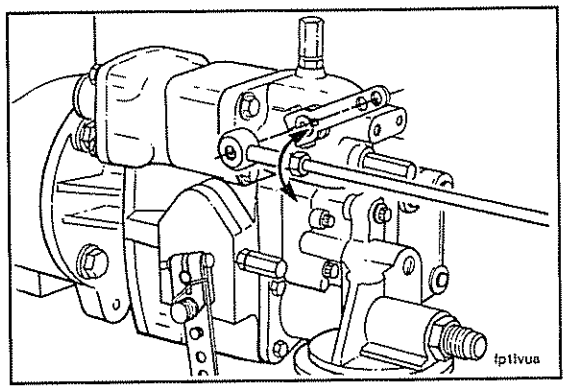
NOTE: The throttle lever stop **must** contact the rear throttle stop screw.

Make sure the throttle switch operates correctly after the throttle linkage is adjusted.

If the engine is equipped with a VS pump, hold the VS lever **counterclockwise** (in the idle position). Move the linkage to the idle position.

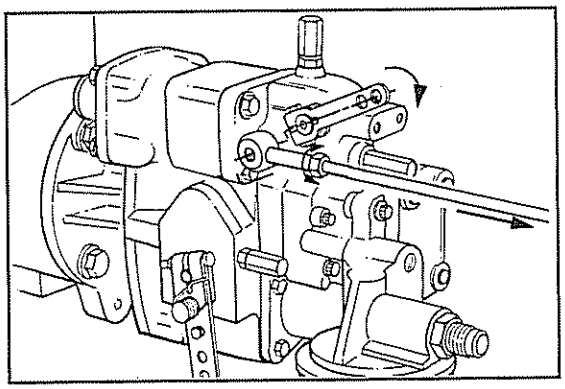


If the lever and the linkage are **not** aligned, adjust the linkage.



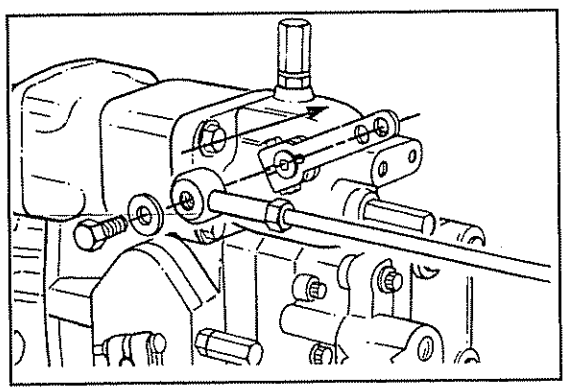
Move the VS lever and linkage **clockwise** to the maximum speed position.

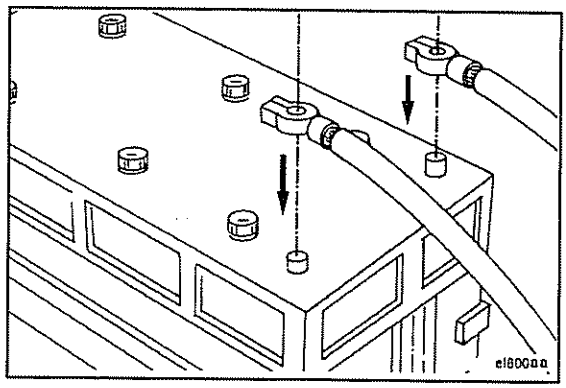
If the lever and the linkage are **not** aligned, adjust the linkage.



Install the linkage on the lever.

Prime the fuel pump. Refer to Section 1.





⚠ WARNING ⚠

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

Install the battery cables.

Operate the engine and check for leaks.

Section A - Adjustment, Repair, and Replacement

Section Contents

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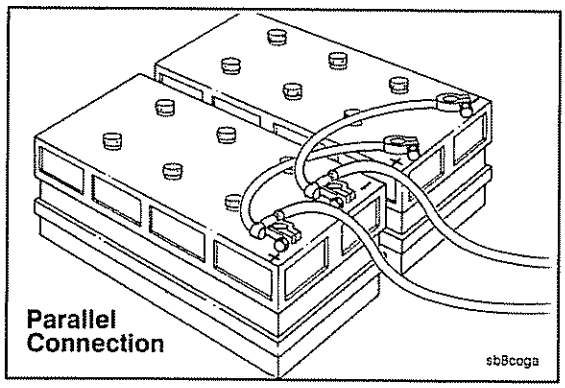
Air Starting Motor

The air starting motor system (tanks, line sizes, and valves) is designed and installed by the original equipment manufacturers and the starting motor suppliers. Refer any questions about the air starting systems to the manufacturer.

- Do **not** operate the air starting motor with air pressure lower than 480 kPa [70 psi].
- Maintain the air starting motor according to the manufacturer's recommendations.
- For maximum efficiency, the hoses, tubes, and lines **must not** leak.
- Refer to the original equipment manufacturers' and starting motor manufacturers' manuals for specific information regarding the starting motors, valves, and systems.



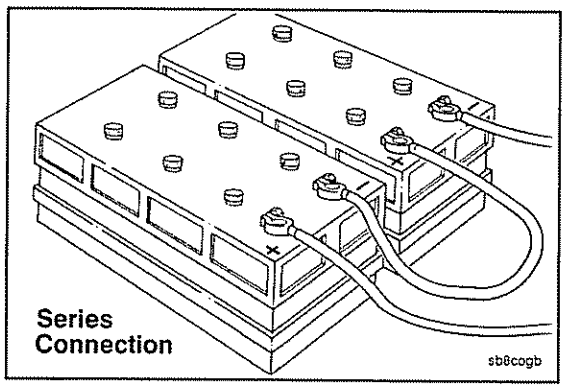
Battery Cables and Connections

Parallel and Series Connections

⚠ WARNING ⚠

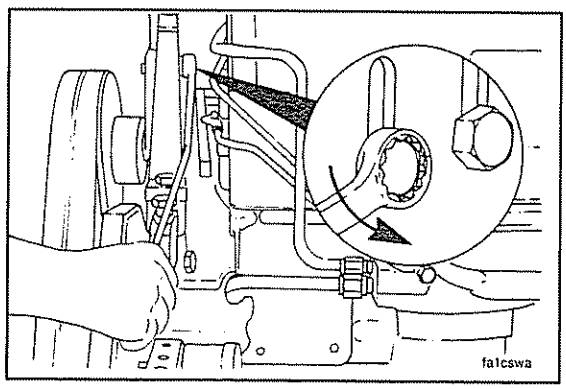
To avoid electrical shock and potential eye danger when using jumper cables to start the engine, make sure to connect the cables in parallel: positive (+) to positive (+) and negative (-) to negative (-). When using an external electrical source to start the engine, turn the disconnect switch to the OFF position, and remove the key before attaching the jumper cables.

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



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

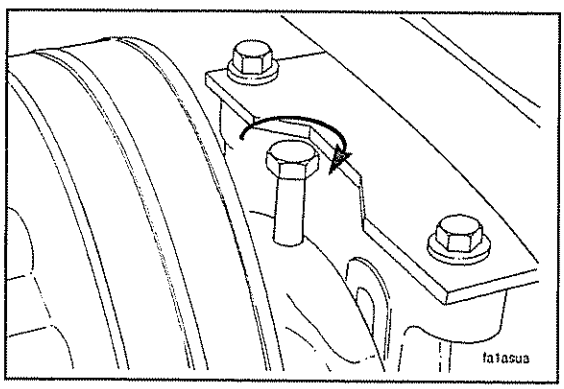
For optimum electrical system and starting motor performance, keep battery connections clean and tight.



Drive Belt, Cooling Fan

Adjust

Loosen the four capscrews that secure the fan hub shaft to the bracket.



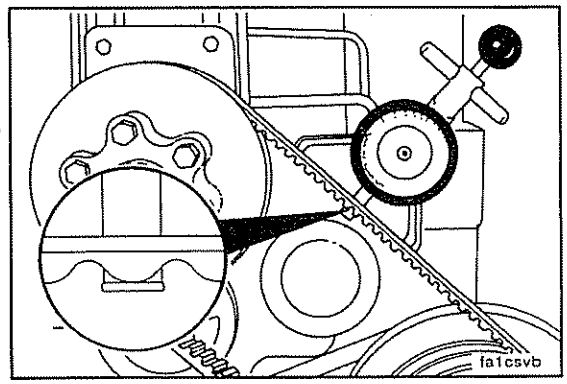
NOTE: Do **not** adjust belt tension to full value with the adjusting screw. Belt tension can increase when the locknut is tightened and, therefore, reduce belt and bearing life.

Turn the adjusting screw to increase belt tension.

Measure the belt tension.

Refer to the Belt Tension Chart in Section V to select the correct gauge and tension values.

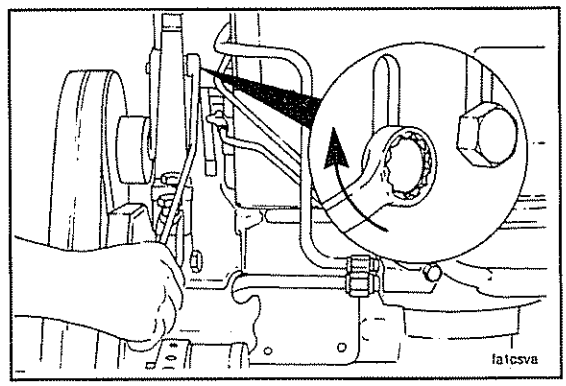
For clogged belts, make sure the belt tension gauge is positioned so that the center tensioning leg is placed directly over the high point (hump) of a cog. Other positioning will result in incorrect measurement.



Tighten the four capscrews until the fan hub is in correct alignment with the fan hub bracket.

NOTE: Do **not** tighten the capscrews to full torque value.

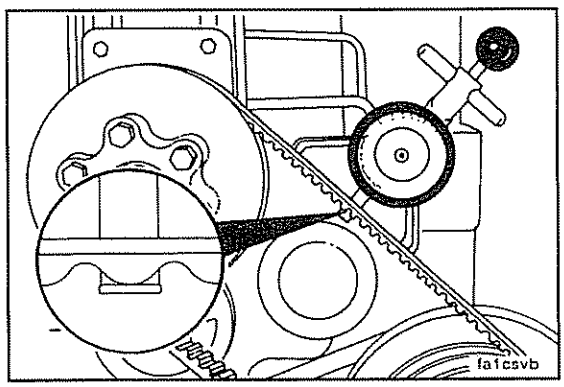
Measure the belt tension.



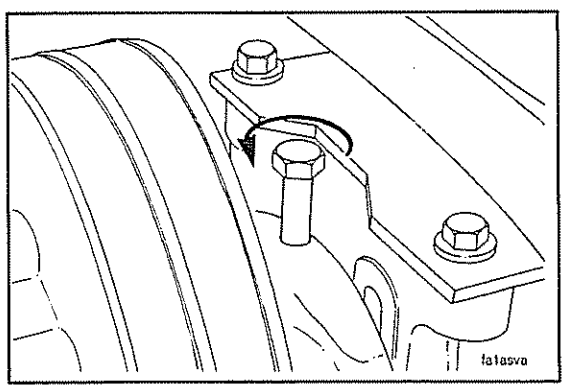
Tighten the four capscrews.

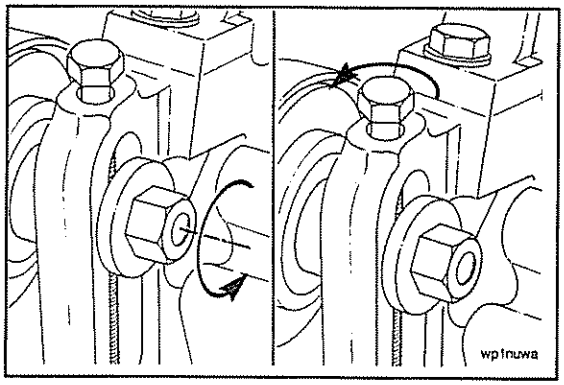
Torque Value: 110 N•m [81 ft-lb]

Measure the belt tension again. Adjust if necessary.



Loosen the adjusting screw 1/2 turn to prevent breakage.

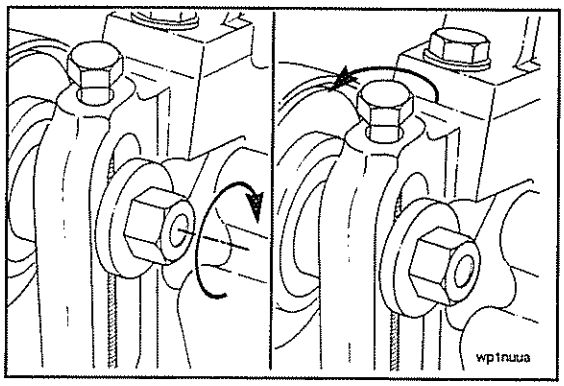




Drive Belt, Water Pump

Adjust

Loosen the locknut that secures the idler pulley to the water pump. Turn the adjusting screw to adjust the belt tension.



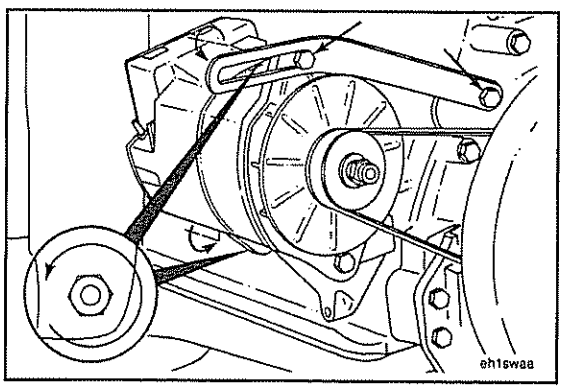
NOTE: Do **not** adjust belt tension to full value with the adjusting screw. Belt tension can increase when the locknut is tightened and, therefore, reduce belt and bearing life.

Secure the idler pulley in position by tightening the locknut.

Torque Value: 70 N•m [51 ft-lb]

Loosen the adjusting screw 1/2 turn to prevent breakage.

Measure the belt tension again. Adjust if necessary.

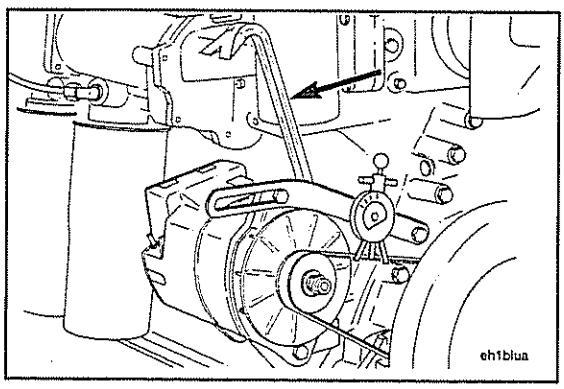


Drive Belt, Alternator

Adjust

Loosen the alternator-to-alternator support bracket nut and capscrew.

Loosen the adjusting link capscrew.



Use a pry bar between the engine and the alternator to tighten the alternator belt.

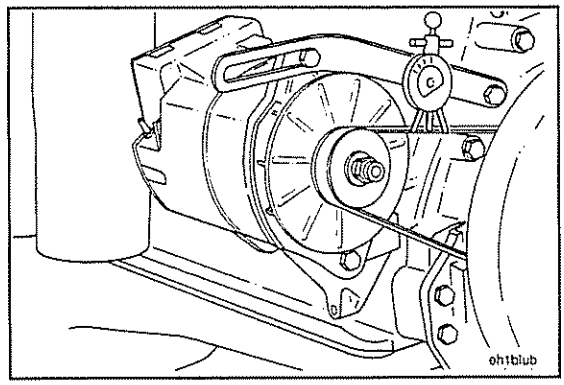
Use Part No. ST-1138 (Burroughs) or 3822524 (click-type) belt tension gauge to measure the 1/2-inch-width V-belt tension.

New Belt Tension	Used Belt Tension
620 N [140 lb]	270 to 490 N [60 to 110 lb]

NOTE: A belt is considered used if it has been in operation for 10 minutes or longer.

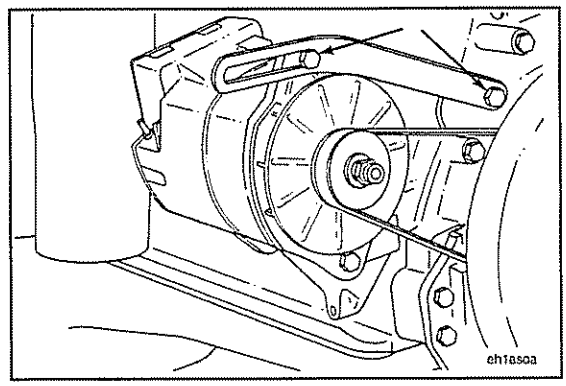
If used belt tension is below the minimum value, tighten to the maximum value.

Replace the belt if it will **not** maintain the correct tension.



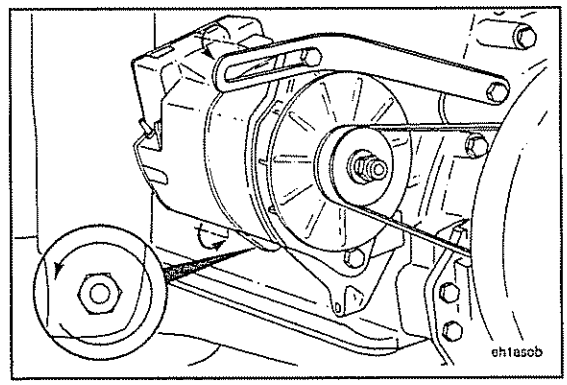
Tighten the adjusting link capscrews to the following torque values (grade 5 or higher):

Bolt Size	Threads/ Inch	N•m	ft-lb
5/16	18	20	[15]
7/16	14	34	[25]
1/2	13	68	[50]



Tighten the alternator-to-alternator support capscrew and nut to the following torque values (grade 5 or higher):

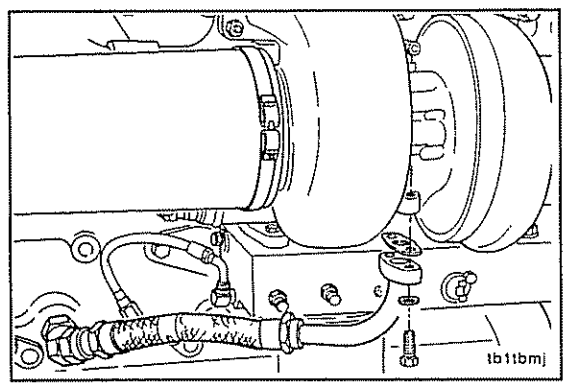
Bolt Size	Threads/ Inch	N•m	ft-lb
3/8	16	41	[30]
7/16	20	88	[65]
1/2	13	108	[80]

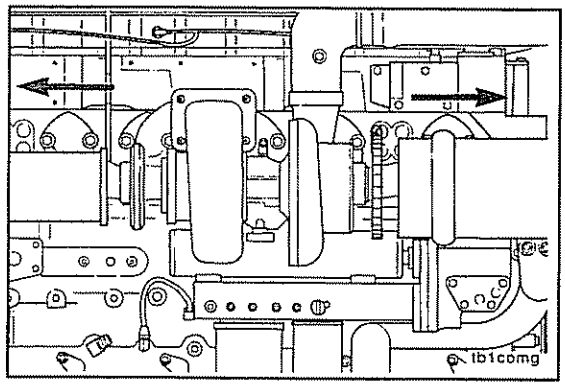


Turbocharger

Remove

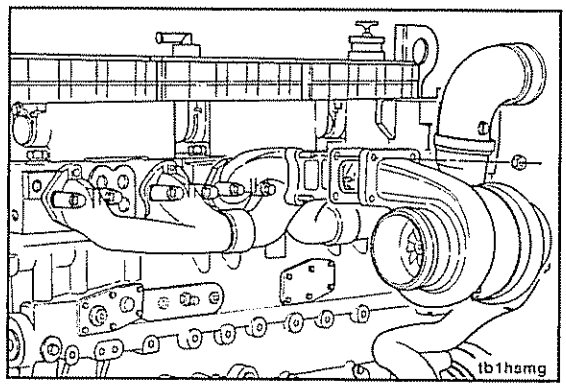
Remove the oil supply and the oil drain tubes from the turbocharger.





Remove the intake and the exhaust pipes from the turbocharger.

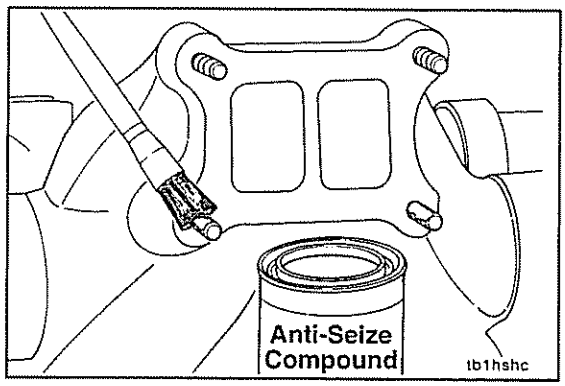
Remove the CAC piping from the discharge elbow.



Remove the four turbocharger mounting nuts.

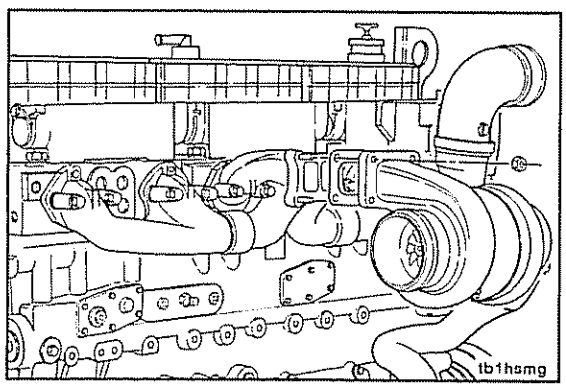
Remove the turbocharger, and discard the gasket.

NOTE: If the turbocharger mounting nuts do **not** loosen freely, split the nuts to avoid breaking a mounting stud.



Install

Apply a film of high-temperature anti-seize compound, Part No. 3823097, onto the turbocharger mounting studs.



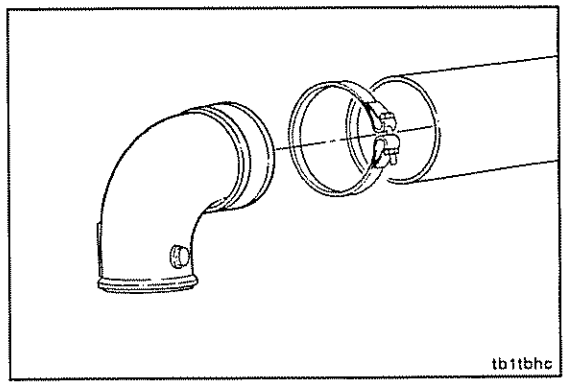
Install a new mounting gasket, the turbocharger, and the four mounting nuts.

Tighten the mounting nuts.

Torque Value: 68 N•m [50 ft-lb]

Install the discharge elbow and clamp onto the CAC pipe connection.

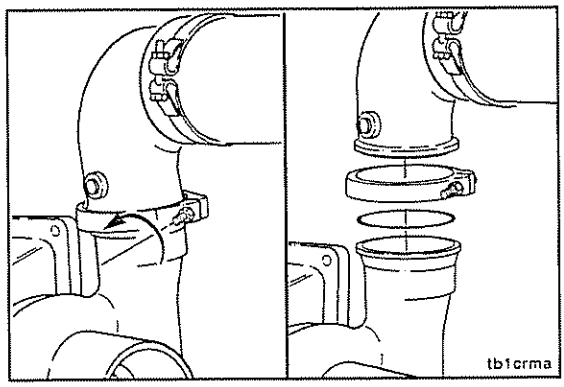
NOTE: Do **not** tighten the clamp until the elbow is installed on the turbocharger.



Install a new o-ring seal, the clamp, and the discharge elbow to the turbocharger.

Tighten the clamps.

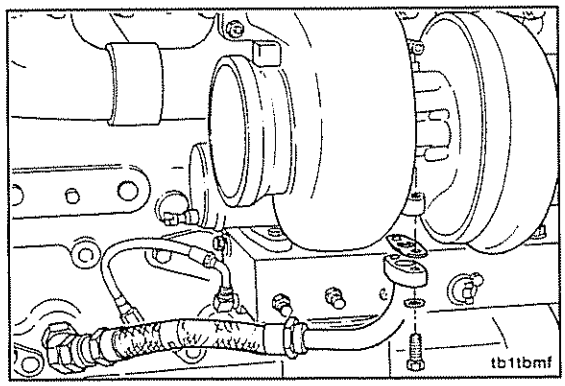
Torque Value: 8.5 N•m [75 in-lb]



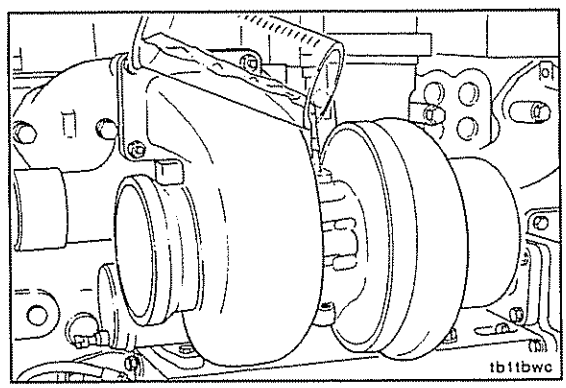
Install a new gasket, oil drain tube, and capscrews.

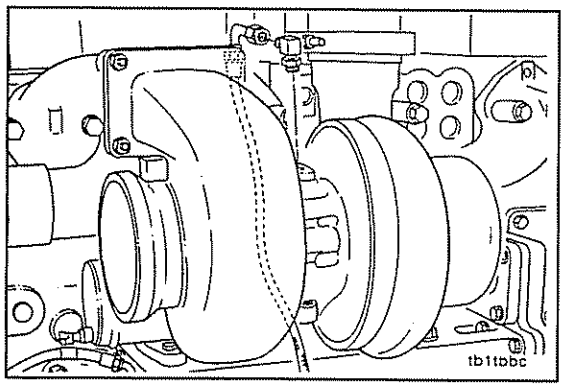
Tighten the capscrews.

Torque Value: 44 N•m [32 ft-lb]



Pour 50 to 60 cc [2.0 to 3.0 oz] of clean engine oil into the turbocharger oil supply opening.





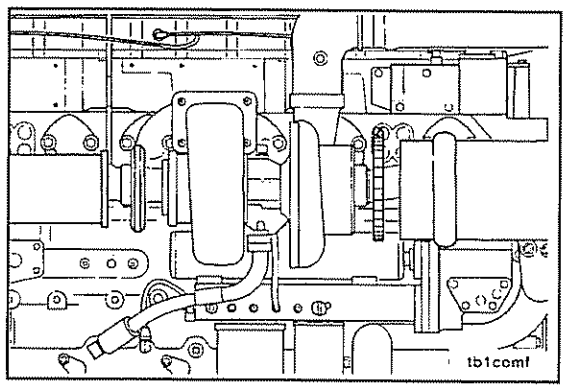
⚠ CAUTION ⚠

Proper routing of the turbocharger oil supply tube is critical to avoid failure. Avoid any tube-to-metal contact. The inlet supply fitting must be oriented slightly off-vertical to allow proper alignment.

If installing a new turbocharger, install the male union elbow.

Install the turbocharger oil supply tube on the elbow.

Torque Value: 30 N•m [22 ft-lb]



Install the intake and exhaust pipes to the turbocharger, and tighten the clamps.

Torque Value: 8.5 N•m [75 in-lb]

Operate the engine, and check for air and oil leaks.

Engine Storage - Long Term

If the engine will be out of service longer than 6 months, take special precautions to prevent rust. Contact your Cummins Authorized Repair Location, or refer to the N14 Engine Shop Manual, Bulletin No. 3810487, for information concerning engine storage procedures.

Section D - System Diagrams

Section Contents

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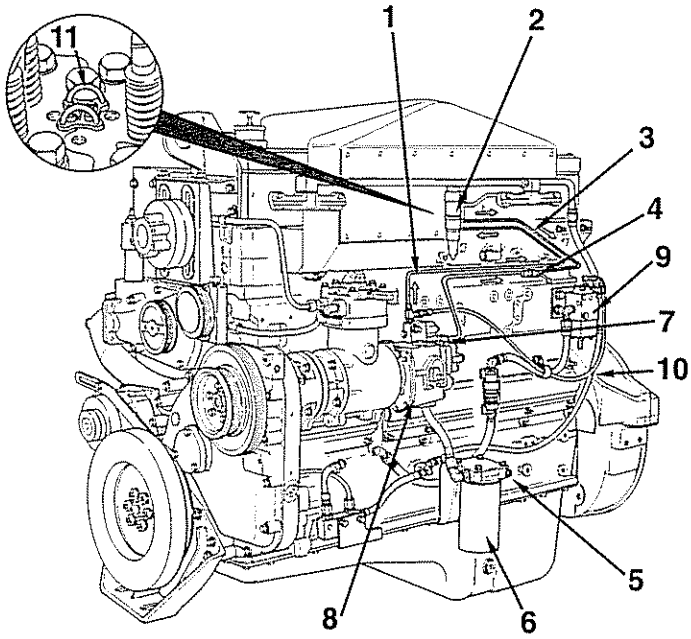
System Diagrams - General Information

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.

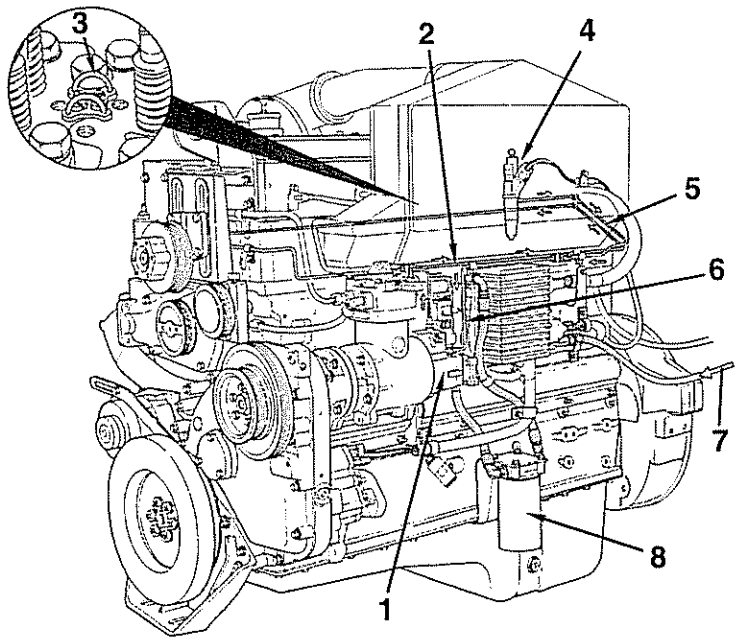
Flow Diagram, Fuel System



05100083

STC Fuel System

1. Fuel Rail Pressure Line
2. Injector
3. Injector Fuel Drain Return
4. Fuel Return to Tank
5. Fuel Inlet Supply
6. Fuel Filter
7. Gear Pump Cooling Drain
8. Fuel Pump
9. STC Control Valve
10. STC Fuel Pressure Sensing Line
11. Fuel Crossover.



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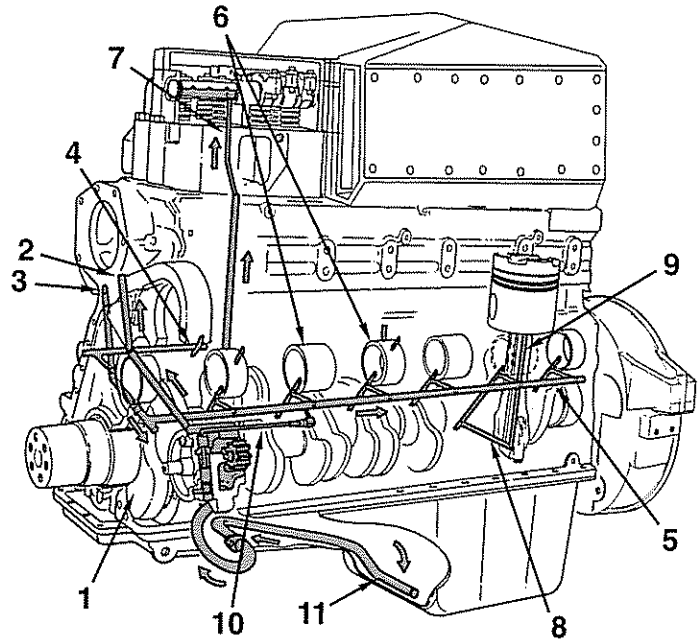
CELECT™ Plus Fuel System

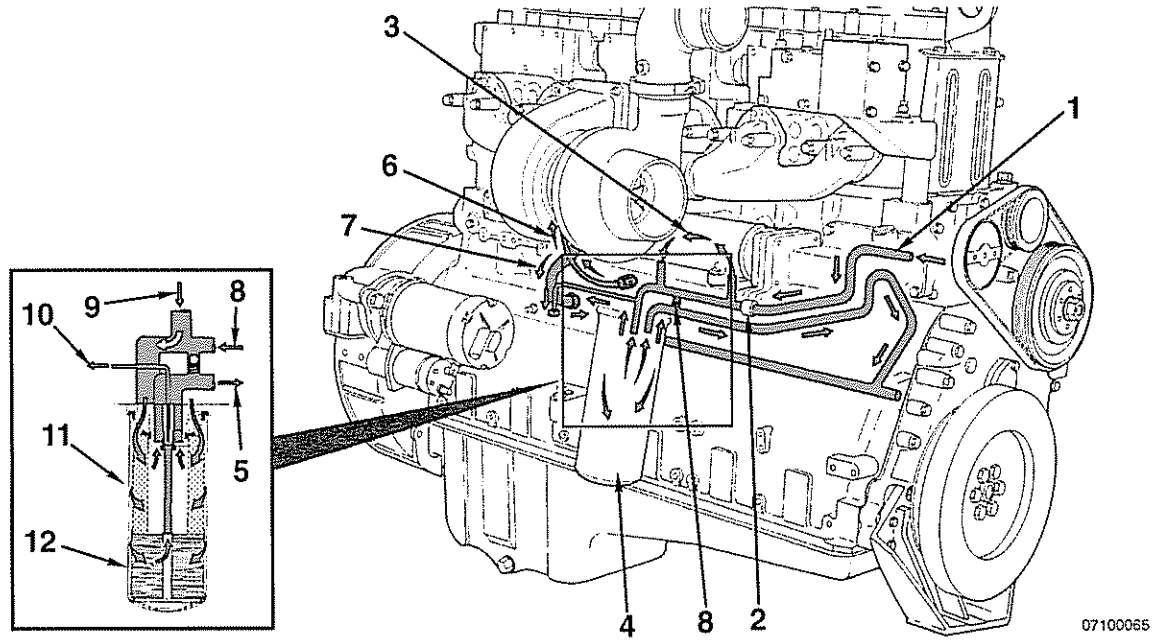
1. Fuel Gear Pump
2. Fuel Rail Pressure Line
3. Fuel Crossover Tubes
4. Injector
5. Injector Fuel Drain Return
6. Cooling Plate (behind ECM)
7. Fuel Inlet Supply
8. Fuel Filter.



07100063

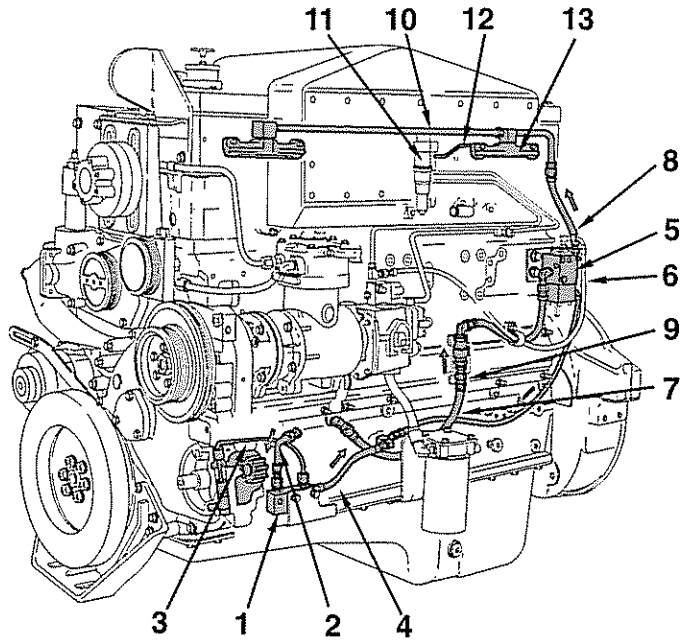
Flow Diagram, Lubricating Oil System

1. Oil Pump
2. To Lubricating Oil Cooler
3. From Lubricating Oil Cooler
4. Piston Cooling Nozzle
5. Main Oil Rifle
6. Cam Bushings
7. To Overhead
8. Main Bearing
9. Connecting Rod Drilling
10. Rifle Pressure Signal Line
11. Suction Tube.



Flow Diagram, Lubricating Oil System

1. From Oil Pump
2. Oil Cooler Thermostat
3. Oil Cooler
4. Combination Full-Flow/Bypass Oil Filter
5. To Main Rifle
6. Turbocharger Oil Supply
7. Turbocharger Drain
8. Oil Filter Bypass Valve
9. From Oil Cooler
10. Bypass Filter Oil to Sump
11. Full-Flow Filtration
12. Bypass Filtration.



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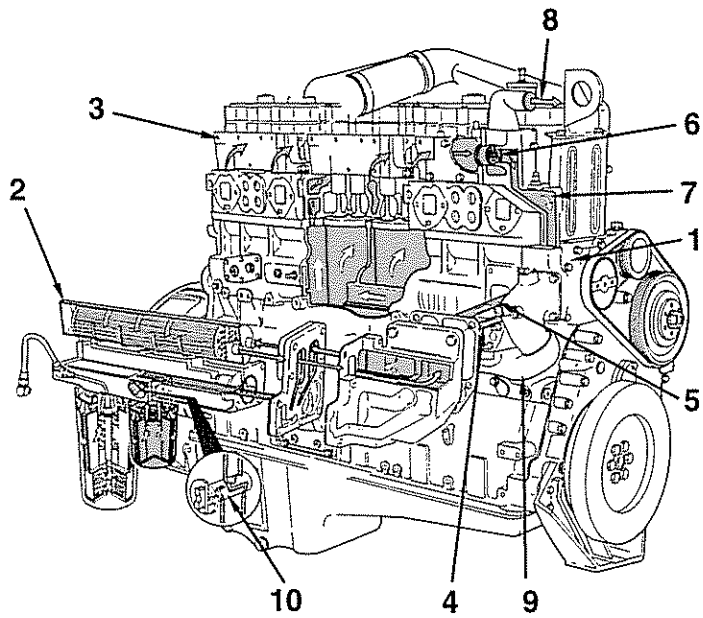
VISCOSITY SENSOR AND STC CONTROL VALVE

1. Viscosity Sensor
2. Rifle Pressure Supply Line
3. Regulator Signal Line
4. Oil Supply Line
5. STC Valve
6. Fuel Rail Pressure Line
7. Lubricating Oil Supply Line
8. Oil to Tappets
9. Check Valve
10. External Oil Manifold
11. STC Injector Tappet (inside injector)
12. Internal Oil Tube
13. External Oil Manifold Connector.

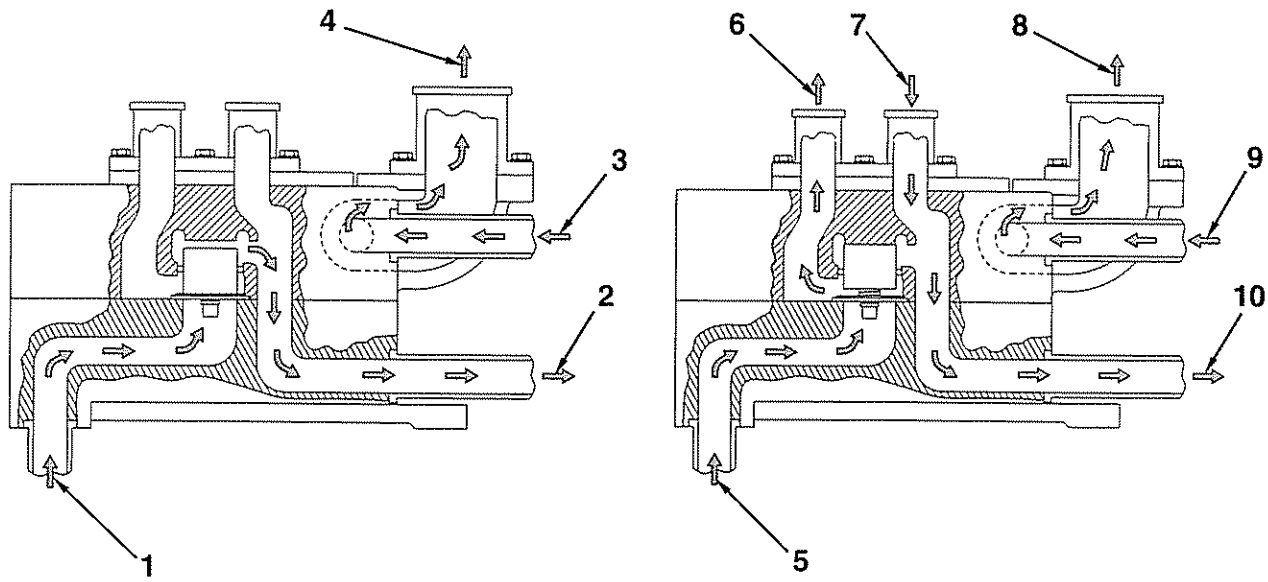
Flow Diagram, Cooling System



08100038

Cooling System

1. Water Pump
2. Oil Cooler
3. Water Manifold
4. Oil Cooler Supply
5. Oil Cooler Return
6. Thermostat
7. Bypass
8. To Radiator
9. Water Pump Inlet
10. Coolant Filter Head Shutoff Valve.



Aftercooler Thermostat Housing
CELECT™ Plus LTA Cooling System

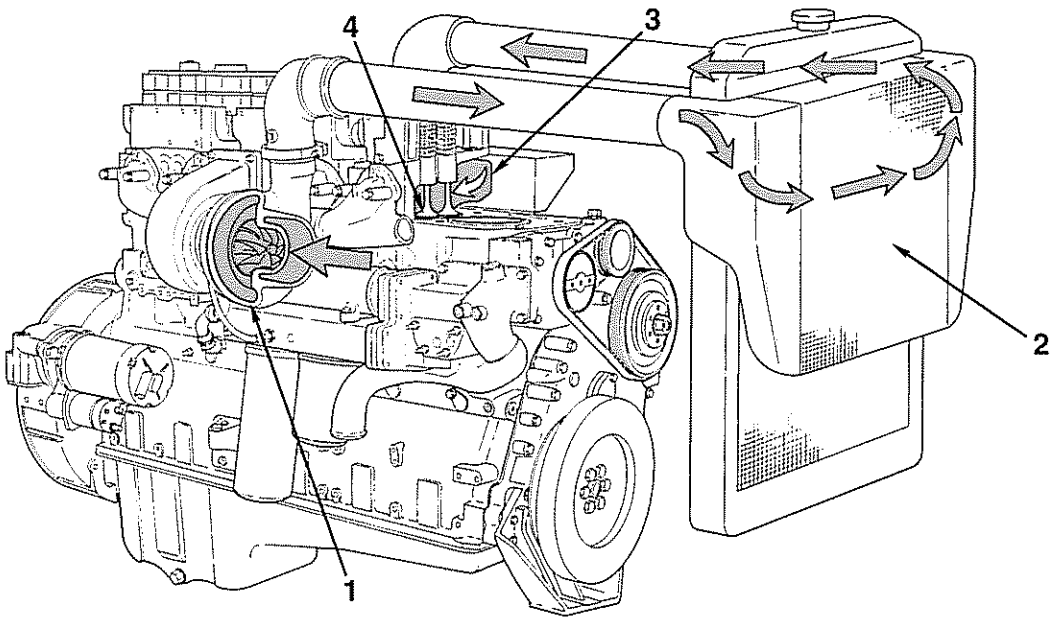
Thermostat Closed

1. From Water Pump
2. To Engine Aftercooler
3. From Engine Aftercooler
4. To Radiator

Thermostat Open

5. To Water Pump
6. To Low-Temperature Aftercooler Radiator
7. From Low-Temperature Aftercooler Radiator
8. To Radiator
9. From Engine Aftercooler
10. To Engine Aftercooler.

Flow Diagram, Air Intake System



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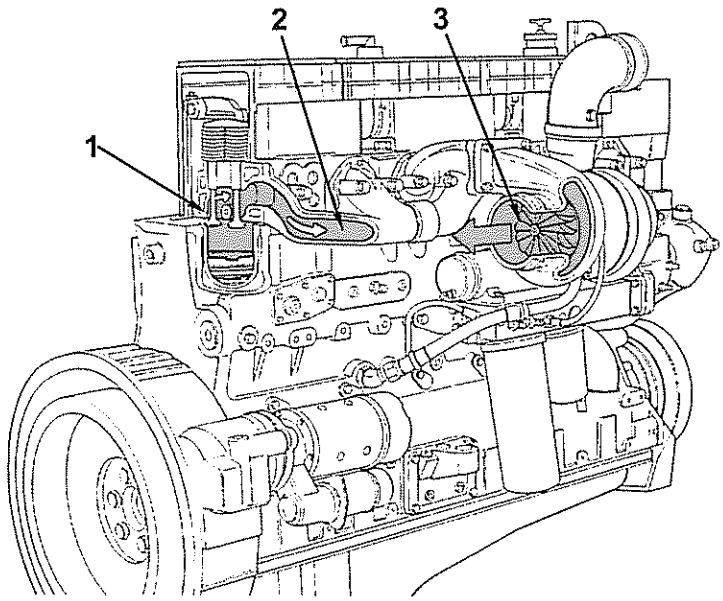
Flow Diagram, Air Intake System

1. Turbocharger Compressor
2. Aftercooler
3. Intake Manifold
4. Intake Valve Ports.

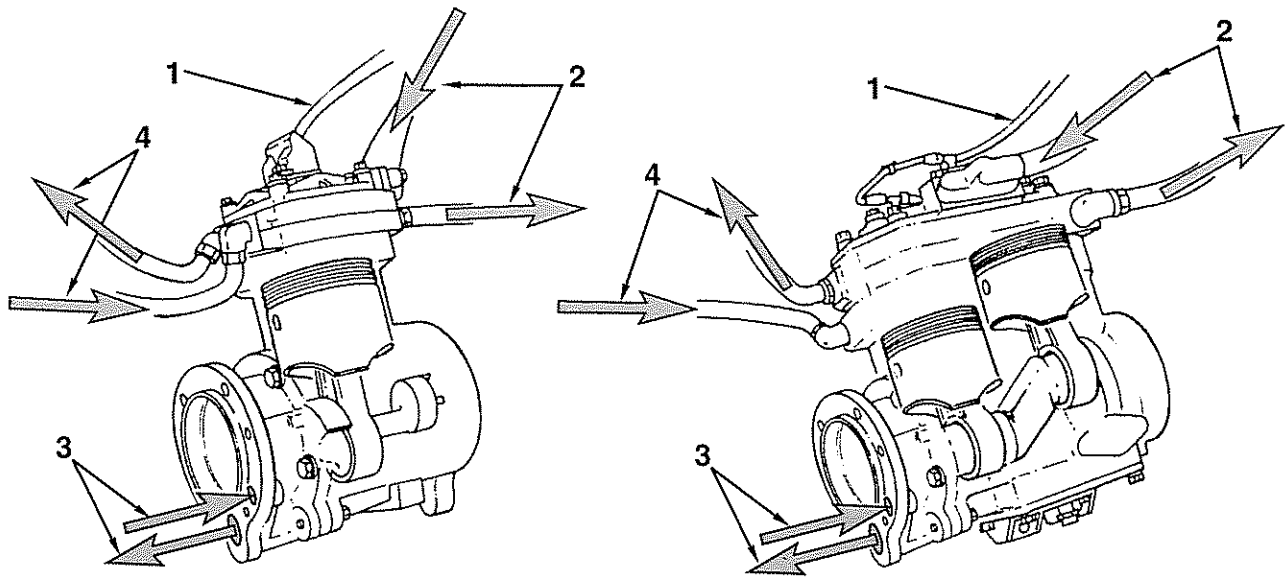
Flow Diagram, Exhaust System



Flow Diagram, Exhaust System

1. Exhaust Valve Ports
2. Exhaust Manifold
3. Turbocharger Turbine.

Flow Diagram, Compressed Air System



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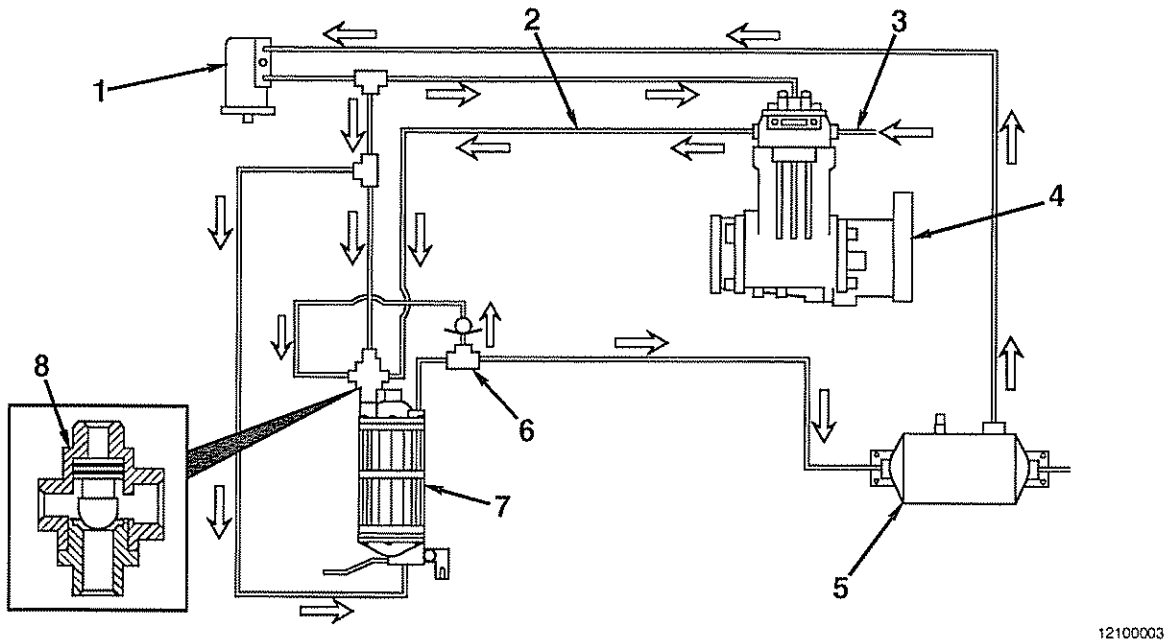
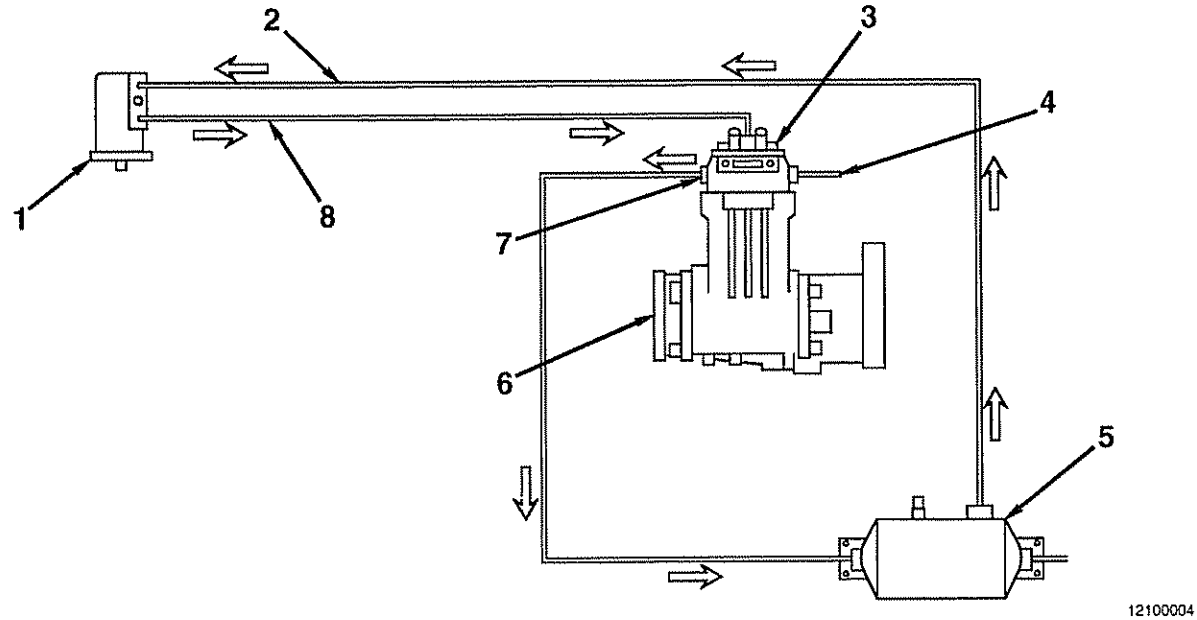
Flow Diagram, Compressed Air System

1. Air Governor Signal
2. Air
3. Lubricant
4. Coolant.



Holset E-Type System with Air Dryer

1. Governor
2. Discharge
3. Intake
4. Air Compressor
5. Reservoir (wet tank)
6. Check Valve
7. Air Dryer
8. Econ Valve.



Holset E-Type System without Air Dryer

1. Governor
2. From Reservoir
3. E-Type Unloader
4. Intake
5. Reservoir (wet tank)
6. Compressor
7. Discharge
8. From Unloader.

NOTES

Section L - Service Literature

Section Contents

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Additional Service Literature

The following publications can be purchased:

Bulletin No.	Title of Publication
3379000	Air for Your Engine
3666090	Specification Manual, 1994 Certification Levels N14
3810340	Cummins Engine Oil Recommendations
3379001	Fuel for Cummins Engines
3666130	CELECT™ Plus, Troubleshooting and Repair Manual
3387251	Coolant Additives and Filtration
3387266	Cold Weather Operation
3810313	PT® (Type D) STC Injector Shop Manual
3810487	Shop Manual, N14 Engines
3810481	Troubleshooting and Repair Manual, STC/PT® Fuel System, N14 Engines
3666142	Troubleshooting and Repair Manual, N14 Series Engines (STC, CELECT™, CELECT™ Plus)
3666070	Troubleshooting and Repair Manual, CENTRY™ System
3666078	CENTRY™ Wiring Diagram
3666146	CELECT™ Plus Wiring Diagram

Service Literature Ordering Location

Region	Ordering Location
United States and Canada	Cummins Distributors or Contact 1-800-DIESELS (1-800-343-7357)
U.K., Europe, Mid-East, Africa, and Eastern European Countries	Cummins Engine Co., Ltd. Royal Oak Way South Daventry Northants, NN11 5NU, England
South and Central America (excluding Brazil and Mexico)	Cummins Americas, Inc. 16085 N.W. 52nd Avenue Hialeah, FL 33104
Brazil and Mexico	Cummins Engine Co., Inc. International Parts Order Dept., MC 40931 Box 3005 Columbus, IN 47202-3005
Far East (excluding Australia and New Zealand)	Cummins Diesel Sales Corp. Literature Center 8 Tanjong Penjuru Jurong Industrial Estate Singapore
Australia and New Zealand	Cummins Diesel Australia Maroondah Highway, P.O.B. 139 Ringwood 3134 Victoria, Australia

Obtain current price information from your local Cummins Distributor.

Section M - Component Manufacturers

Section Contents

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Component Manufacturers' Addresses

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

Air Compressors

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

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

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

Air Cylinders

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

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

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

Air Heaters

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

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

Air Starting Motors

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

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

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

Alternators

Robert Bosch Ltd.
P.O. Box 98
Broadwater Park
North Orbital Road
Denham
Uxbridge
Middlesex UD9 5HG
England
Telephone: 01895-833633

Butec Electrics
Cleveland Road
Leyland
PR5 1XB
England
Telephone: 01744-21663

C.A.V. Electrical Equipment
P.O. Box 36
Warple Way
London
W3 7SS
England
Telephone: 01-743-3111

A.C. Delco Components Group
Civic Offices
Central Milton Keynes
MK9 3EL
England
Telephone: 01908-66001

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

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

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

Auxiliary Brakes

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

Belts

Dayco Rubber U.K.
Sheffield Street
Stockport
Cheshire
SK4 1RV
England
Telephone: 061-432-5163

T.B.A. Belting Ltd.
P.O. Box 77
Wigan
Lancashire
WN2 4XQ
England
Telephone: 01942-59221

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

Gates Rubber Company
900 S. Broadway
Denver, CO 80217

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

Catalytic Convertors

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

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

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

Coolant Level Switches

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

Clutches

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

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

Coolant Heaters

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

Drive Plates

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

Electric Starting Motors

Butec Electrics
Cleveland Road
Leyland
PR5 1XB
England
Telephone: 01744-21663

C.A.V. Electrical Equipment
P.O. Box 36
Warple Way
London
W3 7SS
England
Telephone: 01-743-3111

A.C. Delco Components Group
Civic Offices
Central Milton Keynes
MK9 3EL
England
Telephone: 0908-66001

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

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

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

Electronic Switches

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

Engine Protection Controls

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

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

Teddington Industrial
Equipment
Windmill Road
Sunburn on Thames
Middlesex
TW16 7HF
England
Telephone: 09327-85500

Fan Clutches

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

Holset Engineering Co. Ltd.
P.O. Box A9
Turnbridge
Huddersfield, West Yorkshire
England HD6 7RD
Telephone: 01484-22244

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

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

Fans

Truflo Ltd.
Westwood Road
Birmingham
B6 7JF
England
Telephone: 021-557-4101

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

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

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

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

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

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

Fault Lamps

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

Filters

Fleetguard International Corp.
Cavalry Hill Industrial Park
Weedon
Northampton NN7 4TD
England
Telephone: 01327-41313

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

Flexplates

Corrugated Packing and
Sheet Metal
Hamsterley
Newcastle Upon Tyne
England
Telephone: 01207-560-505

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

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

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

Fuel Coolers

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

Fuel Pumps

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

Fuel Warmers

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

Gauges

A.I.S.
Dyffon Industrial Estate
Ystrad Mynach
Hengoed
Mid Glamorgan
CF8 7XD
England
Telephone: 01443-812791

Grasslin U.K. Ltd.
Vale Rise
Tonbridge
Kent
TN9 1TB
England
Telephone: 01732-359888

Icknield Instruments Ltd.
Jubilee Road
Letchworth
Herts
England
Telephone: 04626-5551

Superb Tool and Gauge Co.
21 Princip Street
Birmingham
B4 61E
England
Telephone: 021-359-4876

Kabi Electrical and Plastics
Cranborne Road
Potters Bar
Herts
EN6 3JP
England
Telephone: 01707-53444

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

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

Governors

Woodward Governors Ltd.
P.O. Box 15
663/664 Ajax Avenue
Slough
Bucks
SL1 4DD
England
Telephone: 01753-26835

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

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

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

Heat Sleeves

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

Hydraulic and Power Steering Pumps

Hobourn Automotive
Temple Farm Works
Priory Road
Strood
Rochester
Kent, England
ME2 2BD
Telephone: 01634-71773

Honeywell Control Systems Ltd.
Honeywell House
Charles Square
Bracknell
Berks RG12 1EB
Telephone: 01344-4245

Sundstrand Hydratec Ltd.
Cheney Manor Trading Estate
Swindon
Wiltshire
SN2 2PZ
England
Telephone: 01793-30101

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

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

In-Line Connectors

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

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

Oil Heaters

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

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

Prelubrication Systems

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

Radiators

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

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

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

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

Throttle Assemblies

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

Torque Converters

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

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

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

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

NOTES

Section S - Service Assistance

Section Contents

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Service Assistance

Routine Service and Parts

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

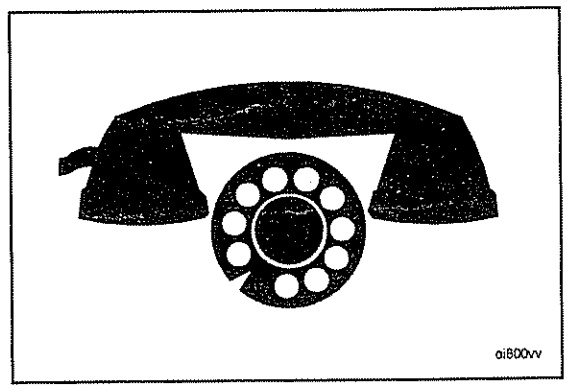
Emergency and Technical Service

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

If additional assistance is required, call Toll-Free:

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

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



Problem Solving

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

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

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

Division and Regional Offices

NOTE: The following list contains offices in U.S., Canada, Australia, New Zealand, and Puerto Rico.

United States

Southern Division Office
Cummins Engine Company, Inc.
425 Franklin Road S.W.
Suite 500
Marietta, GA 30067
Telephone: (770) 423-1108
FAX: (770) 499-8240

Plains Regional Office
Cummins Engine Company, Inc.
1901 Central Drive
Suite 356
Bedford, TX 76021
Telephone: (817) 267-3172
FAX: N/A

Canada

Canadian Division Office
Cummins Diesel of Canada, Ltd.
5575 North Service Road
Burlington, Ontario L726M1
Telephone: (905) 331-5944
FAX: (905) 331-0276

Western Canada Regional Office
Cummins Diesel of Canada, Ltd.
18452 - 96th Avenue
Surrey, B.C. V3T 4W2
Telephone: (604) 882-5727
FAX: (604) 882-9110

Eastern Canada Regional Office
Cummins Diesel of Canada Ltd.
7200 Trans Canada Hwy.
Pt. Cuaire, Quebec H9R 1C0
Telephone: (514) 695-2402
FAX: (514) 695-8917

Central Canada Regional Office
Cummins Diesel of Canada Ltd.
4887 – 35th Street SE
Calgary, Alberta T2B 3C6
FAX: (403) 569-9974

Australia Regional Office

Cummins Engine Company Pty. Ltd.
2 Caribbean Drive
Scoresby, Victoria 3179
Australia
Telephone: (61-3) 9765-3222
FAX: (61-3) 9763-0079

NOTE: This office also serves New Zealand.

Cummins Americas Regional Office

Cummins Latin America
3088 N. Commence Parkway
MPC #14, Building A
Miramar, FL 33025
Telephone: (305) 621-1300

NOTE: This office serves Puerto Rico and South America excluding Brazil.

Distributors and Branches - United States

Alabama

Birmingham Distributor
Cummins Alabama, Inc.
2200 Pinson Highway
P.O. Box 1147
Birmingham, AL 35201
Telephone: (205) 841-0421
FAX: (205) 849–5926

Mobile Branch
Cummins Alabama, Inc.
1924 N. Beltline Hwy.
Mobile, AL 36601–1598
Telephone: (334) 456-2236
FAX: (334) 452–6419

Mobile Onan/Marine Branch
Cummins Alabama, Inc.
3422 Georgia Pacific Avenue
Mobile, AL 36617
Telephone: (334) 452-6426
FAX: (334) 473-6657

Montgomery Branch
Cummins Alabama, Inc.
2325 West Fairview Avenue
Montgomery, AL 36108
Telephone: (205) 263-2594
FAX: (205) 263–2594

Alaska

Anchorage - (Branch of Seattle)
Cummins Northwest, Inc.
2618 Commercial Drive
Anchorage, AK 99501-3095
Telephone: (907) 279-7594
FAX: (907) 276-6340

Arizona

Phoenix Distributor and Branch
Cummins Southwest, Inc.
2239 N. Black Canyon Hgwy
Phoenix, AZ 85009
Telephone: (602) 252-8021
FAX: (602) 253–6725

Tucson Branch
Cummins Southwest, Inc.
1912 West Prince Road
Tucson, AZ 85705
Telephone: (520) 887-7440
FAX: (520) 887–4173

Arkansas

Little Rock - (Branch of Memphis)
Cummins Mid-South, Inc.
6600 Interstate 30
Little Rock, AR 72209
Telephone:
Sales: (501) 569-5600
Service: (501) 569–5656
Parts: (501) 569–5613
FAX: (501) 565–2199

California

San Leandro Distributor
Cummins West, Inc.
14775 Wicks Blvd.
San Leandro, CA 94577–6779
Telephone: (510) 351-6101
FAX: (510) 352–3925

Arcata Branch
Cummins West, Inc.
4801 West End Road
Arcata, CA 95521
Telephone: (707) 822–7392
FAX: (707) 822–7585

Bakersfield Branch
Cummins West, Inc.
4601 East Brundage Lane
Bakersfield, CA 93307
Telephone: (805) 325-9404
FAX: (805) 861–8719

Fresno Branch
Cummins West, Inc.
2740 Church Avenue
Fresno, CA 93706
Telephone: (209) 495–4745
FAX: (209) 486–7402

Redding Branch
Cummins West, Inc.
20247 Charlanne Drive
Redding, CA 96001
Telephone: (916) 222–4070
FAX: (916) 224–4075

Stockton Branch
Cummins West, Inc.
41 West Yokuts Avenue
Suite 131
Stockton, CA 95207
Telephone: (209) 473–0386
FAX: (209) 478–2454

West Sacramento Branch
Cummins West, Inc.
2661 Evergreen Avenue
West Sacramento, CA 95691
Telephone: (916) 371-0630
FAX: (916) 371–2849

Los Angeles Distributor
Cummins Cal Pacific Inc.
1939 Deere Avenue (Irvine)
Irvine, CA 92606
Telephone: (949) 253–6000
FAX: (949) 253–6080

Montebello Branch
Cummins Cal Pacific Inc.
1105 South Greenwood Avenue
Montebello, CA 90640
Telephone: (323) 728–8111
FAX: (323) 889–7422

Bloomington Branch
Cummins Cal Pacific Inc.
3061 S. Riverside Avenue
Bloomington, CA 92377
Telephone: (909) 877-0433
FAX: (909) 877-3787

San Diego Branch
Cummins Cal Pacific Inc.
310 N. Johnson Avenue
El Cajon, CA 92020
Telephone: (619) 593-3093
FAX: (619) 593–0600

Ventura Branch
Cummins Cal-Pacific Inc.
3958 Transport St.
Ventura, CA 93003
Telephone: (805) 644–7281
FAX: (805) 644–7284

Colorado

Denver Distributor
Cummins Rocky Mountain, Inc.
5100 East 58th Avenue
Commerce City, CO 80022
Telephone: (303) 287-0201
FAX: (303) 288–7080

Denver Onan/Industrial Branch
Cummins Rocky Mountain, Inc.
5100 East 58th Ave.
Commerce City, CO 80022
Telephone: (303) 286-7697
FAX: (303) 287–4837

Durango Branch
Cummins Rocky Mountain, Inc.
13595 County Road 213
Durango, CO 81301
Telephone: (970) 259–7470
FAX: (970) 259–7482

Grand Junction Branch
Cummins Rocky Mountain, Inc.
2380 U.S. Highway 6 & 50
P.O. Box 339
Grand Junction, CO 81501
Telephone: (303) 242-5776
FAX: (303) 243–5495

Connecticut

Rocky Hill - (Branch of Bronx)
Cummins Metropower, Inc.
914 Cromwell Ave.
Rocky Hill, CT 06067
Telephone: (860) 529–7474
FAX: (860) 529–7524

Florida

Tampa Distributor
Cummins Southeastern Power, Inc.
Corporate Office
5421 N. 59th Street
Tampa, FL 33610
Telephone: (813) 621-7202
FAX: (813) 621–8250

Ft. Myers Branch
Cummins Southeastern Power, Inc.
2671 Edison Avenue
Ft. Myers, FL 33902
Telephone: (941) 337–1211
FAX: (941) 337-5374

Jacksonville Branch
Cummins Southeastern Power, Inc.
755 Pickettville Rd.
Jacksonville, FL 32220
Telephone: (904) 378-1902
FAX: (904) 378–1904

Hialeah (Miami) Branch
Cummins Southeastern Power, Inc.
9900 N.W. 77th Avenue
Hialeah Gardens, FL 33016
Telephone: (305) 821-4200
FAX: (305) 557-2992

Ocala Branch
Cummins Southeastern Power
321 Southwest 52nd Ave.
Ocala, FL 34474–1892
Telephone: (352) 861–1122
FAX: (352) 861–1130

Orlando Branch
Cummins Southeastern Power, Inc.
4020 North
Orange Blossom Trail
Orlando, FL 32810
Telephone: (407) 298-2080
FAX: (407) 290-8727

Tampa Branch
Cummins Southeastern Power, Inc.
5912 E. Hillsborough Avenue
Tampa, FL 33610
Telephone: (813) 626-1101
FAX: (813) 628–4183

Georgia

Atlanta Distributor
Cummins South, Inc.
5125 Georgia Highway 85
College Park, GA 30349
Telephone: (404) 763-0151
FAX: (404) 766–2132

Albany Branch
Cummins South, Inc.
1915 W. Oakridge Drive
Albany, GA 31707–4938
Telephone: (912) 888-6210
FAX: (912) 883–1670

Atlanta Branch
Cummins South, Inc.
100 University Avenue, S.W.
Atlanta, GA 30315-2202
Telephone: (404) 527-7800
FAX: (404) 527–7832

Augusta Branch
Cummins South, Inc.
1255 New Savannah Road
Augusta, GA 30901-3891
Telephone: (706) 722-8825
FAX: (706) 722–7553

Savannah Branch
Cummins South, Inc.
8 Interchange Court
Savannah, GA 31401–1627
Telephone: (912) 232-5565
FAX: (912) 232–5145

Hawaii

Kapolei Distributor
Cummins Hawaii Diesel Power, Inc.
91–230 Kalaeloa Blvd.
Kapolei, HI 96707
Telephone: (808) 682–8110
FAX: (808) 682–8477

Idaho

Boise - (Branch of Salt Lake City)
Cummins Intermountain, Inc.
2851 Federal Way City
Boise, ID 83705
Telephone: (208) 336-5000
FAX: (208) 338-5436

Pocatello - (Branch of Salt Lake City)
Cummins Intermountain, Inc.
14299 Highway 30 West
Pocatello, ID 83201
Telephone: (208) 234-1661
FAX: (208) 234–1662

Illinois

Chicago Distributor
Cummins Northern Illinois, Inc.
7145 Santa Fe Drive
Hodgkins, IL 60525
Telephone: (708) 579-9222
FAX: (708) 352-7547

Bloomington-Normal – (Branch of Indianapolis)
Cummins Mid-States Power, Inc.
(at U.S. 51 N and I-55)
414 W. Northtown Road
Bloomington-Normal, IL 61761
Telephone: (309) 452-4454
FAX: (309) 452–1642

Onan Branch
Cummins/Onan Northern Illinois
8745 W. 82nd Place
Justin, IL 60458
Telephone: (708) 563–7070
FAX: (708) 563–7095

Harrisburg (Branch of St. Louis)
Cummins Gateway, Inc.
Highway 45 North
Harrisburg, IL 62946
Telephone: (618) 273-4138
FAX: (618) 273–4531

Rock Island - (Branch of Omaha)
Cummins Great Plains Diesel, Inc.
7820 - 42nd Street West
Rock Island, IL 61204
Telephone: (309) 787-4300
FAX: (309) 787–4397

Onan Branch
Cummins Gateway, Inc.
#1 Extra Mile Drive
Collinsville, IL 62234
Telephone: (618) 345–0123
FAX: (314) 531–6604

Indiana

Indianapolis Distributor
Cummins Mid-States Power, Inc.
P.O. Box 42917
3762 West Morris Street
Indianapolis, IN 46242-0917
Telephone: (317) 243-7979
FAX: (317) 240–1925

Evansville - (Branch of Louisville)
Cummins Cumberland, Inc.
7901 Highway 41 North
Evansville, IN 47711
Telephone: (812) 867-4400
FAX: (812) 421–3282

Ft. Wayne Branch
Cummins Mid-States Power, Inc.
3415 Coliseum Blvd. West
(At Jct. I-69 & 30/33)
Ft. Wayne, IN 46808
Telephone: (219) 482-3691
FAX: (219) 484–8930

Gary - (Branch of Chicago)
Cummins Northern Illinois, Inc.
1440 Texas Street
Gary, IN 46402
Telephone: (219) 885-5591
FAX: (219) 883-4817

Indianapolis Branch
Cummins Mid-States Power, Inc.
P. O. Box 42917
3621 West Morris Street
Indianapolis, IN 46242-0917
Telephone: (317) 244-7251
FAX: (317) 240–1215

Onan Branch
Mid-States Power, Inc.
4301 W. Morris Street
P.O. Box 42917
Indianapolis, IN 46240–0917
Telephone: (317) 240–1967
FAX: (317) 240–1975

Iowa

Cedar Rapids - (Branch of Omaha)
Cummins Great Plains Diesel, Inc.
625 - 33rd Avenue SW
Cedar Rapids, IA 52406
Telephone: (319) 366-7537 (24 hours)
FAX: (319) 366–7562

Des Moines - (Branch of Omaha)
Cummins Great Plains Diesel, Inc.
1680 N.E. 51st Avenue
P.O. Box B
Des Moines, IA 50313
Telephone: (515) 262-9591
Parts: (515) 262-9744
FAX: (515) 262–0626

Des Moines - (Branch of Omaha)
Midwestern Power Products
Division of Cummins Great Plains Diesel, Inc.
5194 N.E. 17th Street
Des Moines, IA 50313
Telephone: (515) 264-1650
FAX: (515) 264-1651

Kansas

Colby - (Branch of Kansas City, Missouri)
Cummins Mid-America, LLC.
1880 South Range
Colby, KS 67701
Telephone: (785) 462-3945
FAX: (785) 462-3970

Garden City - (Branch of Kansas City, Missouri)
Cummins Mid-America, Inc.
1285 Acraway
Garden City, KS 67846
Telephone: (316) 275-2277
FAX: (316) 275–2533

Wichita - (Branch of Kansas City, Missouri)
Cummins Mid-America, Inc.
5101 North Broadway
Wichita, KS 67201
Telephone: (316) 838-0875
FAX: (316) 838–0704

Kentucky

Louisville Distributor
Cummins Cumberland, Inc.
(Corporate Office)
2301 Nelsonville Parkway
Louisville, KY 40223
Telephone: (502) 254-3363
FAX: (502) 254–9272

Hazard Branch
Cummins Cumberland, Inc.
Highway 15 South
P.O. Box 510
Hazard, KY 41701
Telephone: (606) 436-5718
FAX: (606) 436–5038

Louisville Branch
Cummins Cumberland, Inc.
9820 Bluegrass Parkway
Louisville, KY 40299
Telephone: (502) 491-4263
FAX: (502) 499–0896

Louisiana

Morgan City - (Branch of Memphis)
Cummins Mid-South, Inc.
Hwy. 90 East
P.O. Box 1229
Amelia, LA 70340
Telephone: (504) 631-0576
FAX: (504) 631–0081

New Orleans - (Branch of Memphis)
Cummins Mid-South, Inc.
110 E. Airline Highway
Kenner, LA 70062
Telephone: (504) 468-3535
FAX: (504) 465–3408

Maine

Bangor (Branch of Boston)
Cummins Northeast, Inc.
221 Hammond Street
Bangor, ME 04401
Telephone: (207) 941-1061
FAX: (207) 945–3170

Scarborough - (Branch of Boston)
Cummins Northeast, Inc.
10 Gibson Road
Scarborough, ME 04074
Telephone: (207) 883-8155
FAX: (207) 883–5526

Maryland

Baltimore Distributor
Cummins Power Systems, Inc.
1907 Parkwood Drive
MD 21061
Telephone: (410) 590–8700
FAX: (410) 590–8723

Massachusetts

Boston Distributor
Cummins Northeast, Inc.
100 Allied Drive
Dedham, MA 02026
Telephone: (781) 329-1750
FAX: (781) 329–4428

Springfield Branch
Cummins Northeast, Inc.
177 Rocus Street
Springfield, MA 01104
Telephone: (413) 737-2659
FAX: (413) 731–1082

Mexico

Tijuana - (Branch of Los Angeles)
Distribuidora Cummins De Baja
Blvd. 3ra. Oeste No. 17523
Fracc. Industrial
Garita de Otay C.P. 22400
Tijuana, Baja California
Mexico
Telephone: 011–52–66–238433
FAX: 011–52–66–238649

Michigan

Detroit (Novi) Distributor
Cummins Michigan, Inc.
41216 Vincenti Court
Novi, MI 48375
Telephone: (248) 478-9700
FAX: (248) 478-1570

Blissfield, Michigan
Diesel Fuel Systems, Inc.
Subsidiary of Cummins Michigan Inc.
211 N. Jipson Street
Blissfield, MI 49228
Telephone: (517) 486-4324
FAX: (517) 486-3614

Dearborn Branch
Cummins Michigan, Inc.
3760 Wyoming Avenue
Dearborn, MI 48120
Telephone: (313) 843-6200
FAX: (313) 843-6070

Grand Rapids Branch
Cummins Michigan, Inc.
3715 Clay Avenue, S.W.
Grand Rapids, MI 49508
Telephone: (616) 538-2250
FAX: (616) 538-3830

Grand Rapids Branch
Standby Power, Inc.
7580 Expressway Drive S.W.
Grand Rapids, MI 49548
Telephone: (616) 281-2211
FAX: (616) 281-3177

Iron Mountain - (Branch of De Pere)
Cummins Great Lakes, Inc.
1901 Stevenson Avenue
Iron Mountain, MI 49801
Telephone: (906) 774-2424
(800) 236-2424
FAX: (906) 774-1190

Novi Branch
Cummins Michigan, Inc.
25100 Novi Road
Novi, MI 48375
Telephone: (248) 380-4300
FAX: (248) 380-0910

Power Products (Branch of Detroit)
Cummins Michigan, Inc.
41326 Vincenti Ct.
Novi, MI 48375
Telephone: (248) 426-9300
FAX: (248) 473-8560

Saginaw Branch
Cummins Michigan, Inc.
722 N. Outer Drive
Saginaw, MI 48605
Telephone: (517) 752-5200
FAX: (517) 752-4194

Standby Power - (Branch of Detroit)
Cummins Michigan, Inc.
12130 Dixie
Redford, MI 48239
Telephone: (313) 538-0200
FAX: (313) 538-3966

Minnesota

St. Paul Distributor
Cummins North Central, Inc.
3030 Centre Pointe Drive
Suite 500
Roseville, MN 55113
Telephone: (651) 636-1000
FAX: (651) 638-2442

Duluth Branch
Cummins Diesel Sales, Inc.
3115 Truck Center Drive
Duluth, MN 55806–1786
Telephone: (218) 628-3641
FAX: (218) 628–0488

St. Paul Branch
Cummins North Central, Inc.
2690 Cleveland Ave. North
St. Paul, MN 55113
Telephone: (651) 636-1000
FAX: (651) 638-2497

Mississippi

Jackson - (Branch of Memphis)
Cummins Mid-South, Inc.
325 New Highway 49 South
Jackson, MS 39288-4224
Telephone:
Admin.: (601) 932-7016
Parts: (601) 932-2720
Service: (601) 939-1800
FAX: (601) 932–7399

Missouri

Kansas City Distributor and Branch
Cummins Mid-America, Inc.
8201 NE Parvin Road
Kansas City, MO 64161
Telephone: (816) 414–8200
FAX: (816) 414–8299

Joplin Branch
Cummins Mid-America, Inc.
3507 East 20th Street
Joplin, MO 64801
Telephone: (417) 623-1661
FAX: (417) 623–1817

Springfield Branch
Cummins Mid-America, Inc.
3637 East Kearney
Springfield, MO 65803
Telephone: (417) 862-0777
FAX: (417) 862-4429

St. Louis Distributor
Cummins Gateway, Inc.
7210 Hall Street
St. Louis, MO 63147
Telephone: (314) 389-5400
FAX: (314) 389–9671

Columbia Branch
Cummins Gateway, Inc.
5221 Highway 763 North
Columbia, MO 65202
Telephone: (314) 449-3711
FAX: (314) 449–3712

Sikeston Branch
Cummins Gateway, Inc.
101 Keystone Drive
Sikeston, MO 63801
Telephone: (314) 472-0303
FAX: (314) 472–0306

Industrial Power Branch
Cummins Gateway, Inc.
3256 E. Outer Road
Scott City, MO 63788
Telephone: (573) 335-9399
FAX: (573) 335-7062

Montana

Billings - (Branch of Denver)
Cummins Rocky Mountain, Inc.
5151 Midland Road
Billings, MT 59101
Telephone: (406) 245-4194
FAX: (406) 245–7923

Great Falls - (Branch of Denver)
Cummins Rocky Mountain, Inc.
415 Vaughn Road
Great Falls, MT 59404
Telephone: (406) 452-8561
FAX: (406) 452–9911

Missoula - (Branch of Seattle)
Cummins Northwest, Inc.
4950 North Reserve Street
Missoula, MT 59802-1498
Telephone: (406) 728-1300
FAX: (406) 728-8523

Nebraska

Omaha Distributor and Branch
Cummins Great Plains Diesel, Inc.
5515 Center Street
P.O. Box 6068
Omaha, NE 68106
Telephone: (402) 551-7678 (24 Hours)
FAX: (402) 551–1952

Kearney Branch
Cummins Great Plains Diesel, Inc.
515 Central Avenue
Kearney, NE 68847
Telephone: (308) 234-1994
FAX: (308) 234–5776

Nevada

Elko - (Branch of Salt Lake City)
Cummins Intermountain, Inc.
5370 East Idaho Street
Elko, NV 89801
Telephone: (775) 738-6405
FAX: (775) 738–1719

Las Vegas - (Branch of Salt Lake City)
Cummins Intermountain, Inc.
2750 Losee Road
North Las Vegas, NV 89030
Telephone: (702) 399-2339
FAX: (702) 399–7457

Sparks - (Branch of Salt Lake City)
Cummins Intermountain, Inc.
150 Glendale Avenue
Sparks, NV 89431
Telephone: (775) 331-4983
FAX: (775) 331–7429

New Jersey

Newark - (Branch of Bronx)
Cummins Metropower, Inc.
41-85 Doremus Ave.
Newark, NJ 07105
Telephone: (973) 491–0100
FAX: (973) 578–8873

New Mexico

Albuquerque - (Branch of Phoenix)
Cummins Southwest, Inc.
1921 Broadway N.E.
Albuquerque, NM 87102
Telephone: (505) 247-2441
FAX: (505) 842–0436

Farmington - (Branch of Phoenix)
Cummins Southwest, Inc.
1101 North Troy King Road
Farmington, NM 87401
Telephone: (505) 327-7331
FAX: (505) 326–2948

New York

Bronx Distributor
Cummins Metropower, Inc.
890 Zerega Avenue
Bronx, NY 10473
Telephone: (718) 892-2400
FAX: (718) 892–0055

Albany - (Branch of Boston)
Cummins Northeast, Inc.
101 Railroad Avenue
Albany, NY 12205
Telephone: (518) 459-1710
FAX: (518) 459–7815

Buffalo - (Branch of Boston)
Cummins Northeast, Inc.
480 Lawrence Bell Dr.
Williamsville, NY 14221-7090
Telephone: (716) 631-3211
FAX: (716) 626–0799

Syracuse - (Branch of Boston)
Cummins Northeast, Inc.
29 Eastern Avenue
Syracuse, NY 13211
Telephone: (315) 437-2751
FAX: (315) 437-8141

North Carolina

Charlotte Distributor
Cummins Atlantic, Inc.
11101 Nations Ford Road (28273)
P.O. Box 240729
Charlotte, NC 28224-0729
Telephone: (704) 588-1240
FAX: (704) 587-4870

Charlotte Branch
Cummins Atlantic, Inc.
3700 North Interstate 85
Charlotte, NC 28206
Telephone: (704) 596-7690
FAX: (704) 596–3038

Greensboro Branch
Cummins Atlantic, Inc.
513 Preddy Boulevard (27406)
P.O. Box 22066
Greensboro, NC 27420-2066
Telephone: (336) 275-4531
FAX: (336) 275–8304

Wilson Branch
Cummins Atlantic, Inc.
1514 Cargill Avenue (27893)
P.O. Box 1177
Wilson, NC 27894-1117
Telephone: (252) 237-9111
FAX: (252) 237–9132

North Dakota

Fargo - (Branch of St. Paul)
Cummins North Central, Inc.
3801 - 34th Ave. SW
Fargo, ND 58104
Telephone: (701) 282-2466
FAX: (701) 277–5399

Grand Forks - (Branch of St. Paul)
Cummins North Central, Inc.
4728 Gateway Drive
Grand Forks, ND 58201
Telephone: (701) 775-8197
FAX: (701) 775–4833

Minot - (Branch of St. Paul)
Cummins North Central, Inc.
1501 - 20th Avenue, S.E.
Minot, ND 58702
Telephone: (701) 852-3585
FAX: (701) 852–3588

Ohio

Columbus Distributor and Branch
Cummins Interstate Power, Inc.
4000 Lyman Drive
Hilliard (Columbus), OH 43026
Telephone: (614) 771-1000
FAX: (614) 771–0769

Columbus Distributor
Cummins Interstate Power, Inc.
2297 Southwest Bldv., Suite K
Grove City, OH 43123
Telephone: (614) 771-1000
FAX: (614) 527-2576

Cincinnati Branch
Cummins Interstate Power, Inc.
10470 Evendale Drive
Cincinnati, OH 45241
Telephone: (513) 563-6670
FAX: (513) 563–0594

Cleveland Branch
Cummins Interstate Power, Inc.
7585 Northfield Road
Cleveland, OH 44146
Telephone: (440) 439-6800
FAX: (440) 439–7390

Strasburg Branch
Cummins Interstate Power, Inc.
777 South Wooster Avenue
Strasburg, OH 44680
Telephone: (216) 878-5511
FAX: (216) 878–7666

Toledo Branch
Cummins Interstate Power, Inc.
801 Illinois Avenue
Maumee
(Toledo), OH 43537
Telephone: (419) 893-8711
FAX: (419) 893–5362

Youngstown Branch
Cummins Interstate Power, Inc.
7145 Masury Road
Hubbard
(Youngstown), OH 44425
Telephone: (216) 534-1935
FAX: (216) 534–5606

Oklahoma

Oklahoma City - (Branch of Arlington)
Cummins Southern Plains, Inc.
5800 West Reno
Oklahoma City, OK 73127
Telephone: (405) 946-4481 (24 hours)
FAX: (405) 946–3336

Tulsa - (Branch of Arlington)
Cummins Southern Plains, Inc.
16525 East Skelly Drive
Tulsa, OK 74116
Telephone: (918) 234–3240
FAX: (918) 234–2342

Oregon

Bend - (Branch of Seattle)
Cummins Northwest, Inc.
3500 N. Highway 97 (97701-5729)
P.O. Box 309
Bend, OR 97709-0309
Telephone: (541) 389-1900
FAX: (541) 389–1909

Coburg/Eugene - (Branch of Seattle)
Cummins Northwest, Inc.
91201 Industrial Parkway
Coburg, OR 97401
(Mailing Address)
P.O. Box 10877
Eugene, OR 97440-2887
Telephone: (541) 687-0000
FAX: (541) 687–1977

Medford - (Branch of Seattle)
Cummins Northwest, Inc.
4045 Crater Lake Highway
Medford, OR 97504-9796
Telephone: (541) 779-0151
FAX: (541) 772–2395

Pendleton - (Branch of Seattle)
Cummins Northwest, Inc.
223 S.W. 23rd Street
Pendleton, OR 97801-1810
Telephone: (541) 276-2561
FAX: (541) 276-2564

Portland - (Branch of Seattle)
Cummins Northwest, Inc.
4711 N. Basin Avenue
P. O. Box 2710 (97208-2710)
Portland, OR 97217-3557
Telephone: (503) 289-0900
FAX: (503) 286-5938

Pennsylvania

Philadelphia Distributor
Cummins Power Systems, Inc.
2727 Ford Road
Bristol, PA 19007
Telephone: (215) 785-6005 and
(609) 563–0005
FAX: (215) 785-4085

Bristol Branch
Cummins Power Systems, Inc.
2727 Ford Road
Bristol, PA 19007
Telephone: (215) 785-6005 and
(609) 563–0005
FAX: (215) 785–4728

Pittsburgh Branch
Cummins Power Systems, Inc.
3 Alpha Drive
Pittsburgh, PA 15238–2901
Telephone: (412) 820–8300
FAX: (412) 820–8308

Harrisburg Branch
Cummins Power Systems, Inc.
4499 Lewis Road
Harrisburg, PA 17111-2541
Telephone: (717) 564-1344
FAX: (717) 558-8217

Puerto Rico

Puerto Nuevo - (Branch of Tampa)
Cummins Diesel Power, Inc.
#31 Calle "C"
El Matadero
Puerto Nuevo, Puerto Rico 00920
Telephone: (787) 793–0300
FAX: (787) 793–1072

South Carolina

Charleston - (Branch of Charlotte)
Cummins Atlantic, Inc.
3028 West Montague Avenue
Charleston, SC 29418–5593
Telephone: (843) 554-5112
FAX: (843) 745–0745

Charleston - (Branch of Charlotte)
Cummins Atlantic Inc.
231 Farmington Road
Charleston, SC 29483
Telephone: (843) 851-9819
FAX: (843) 875–4338

Columbia - (Branch of Charlotte)
Cummins Atlantic, Inc.
1233 Bluff Road (29201)
P.O. Box 13543
Columbia, SC 29201–3543
Telephone: (803) 799-2410
FAX: (803) 779–3427

South Dakota

Sioux Falls - (Branch of Omaha)
Cummins Great Plains Diesel, Inc.
701 East 54th Street North
Sioux Falls, SD 57104
Telephone: (605) 336-1715
FAX: (605) 336–1748

Tennessee

Memphis Distributor & Distribution Center
Cummins Mid-South, Inc.
666 Riverside Drive
Memphis, TN 38703
Telephone: (901) 577-0666
FAX: (901) 522–8758

Chattanooga - (Branch of Atlanta)
Cummins South, Inc.
1509 East 26th Street
Chattanooga, TN 37407-1095
Telephone: (615) 629-1447
FAX: (615) 629–1494

Knoxville - (Branch of Louisville)
Cummins Cumberland, Inc.
1211 Ault Road
Knoxville, TN 37914
Telephone: (423) 523-0446
FAX: (423) 523-0343

Memphis Branch
Cummins Mid-South, Inc.
1784 E. Brooks Road
Memphis, TN 38116
Telephone:
Sales/Admin.: (901) 345-7424
Parts: (901) 345-1784
Service: (901) 345-6185
FAX: (901) 346–4735

Nashville - (Branch of Louisville)
Cummins Cumberland, Inc.
706 Spence Lane
Nashville, TN 37217
Telephone: (615) 366-4341
FAX: (615) 366–5693

Texas

Arlington Distributor
Cummins Southern Plains, Inc.
600 N Watson Road
Arlington, TX 76004-3027
Telephone: (817) 640-6801
FAX: (817) 640-6852

Amarillo Branch
Cummins Southern Plains, Inc.
5224 Interstate 40 -
Expressway East
P.O. Box 31570
Amarillo, TX 79120-1570
Telephone: (806) 373-3793 (24 hours)
FAX: (806) 372–8547

Dallas Branch
Cummins Southern Plains, Inc.
3707 Irving Boulevard
Dallas, TX 75247
Telephone: (214) 631-6400 (24 hours)
FAX: (214) 631–2322

El Paso - (Branch of Phoenix)
Cummins Southwest, Inc.
14333 Gateway West
El Paso, TX 79927
Telephone: (915) 852-4200
FAX: (915) 852-3295

Fort Worth Branch
Cummins Southern Plains, Inc.
3250 North Freeway
Fort Worth, TX 76111
Telephone: (817) 624-2107 (24 hours)
FAX: (817) 624–3296

Houston Branch
Cummins Southern Plains, Inc.
4750 Homestead Road
P.O. Box 1367
Houston, TX 77251-1367
Telephone: (713) 675-7421 (24 hours)
FAX: (713) 675–1515

Mesquite Branch
Cummins Southern Plains, Inc.
2615 Big Town Blvd.
Mesquite, TX 75150
Telephone: (214) 321-5555 (24 hours)
FAX: (214) 328–2732

Odessa Branch
Cummins Southern Plains, Inc.
1210 South Grandview
P.O. Box 633
Odessa, TX 79760-0633
Telephone: (915) 332-9121 (24 hours)
FAX: (915) 333–4655

San Antonio Branch
Cummins Southern Plains, Inc.
6226 Pan Am Expressway North
P.O. Box 18385
San Antonio, TX 78218–0385
Telephone: (512) 655-5420 (24 hours)
FAX: (512) 655–3865

Houston Onan Branch
Southern Plains Power
A Division of Cummins Southern Plains
1155 West Loop North
Houston, TX 77055
Telephone: (713) 956-0020
FAX: (713) 956-0266

Utah

Salt Lake City Distributor
Cummins Intermountain, Inc.
1030 South 300 West
Salt Lake City, UT 84101
Telephone: (801) 355-6500
FAX: (801) 524–1351

Vernal Branch
Cummins Intermountain, Inc.
1435 East 335 South
Vernal, UT 84078
Telephone: (435) 789-5732
FAX: (435) 789-2853

Virginia

Cloverdale - (Branch of Charlotte)
Cummins Atlantic, Inc.
263 Simmons Drive
Cloverdale, VA 24077
Telephone: (540) 966-3169
FAX: (540) 966-3749

Richmond - (Branch of Charlotte)
Cummins Atlantic, Inc.
3900 Deepwater Terminal Road
Richmond, VA 23234
Telephone: (804) 232-7891
FAX: (804) 232-7428

Tidewater - (Branch of Charlotte)
Cummins Atlantic, Inc.
Atlantic Power Generation
3729 Holland Blvd.
Chesapeake, VA 23323
Telephone: (757) 485-4848
FAX: (757) 485-5085

Washington

Seattle Distributor
Cummins Northwest, Inc.
811 S.W. Grady Way (98055-2944)
P.O. Box 9811
Renton, WA 98057–9811
Telephone: (425) 235-3400
FAX: (425) 235–8202

Chehalis Branch
Cummins Northwest, Inc.
926 N.W. Maryland
Chehalis, WA 98532-0339
Telephone: (360) 748-8841
FAX: (360) 748–8843

Spokane Branch
Cummins Northwest, Inc.
11134 W. Westbow Blvd.
Spokane, WA 99204
Telephone: (509) 455–4411
FAX: (509) 624–4681

Tacoma Branch
Cummins Northwest, Inc.
3701 Pacific Highway East
Tacoma, WA 98424-1135
Telephone: (253) 922-2191
FAX: (253) 922–2379

Yakima Branch
Cummins Northwest, Inc.
1905 East Central Avenue (98901-3609)
P.O. Box 9129
Yakima, WA 98909-0129
Telephone: (509) 248-9033
FAX: (509) 248–9035

West Virginia

Charleston - (Branch of Louisville)
Cummins Cumberland, Inc.
3100 MacCorkle Ave. SW
P.O. Box 8456
South Charleston, WV 25303
Telephone: (304) 744-6373
FAX: (304) 744-8605

Fairmont - (Branch of Louisville)
Cummins Cumberland, Inc.
South Fairmount Exit, I-79
145 Middletown Road
Fairmont, WV 26554
Telephone: (304) 367-0196
FAX: (304) 367–1077

Wisconsin

DePere Distributor
Cummins Great Lakes, Inc.
Corporate Office
875 Lawrence Drive
P.O. Box 5070
DePere, WI 54115–5070
Telephone: (920) 337-1991
FAX: (920) 337-9746

Chippewa Falls Branch
Cummins Great Lakes, Inc.
2030 St. Highway 53
Chippewa Falls, WI 54729
Telephone: (715) 720-0680
FAX: (715) 720–0685

DePere Branch
Cummins Great Lakes, Inc.
939 Lawrence Drive
P. O. Box 5070
DePere, WI 54115–5070
Telephone: (920) 336-9631
(800) 236–1191
FAX: (920) 336–8984

Milwaukee Branch
Cummins Great Lakes, Inc.
9401 South 13th Street
P.O. Box D
Oak Creek, WI 53154
Telephone: (414) 768-7400
(800) 472-8283
FAX: (414) 768-9441

Wausau Branch
Cummins Great Lakes, Inc.
4703 Rib Mountain Drive
Wausau, WI 54401
Telephone: (715) 359-6888
(800) 236-3744
FAX: (715) 359-3744

Wyoming

Gillette - (Branch of Denver)
Cummins Rocky Mountain, Inc.
2700 Hwy. 14 & 16 North
P.O. Box 1207 (82717)
Gillette, WY 82716
Telephone: (307) 682-9611
FAX: (307) 682–8242

Rock Springs - (Branch of Salt Lake City)
Cummins Intermountain, Inc.
2000 Foothill Blvd.
P.O. Box 1634
Rock Springs, WY 82901
Telephone: (307) 362-5168
FAX: (307) 362–5171

Distributors and Branches - Canada

Alberta

Edmonton Distributor and Branch
Cummins Alberta
11751 - 181 Street
Edmonton, AB T5S 2K5
Telephone: (780) 455-2151
FAX: (780) 454-9512

Calgary Branch
Cummins Alberta
4887 - 35th Street S.E.
Calgary, Alberta T2B 3H6, Canada
Telephone: (403) 569-1122
FAX: (403) 569-0027

Grande Prairie
Cummins Alberta - Grande Praire
RR2, Site 9, Box 22
Sexsmith, AB CN T0H 3C0
Telephone: (780) 568-3359
FAX: (780) 568-2263

Hinton Branch
Cummins Alberta
135 Veats Avenue
Hinton, Alberta T7V 1S8, Canada
Telephone: (780) 865-5111
FAX: (780) 865-5714

Lethbridge Branch
Cummins Alberta
240 - 24th Street North
Lethbridge, Alberta T1H 3T8, Canada
Telephone: (403) 329-6144
FAX: (403) 320-5383

British Columbia

Vancouver Distributor
Cummins British Columbia
18452 - 96th Avenue
Surrey, B.C., Canada
V4N 3P8
Telephone: (604) 882-5000
FAX: (604) 882-5080

Kamloops Branch
Cummins British Columbia
976 Laval Crescent
Kamloops, B.C. Canada V2C 5P5
Telephone: (250) 828-2388
FAX: (250) 828-6713

Prince George Branch
Cummins British Columbia
102- 3851- 18th Avenue
Prince George, B.C. V2N 1B1
Telephone: (250) 564-9111
FAX: (250) 564-5853

Sparwood Branch
Cummins British Columbia
731 Douglas Fir Road
Sparwood, B.C. VOB 2GO, Canada
Telephone: (250) 425-0522
FAX: (250) 425-0323

Tumbler Ridge Branch
Cummins British Columbia
Industrial Site, Box 226
Tumbler Ridge, B.C.
Canada VOC 2WO
Telephone: (250) 242-4217
FAX: (250) 242-4906

Manitoba

Winnipeg Distributor
Cummins Mid-Canada Ltd.
489 Oak Point Road
P.O. Box 1860
Winnipeg, MB R3C 3R1, Canada
Telephone: (204) 632-5470
FAX: (204) 697-0267

New Brunswick

Fredericton - (Branch of Montreal)
Cummins Eastern Canada, Inc.
R.R.#1 Doak Road
P.O. Box 1178, Station 'A'
Fredericton,
New Brunswick E3B 4X2, Canada
Telephone: (506) 451-1929
FAX: (506) 451-1921

Newfoundland

St. John's - (Branch of Montreal)
Cummins Eastern Canada, Inc.
122 Clyde Avenue
Donovans Industrial Park
Mount Pearl, Newfoundland A1N 2C2
Canada
Telephone: (709) 747-0176
FAX: (709) 747-2283

Wabush - (Branch of Montreal)
Cummins Eastern Canada, Inc.
Wabush Industrial Park
Wabush, Newfoundland A0R 1B0
Telephone: (709) 282-3626
FAX: (709) 282-3108

Nova Scotia

Halifax - (Branch of Montreal)
Cummins Eastern Canada, Inc.
50 Simmonds Drive
Dartmouth, Nova Scotia B3B 1R3
Telephone: (902) 468-7938
FAX: (902) 468-5177
Parts: (902) 468-6560

Ontario

Toronto Distributor
Cummins Ontario, Inc.
7175 Pacific Circle
Mississauga, ON L5T 2A5
Telephone: (905) 795-0050
FAX: (905) 795-0021

Kenora - (Branch of Winnipeg)
Cummins Mid-Canada Ltd.
Highway 17 East
P.O. Box 8
Kenora, Ontario P9N 3X1
Telephone: (807) 548-1941
FAX: (807) 548-8302

Ottawa Branch
Cummins Ontario Inc.
3189 Swansea Crescent
Ottawa, Ontario K1G 3W5,
Telephone: (613) 736-1146
FAX: (613) 736-1202

Thunder Bay Branch
Cummins Ontario Inc.
1400 W. Walsh Street
Thunder Bay
Ontario P7E 4X4
Telephone: (807) 577-7561
FAX: (807) 577-1727

Whitby Branch
Cummins Ontario Inc.
1311 Hopkins Street
Whitby, Ontario L1N 2C2, Canada
Telephone: (905) 668-6886
FAX: (905) 668-1375

Quebec

Montreal Distributor
Cummins Eastern Canada, Inc.
7200 Trans Canada Highway
Pointe Claire, Quebec H9R 1C2,
Telephone: (514) 695-8410
FAX: (514) 695-8917

Montreal Branch
Cummins Eastern Canada, Inc.
7200 Trans Canada Highway
Pointe Claire, Quebec H9R 1C2,
Canada
Telephone: (514) 695-8410
Sales: (514) 695-4555
Parts: (514) 694-5880
FAX: (514) 695-8917

Dorval Onan Branch
Cummins, Eastern Canada, Inc.
580 Lepihe
Dorval, Quebec H9H 1G2
Telephone: (514) 631-5000
FAX: (514) 631-0104

Quebec City Branch
Cummins Diesel
Branch of Cummins Americas, Inc.
2575 Dalton Street
Ste. Foy, Quebec G1P 3S7
Telephone: (418) 653-6411
FAX: (418) 653-5844

Val D'Or Branch
Cummins, Eastern Canada, Inc.
1025 Rue Del
Val D'Or, Quebec 59P 4P6
Telephone: (819) 825-0993
FAX: (819) 825-8488

Saskatchewan

Lloydminster - (Branch of Winnipeg)
Cummins Mid-Canada Ltd.
4005 52nd
Lloydminster, SK S9V 0Y9
Telephone: (305) 825–2062
FAX: (305) 825–6702

Regina - (Branch of Winnipeg)
Cummins Mid-Canada Ltd.
110 Kress Street
P.O. Box 98
Regina, SK S4P 2Z5
Telephone: (306) 721-9710
FAX: (306) 721–2962

Saskatoon - (Branch of Winnipeg)
Cummins Mid-Canada, Ltd.
3001 Faithful Avenue
P.O. Box 7679
Saskatoon, SK S7K 4R4, Canada
Telephone: (306) 933-4022
FAX: (306) 242–1722

Distributors and Branches - Australia

Branches:

Gepps Cross
Cummins Engine Company, Pty. Ltd.
P.O. Box 108
Blair Athol, 5084
South Australia, Australia
Location:
45-49 Cavan Road
Gepps Cross, 5094
Telephone: (61-8) 8262-5211

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

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

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

Campbellfield
Cummins Engine Company, Pty. Ltd.
Private Bag 9
Campbellfield, 3061
Victoria, Australia
Location:
1788-1800 Hume Highway
Campbellfield, 3061
Telephone: (613) 9357-9200

Dandenong
Cummins Engine Company, Pty. Ltd.
Lot 7 Greens Road
Dandenong, 3175
Victoria, Australia
Telephone: (613) 9706-8088

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

Devonport
Cummins Engine Company, Pty. Ltd.
P.O. Box 72E
Tasmania, Australia
Location:
2 Matthews Way
Devonport, 7310
Telephone: (61-3) 6424-8800

Emerald
Cummins Engine Company, Pty. Ltd.
P.O. Box 668
Emerald, 4720
Queensland, Australia
Location:
Capricorn Highway
Emerald, 4720
Telephone: (61-7) 4982-4022

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

Hexham
Cummins Engine Company, Pty. Ltd.
21 Galleghan Street
Hexham
New South Wales, Australia
Telephone: (61-2) 4964-8466
FAX: (61-2) 4964-8616

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

Karratha
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

Laverton
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

Leeton
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

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

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

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

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

Regency Park
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

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

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

Townsville
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

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

Wetherill Park
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

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 Diesel Sales & Service (NZ) Ltd.
Private Bag 92804
Penrose, Auckland, New Zealand
Location:
440 Church Street
Penrose
Telephone: (64-9) 579-0085

Branches:

Auckland

Cummins Diesel Engines
Private Bag 92804
Penrose, Auckland, New Zealand
Location:
440 Church Street
Penrose
Telephone: (64-9) 579-0085

Christchurch

Cummins Diesel Engines
P.O. Box 16-149
Hornby, Christchurch, New Zealand
Location:
35 Parkhouse Road
Sockburn, Christchurch
Telephone: (64-3) 348-8170

Mt. Maunganui

Cummins Diesel Engines
P.O. Box 4005
Mt. Maunganui, New Zealand
Location:
101 Totara Street
Mt. Maunganui
Telephone: (64-7) 575-0545

Palmerston North

Cummins Diesel Engines
P.O. Box 9024
Palmerston North, New Zealand
Location:
852-860 Tremaine Avenue
Telephone: (64-6) 356-2209

Regional Offices - International

North Africa Regional Office - Algiers

Cummins Corporation
Bureau de Liaison
38, Lotissement Benachour Abdelkader
Cheraga
42300 Wilaya de Tipasa
Algeria
Telephone: (213) 2374326

Country Covered: Algeria

European Regional Office - Mechelen

Cummins Diesel N.V.
Blarenberglaan 4
Industriepark Noord 2
2800 Mechelen
Brussels
Telephone: (32-15) 20003

Countries Covered:

- Austria
- Belgium
- Czech Republic
- Denmark
- Finland
- Greece
- Hungary
- Iceland
- Israel
- Luxembourg
- Netherlands
- Norway
- Portugal
- Slovakia
- Spain
- Sweden
- Switzerland

Cumbrasa Regional Office - Brazil

Cummins Brasil S.A.
Rua Jati, 266
07180-900 Guarulhos
Sao Paulo, Brazil

Mailing Address:
P.O. Box 13
07180-900 Guarulhos
Sao Paulo, Brazil
Telephone: (55-11) 945-9811

Country Covered: Brazil

Beijing Regional Office - China

Cummins Corporation
China World Tower, Suite 917
China World Trade Center
No. 1 Jian Guo Men Wai
Beijing 100004
People's Republic of China
Telephone: (86-1) 505-4209/10

Countries Covered:

- China
- Mongolia

Bogota Regional Office - Columbia

Cummins Engine Co. de Colombia S.A.
Carrera 11A No. 90-15 Of. 601/602
Bogota, D.E., Colombia
Telephone: (57-1) 610-4849

Mailing Address:
Apartado Aereo 90988
Bogota D.E., Colombia

Countries Covered:

- Argentina
- Bolivia
- Chile
- Colombia
- Ecuador
- Paraguay
- Peru
- Uruguay

Lyon Regional Office - France

Cummins Diesel Sales Corporation
39, rue Ampere - Zone Industrielle
69680 Chassieu
France
Telephone: (33) 72-22-92-72

Countries Covered:

- Algeria
- France
- Guadeloupe
- Guyana
- Martinique
- New Caledonia
- Reunion

Gross-Gerau Regional Office - Germany

Cummins Diesel Deutschland GmbH
Odenwaldstr. 23
D-6080 Gross-Gerau
Germany
Telephone: (49-6152) 174-0

Countries Covered:

- Albania
- Bulgaria
- *Czech Republic
- Germany
- Luxembourg
- Poland
- Romania
- Southeastern Europe
- Slovika

*Marine Only

Hong Kong Regional Office - Hong Kong

Cummins Engine H.K. Ltd.
Unison Industrial Centre
15th Floor, Units C & D
27-31 Au Pui Wan Street
P. O. Box 840 Shatin
Fo Tan, Shatin, N.T.
Hong Kong
Telephone: (852) 606-5678

Country Covered: Hong Kong

Pune Kirloskar Regional Office - India

Kirloskar Cummins Limited
Kothrud
Pune - 411 029, India
Telephone: (91-212) 33-0240, 33-5435, 33-1105

Countries Covered:

- Bhutan
- India
- Nepal

Milan Regional Office - Italy

Cummins Diesel Italia S.P.A.
Piazza Locatelli 8
Zona Industriale
20098 San Giuliano Milanese
Milan, Italy
Telephone: (39-2) 982-81235/6/7

Country Covered: Italy

North Asia Regional Office - Japan

Cummins Diesel Sales Corporation
1-12-10 Shintomi
Chuo-ku, Tokyo 104
Japan
Telephone: (81-3) 3555-3131/2/3/4/5

Country Covered: Japan

Seoul Regional Office - Korea

Cummins Korea Ltd.
5th Floor, Hye Sung Building
35-26 Sam Sung Dong, Kang Nam Ku
Seoul, South Korea
Telephone: (82-2) 516-0431/2/3, 517-3370/1

Country Covered: South Korea

Cummsa Regional Office - Mexico

Cummins, S.A. de C.V.
Arquimedes No. 209
Col. Polanco
11560 Mexico, D.F.
Mexico
Telephone: (52-5) 254-3822/3783/3622

Mailing/Shipping Address:
Gonzalez de Castilla Inc.
P.O. Box 1391
4605 Modern Lane
Modern Industrial Park
Laredo, TX 78040
Telephone: (512) 722-5207

Country Covered: Mexico

Moscow Regional Office - Russia

Cummins Engine Co., Inc.
Park Place
Office E708
Leninsky Prospect 113
Russia 11798
Telephone: (7-502) 256-5122 or 256-5123

Countries Covered:

- Armenia
- Azerbaijan
- Bolarus
- Estonia
- Georgia
- Kirghizia
- Latvia
- Lithuania
- Moldova
- Russia
- Tadzhikstan
- Turkmenistan
- Ukraina
- Uzbekistan

South And East Asia Area Office - Singapore

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

Countries Covered:

- Bangladesh
- Brunei
- Burma/Mynamar
- Cambodia
- China
- Hong Kong
- Indonesia
- Laos
- Macau
- Malaysia
- Mongolia
- Philippines
- Singapore
- Sri Lanka
- Taiwan
- Thailand
- Vietnam

Taipei Regional Office - Taiwan

Cummins Corporation - Taiwan
12th Floor, No. 149
Min-Sheng E. Road
Section 2
Taipei, Taiwan
R.O.C. 104
Telephone: (886-2) 515-0891

Country Covered: Taiwan

Turkey and Iran Regional Office - Turkey

Cummins Corporation
Istanbul Office
Buyukdere Cad.
Beytem Han, Kat 11
Sisli 80220
Istanbul
Telephone: (90-1) 246-2575/2775/2545

Countries Covered:

- Iran
- Turkey

Middle East Regional Office - Daventry (U.K.)

Cummins Engine Company Ltd.
Royal Oak Way South
Daventry, Northants NN11 5NU
England
Telephone: (44-1327) 76000

Countries Covered:

MIDEAST

- Afghanistan
- Bahrain
- Cyprus
- Djibouti
- Egypt
- Iraq
- Jordan
- Kuwair
- Lebanon
- Oman
- Pakistan
- Qatar
- Saudi Arabia
- Sudan
- Syria
- U.A.E.
- Yemen

Africa Regional Office - Daventry (U.K.)

Cummins Engine Company Ltd.
Royal Oak Way South
Daventry, Northants NN11 5NU
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Telephone: (44-1327) 76000

Countries Covered:

NORTH/WEST AFRICA

Benin	Gabon	Mauritania
Burkina-Paso	Gambia	Morocco
Cameroon	Ghana	Niger
Cape Verde	Guinea	Nigeria
Central African Republic	Guinea-Bissau	Sao Tome & Principe
Chad	Liberia	Senegal
Cote d'Ivoire	Libya	Siera Leone
Equatorial Guinea	Mali	Togo
	Malta	Tunisia

SOUTH AFRICA

Botswana	Namibia	Swaziland
Lesotho	South Africa	

New Malden Regional Office - U.K.

Cummins Engine Company Limited
46-50 Coombe Road
New Malden
Surrey KT3 4QL
England
Telephone: (44-81) 949-6171

Countries Covered:
Ireland
United Kingdom

Latin America Regional Office - Miramar (U.S.A.)

Cummins Americas, Inc.
Miramar Park of Commerce
3450 Executive Way
Miramar, FL 33025
Telephone: (305) 431-5511

Countries Covered:

Argentina	Guatemala
Bolivia	Honduras
Chile	Nicaragua
Colombia	Panama
Costa Rica	Paraguay
Dominican Republic	Peru
El Salvador	Uruguay
Eucador	Venezuela

Caracas Regional Office - Venezuela

Cummins Engine Company
Oficina de Delegado
Torre La Primera, Oficina 5-D
Av. Francisco de Miranda
Chacao, Caracas 1060

Mailing Address:
Cummins Engine Company M-227
c/o Jet Cargo International
P.O. Box 020010
Miami, FL 33102-0010 U.S.A.
Telephone: (58-2) 32-0563, 32-718

Counties Covered:

Costa Rica	Honduras
Dominican Republic	Nicaragua
El Salvador	Panama
Guatemala	Venezuela

East/Southern Africa Regional Office - Harare, Zimbabwe

Cummins Zimbabwe (Private) Limited
72 Birmingham Road
Southerton
Harare, Zimbabwe

Mailing Address:
P.O. Box ST363
Southerton
Harare, Zimbabwe
Telephone: (263-4) 67645, 60553, 69220

Countries Covered:

Angola	Reunion
Burundi	Rwanda
Comoros Island	Seychelles
Congo	Somalia
Ethiopia	Tanzania
Kenya	Uganda
Madagascar	Zaire
Malawi	Zambia
Mauritius	Zimbabwe
Mozambique	

Distributors - International

ABU DHABI
- See United Arab Emirates

AFGHANISTAN
- See Middle East Regional Office

ALBANIA
- See Germany Regional Office - Gross-Gerau

ALGERIA

Algiers
Cummins Corporation
Bureau de Liaison
38, Lotissement Benachour Abdelkader Cheraga
43200 Wilaya de Tipasa
Algeria
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AMERICAN SAMOA
- See South Pacific Regional Office

ANDORRA
- See European Regional Office - Mechelen

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Buenos Aires, Argentina
Telephone: (54-1)814-1895/1395/1393

ARUBA, ISLAND OF
- See Netherlands Antilles

AUSTRIA

Neudoerfl
Cummins Diesel Motorenvertriebsges m.b.H. Trenner & Co.
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A-7201 Neudoerfl
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BAHRAIN

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BALEARIC ISLANDS

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Cummins Ventas y Servicio, S.A.
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376-2404

BANGLADESH

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Equipment & Engineering Co., Ltd.
G.P.O. Box 2339
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BARBADOS

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BELGIUM

Brussels
Cummins Distributor
Belgium S.A.
623/629 Chaussee de Haecht
B-1030 Brussels, Belgium
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(32-2) 216-81-10

BELIZE

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Cummins Southeastern Power, Inc.
5421 N. 59th Street
Tampa, FL 33610
Telephone: (813) 621-7202

BENIN
- See Togo

BERMUDA

Bronx (Office in U.S.A.)
Cummins Metropower, Inc.
890 Zerega Avenue
Bronx, NY 10473
Telephone: (718) 892-2400

BHUTAN

Pune (Office in India)
Cummins Diesel Sales & Service (India) Ltd.
35A/1/2, Erandawana
Pune - 411 038, India
(State of Maharashtra) India
Telephone: (91-212) 331234/331554/331635/330066/330166/330356/31703

BOLIVIA

La Paz
Machinery & Auto Service
Casilla 4042
La Paz, Bolivia
Location:
Av. 20 de Octubre Esq.
Rosendo Gutierrez
Telephone: (591-2) 379650, 366394

BONAIRE, ISLAND OF
- See Netherlands Antilles

BOTSWANA
- See East and Southern Africa Regional Office - Harare

BRAZIL

Ananindeua
Marcos Marcelino & Companhia Ltda.
Rodovia BR-316, Km 9
67020-010 Ananindeua, Para,
Brazil
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Belo Horizonte
Distribuidora Cummins Minas S.A.
31950-640 Olhos D'Agua Norte
Belo Horizonte, MG
Brazil
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Campo Grande
Distribuidora Cummins Mato Grosso Ltda.
Rodovia BR 163 Km 01
79060-000 Campo Grande
Mato Grosso do Sul, Brazil
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Curitiba
Distribuidora Cummins Parana S.A.
Rua Brasilio Itibere, 2195
80230 Curitiba, Parana
Brazil
Telephone: (55-41) 222-4036

Fortaleza
Distribuidora Cummins Diesel
Do Nordeste Ltda.
Av. da Abolicao, 3882,
Mucuripe
60165-081 Fortaleza, Ceara
Brazil
Telephone: (55-85) 263-1212

Goianian
Distribuidora de Motores Cummins
Centro Oeste Ltda.
Av. Caiapo 777 - Setor Sta. Genoveva
74672-400 Goiania, Goias
Brazil
Telephone: (55-62) 207-1010

Manaus
Distribuidora Cummins
Amazonas Ltda.
Estrada da Ponta Negra, 6080 - Sao Jorge
69037 Manaus, Amazonas,
Brazil
Telephone: (55-92) 656-5444

Porto Alegre
Distribuidora Cummins
Meridional S.A.
Rua Dona Alzira, 98, Sarandi
91110-010 Porto Alegre,
Rio Grande do Sul, Brazil
Telephone: (55-51) 340-8222

Rio de Janeiro
Distribuidora Cummins
Leste Ltda.
Rua Sariema, 138-Olaria
21030-550 Rio de Janeiro,
Rio de Janeiro, Brazil
Telephone: (55-21) 290-7899

Sao Paulo
Companhia Distribuidora
de Motores Cummins
Rua Martin Burchard, 291 - Bras
03043-020 Sao Paulo,
Sao Paulo, Brazil
Telephone: (55-11) 270-2311

BRITISH VIRGIN ISLANDS
- See Puerto Rico

BRUNEI
- See Malaysia

BURKINA - FASO
- See North/West Africa Regional Office - Daventry

BULGARIA
-See Germany Regional Office - Gross-Gerau

BURMA

Kuala Lumpur (Office In Malaysia)
Contact: Scott &
English (M) Sdn Bhd
P.O. Box 10324
50710 Kuala Lumpur
West Malaysia
Location:
16 Jalan Chan Sow Lin
55200 Kuala Lumpur
West Malaysia
Telephone: (60-3) 2211033

BURUNDI

Brussels (Office in Belgium)
Bia, S.A.
Rameistraat, 123
B-3090 - Overijse, Belgium
Telephone: (32-2) 6892811

CAMBODIA
- See South & East Asia Regional Office
- Singapore

CANARY ISLANDS

Madrid (Office in Spain)
Cummins Ventas y
Servicio, S.A.
Torrelaquna, 56
28027 Madrid, Spain
Telephone: (34-91) 3672000/3672404

CAPE VERDE
- See North/West Africa Regional Office
- Daventry

CENTRAL AFRICAN REPUBLIC
- See North/West Africa Regional Office
- Daventry

CEYLON
- See Sri Lanka

CHAD
- See North/West Africa Regional Office
- Daventry

CHILE

Santiago
Distribuidora Cummins Diesel
S.A.C.I.
Casilla Postal 1230
Calle Bulnes 1203
Santiago, Chile
Corporate Office:
Av. Providencia 2653, Office 1901
Santiago, Chile
Telephone: (56-2) 698-2113/4/5,
697-3566/7/8,
697-2709

CHINA, PEOPLE'S REPUBLIC
- See China Regional Office - Beijing

COLOMBIA

Barranquilla
Cummins de Colombia S.A.
Apartado Aereo 5347
Barranquilla, Colombia
Location: Calle 30, No. 19 - 21
Telephone: (57-58) 40-02-06/40-13-46

Bogota
Cummins Colombiana Ltda.
Apartado Aereo No. 7431
Bogota, D.E. Colombia
Location:
Av. Americas X Carrera
42C No. 19-45
Telephone: (57-1) 244-5688/5882

Bucaramanga
Cummins API, Ltda.
Apartado Aereo 352
Bucaramanga, Colombia
Location:
Autopista a Giron, Km 7
Telephone: (57-76) 468060

Cali
Distribuidora Cummins del Valle, Ltda.
Apartado Aereo No. 6398
Cali, Colombia
Location:
Av. 3a. # 39-35 - Vipasa
Telephone: (57-3) 65-4343

Medellin
Equipos Tecnicos Ltda.
Apartado Aereo No. 2046
Medellin, Colombia
Location: Carrera 52 No. 10-184
Telephone: (57-4) 255-4200

Pereira
Equipos Tecnicos Ltda. C.Q.R.
Apartado Aereo No. 1240
Pereira, Colombia
Location: Carrera 8a. No. 45-39
Telephone: (57-63) 366341

COMOROS
- See East and Southern Africa Regional Office - Harare

CONGO, PEOPLE'S REPUBLIC

Brussels (Office in Belgium)
Bia, S.A.
Rameistraat, 123
B-3090
Overijse, Belgium
Telephone: (32-2) 6892811

CORSICA
- See France

COSTA RICA

San Jose
Servicios Unidos, S.A.
P.O. Box 559
San Jose, Costa Rica
Location:
100 metros al este de
Excelsior Antiguo
Curridabat, San Jose
Telephone Office: (506) 53-93-93
Telephone Service Shop:
(506) 26-00-76

CUBA

Miami (Office in U.S.A.)
Cummins Southeastern Power, Inc.
9900 N.W. 77 Court
Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

CYPRUS

Nicosia
Alexander Dimitriou & Sons Ltd.
P.O. Box 1932
Nicosia, Cyprus
Location:
4 Salamis Avenue
Telephone: (357-2) 349450

CZECH REPUBLIC
- See European Regional Office - Mechelen

DENMARK

Glostrup
Preben Lange Industrimaskiner A/S
Post Box 166
2605 Broendby, Denmark
Location:
Midtager 22
Telephone: (45-43) 96-21-61

DJIBOUTI
- See Middle East Regional Office - Daventry

DOMINICA

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Cummins Southeastern Power, Inc.
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Hialeah Gardens, FL 33016
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DOMINICAN REPUBLIC

Santo Domingo
Argico C. Por A.
P.O. Box 292-2 Feria
Santo Domingo
Dominican Republic, ZP-6
Location:
Calle Jose A. Soler
No. 3, ESQ.
Avenida Lope de Vega
Telephone: (809) 562-6281

DUBAI
- See United Arab Emirates

ECUADOR

Guayaquil
Motores Cummins (MOTCUM) S.A.
P.O. Box 1062
Guayaquil, Ecuador
Location:
Avenida Carlos Julio
Arosemena Km. 4
Telephone: (593-4) 203995/201177

Quito
Rectificadora Botar S.A.
P.O. Box 17-01-3344
Quito, Ecuador
Location:
Av. 10 de Agosto No. 5980
Telephone: (593-2) 465-176/177/
178/195/197

EGYPT

Cairo
ADAT
P.O. Box 1572
Cairo, Egypt
Sales and Service Location:
25, Pyramid Road
Giza, Cairo, Egypt
Telephone: (20-2) 384-6607/384-6609
385-4001/2/4/5/6/8/9

EL SALVADOR

San Salvador
Salvador Machinery
Company, S.A. de C.V.
P.O. Box 125
San Salvador, El Salvador
Location:
Blvd. Ejercito Nacional
Telephone: (503) 711022, 228388

ENGLAND
- See United Kingdom

EQUATORIAL GUINEA
- See North/West Africa Regional Office - Daventry

ESTONIA
- See Moscow Regional Office - Moscow

FAROE ISLANDS

Wellingborough (Office in United Kingdom)
Cummins Diesel
Denington Industrial Estate
Wellingborough
Northants NN8 2QH,
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Telephone: (44-933) 276231

FERNANDO PO
- See Spain

FIJI
- See Cummins Diesel Sales & Service New Zealand Ltd.

FINLAND

Helsinki
Machinery OY
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SF 00511 Helsinki, Finland
Location:
Teollisuuskatu 29
Telephone: Int: (358-9) 77221

FRANCE

Lyon
Cummins Diesel
Sales Corporation
39, rue Ampere Z.I.
69680 Chassieu, France
Telephone: (33) 72-22-92-72
Parts and Service Telephone:
(33) 72-22-92-69

GABON
- See North/West Africa Regional Office - Daventry

GAMBIA
Senegal (Matforce)

GEORGIA
- See Moscow Regional Office - Moscow

GERMANY

Gross-Gerau
Cummins Diesel Deutschland GmbH
P.O. Box 1134
D-6080 Gross-Gerau,
Germany
Location: Odenwaldstr. 23
Telephone: (49-6152) 174-0

GHANA

Accra
Leyland DAF (Ghana) Ltd.
P.O. Box 2969
Accra, Ghana
Location:
39/40 Ring Road South
Industrial Estate
Telephone: (233-21) 22-88-06

GREECE

Athens
Eliopoulos Brothers Ltd.
P.O.B. 51528
14 Km. National Rd.
Athens-Lamia
14510 Kifissia, Greece
Telephone: (30-1) 6202401/6202066/
6201955

GREENLAND
- See Denmark

GRENADA

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Cummins Southeastern Power, Inc.
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Hialeah Gardens, FL 33016
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GUADELOUPE

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Cummins Southeastern Power, Inc.
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GUAM

Barrigada
Mid-Pac Far East, Inc.
Airport Industrial Park
825 Tiyan Parkway
Barrigada, Guam 96921
Telephone: (671) 632-5160

GUATEMALA

Guatemala City
Maquinaria y Equipos, S.A.
P.O. Box 2304
Guatemala City, Guatemala
Location:
Carretera Amatitlan
Km 12 zona 12
Telephone: (502-2) 773334/7/9

GUINEA BISSAU
- See North/West Africa Regional Office - Daventry

GUYANA

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HAITI

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HOLLAND
- See Netherlands

HONDURAS

Tegucigalpa
Comercial Laeisz
Honduras, S.A.
P.O. Box 1022
Tegucigalpa, D.C., Honduras
Location:
Zona La Burrera,
Blvd. Toncontin
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Telephone: (504) 333570/335615

HONG KONG

Kowloon
Cummins Engine H. K. Ltd.
P.O. Box 840 Shatin
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Location:
Unison Industrial Centre
15th Floor, Units C & D
27-31 Au Pui Wan Street
Fo Tan, Shatin, Hong Kong
Telephone: (852) 606-5678

INDIA

Pune
Cummins Diesel Sales &
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35A/1/2, Erandawana
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Telephone: (91-212) 331234, 331554,
331635, 330066,
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331703

Bombay
Cummins Diesel Sales &
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Bombay 400001, India
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Calcutta 700 019 (West Bengal), India
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New Delhi 110 019, India
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6452817

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Cummins Diesel Sales &
Service (I) Ltd.
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India
Telephone: (91-771) 24994/23157/29498

Ranchi
Cummins Diesel Sales &
Service (I) Ltd.
'Shanti Kunj' C-202, Vidyalaya Marg
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Ranchi 834 002 (Bihar)
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Telephone: (91-651) 301948/303623

INDONESIA

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P.O. Box 64/KBYL
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IRAN

Tehran
Technical Service Development
Company
P.O. Box 13445/741
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Dr. Beheshti Avenue
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Telephone:
Head Office: (98-21) 846666, 851021-7
Work Shop: (98-21) 995021-2/993240

IRAQ
- See Middle East Regional Office - Daventry

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ITALY

Milan
Cummins Diesel Italia S.p.A.
Piazza Locatelli, 8
Zona Industriale Sesto Ulteriano
20098 S. Giuliano
Milanese (Milan), Italy
Telephone: (39-2) 9828-1235/6/7

IVORY COAST
- See Cote d' Ivoire

JAMAICA

Miami (Office in U.S.A.)
Cummins Southeastern Power, Inc.
9900 N.W. 77 Court
Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

JAPAN

Tokyo
Cummins Diesel (Japan) Ltd.
1-12-10-Shintomi
Chuo-ku, Tokyo 104
Japan
Telephone: (81-3) 3555-8511

JORDAN

Amman
S.E.T.I. Jordan Limited
P.O. Box 8053
Amman, Jordan
Telephone: (962-6) 621867/621884

KENYA

Nairobi
Werrot & Company Limited
P.O. Box 41216
Nairobi, Kenya
Location:
Lusaka Road
Telephone: (254-150) 20316

KOREA, SOUTH

Seoul
Hwa Chang Trading Co., Ltd.
Central P.O. Box No. 216
Seoul, South Korea
Location:
143-11 Doksan-dong, Kuro-ku
Telephone: (82-2) 854-0071/2/3/4/5,
869-1411/2/3

KUWAIT

Kuwait
General Transportation &
Equipment Co.
(Sales Department)
P.O. Box 1096
13011 Safat, Kuwait
Location:
Shuwaikh Behind
Canada Dry Factory
Telephone: (965) 4833380/1/2

Kuwait
General Transportation &
Equipment Co.
(Service Department)
East Ahmadi Area
13011 Safat, Kuwait
Telephone: (965) 3981577

LAOS
- See South and East Asia Regional Office - Singapore

LATVIA
- See Moscow Regional Office - Moscow

LEBANON

Beirut
S.E.T.I. Charles Keller
S.A.L.
B.P. 16-6726
Beirut, Lebanon
Location:
Corniche du Fleuve
Telephone: (961-1) 425040/41

LESOTHO
- See South Africa

LIBYA
- See North/West Africa Regional Office
- Daventry

LIECHTENSTEIN
- See Switzerland

LUXEMBOURG

Gross-Gerau (Office in Germany)
Cummins Diesel Deutschland GmbH
P.O. Box 11 34
Odenwaldstrasse 23
D-6080 Gross-Gerau, Germany
Telephone: (49-6152) 174-0

MACAU
- See Hong Kong

MADAGASCAR
- See East and Southern Africa Regional Office - Harare

MADEIRA ISLANDS
- See Portugal

MALAYSIA

Kuala Lumpur
Cummins Diesel Sales & Service
Div. of Scott & English
(M) Sdn. Bhd.
P.O. Box 10324
50710 Kuala Lumpur, West Malaysia
Location:
16 Jalan Chan Sow Lin
55200 Kuala Lumpur
Telephone: (60-3) 2211033

MALI
- See Senegal (Matforce)

MALTA

Valletta
Plant & Equipment Ltd.
Regency House
254, Republic Street
Valletta, Malta
Telephone: (356) 23-26-20, 23-33-43,
23-16-23, 24-75-17

MARTINIQUE

Miami (Office in U.S.A.)
Cummins Southeastern Power, Inc.
9900 N.W. 77 Court
Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

MEXICO

Guadalajara
Cummins Del Occidente, S.A.
Lazaro Cardenas No. 2950
Fracc. Alamo Industrial
45560 Guadalajara, Jal. Mexico
Telephone: (52-3) 670-93-06, 670-53-38,
670-63-61, 670-62-33

Monterrey
Tecnica Automotriz, S.A.
Av. Alfonso Royes
No. 3637 Nte.
Monterrey, Nuevo Leon, Mexico
Telephone: (52-83) 51-41-51, 51-46-56

Merida
Cummins Del Sureste, S.A. de C.V.
Av. Aviacion Civil No. 647
Esquina Calle 100
Col. Sambula
97259 Merida, Yucatan, Mexico
Telephone: (52-99) 24-11-55, 24-00-15

Puebla
Cummins de Oriente, S.A. de C.V.
Av. Reforma No. 2112,
Puebla, Pue. Mexico
Telephone: (52-22) 48-76-74, 48-76-75

Queretaro
Distribuidor Cummins Del Centro, S.A.
de C.V.
Blvd. Bernardo Quintana No. 518
Col. Arboledas
C.P. 76140 Queretaro, Qro., Mexico
Telephone: (52-42) 12-41-90, 12-58-90,
12-62-94, 14-04-16,
14-08-81, 14-15-91

Tlalnepantla
Distribuidor Cummins
Metropolitana, S.A. DE C.V.
Sor Juana Ines de la Cruz No. 555
54000 Tlalnepantla, Edo. de Mexico,
Mexico
Telephone: (52-5) 327-38-00, 390-64-37,
390-12-27

MOROCCO

Casablanca
Societe Auto-Hall, S.A.
44 Avenue Lalla Yacout
Casablanca, Morocco
Telephone: (212) 31-84-60, 31-70-52, 31-90-56, 31-70-44

MOZAMBIQUE
- See East and Southern Africa Regional Office - Harare

NAMIBIA (Southwest Africa)

Windhoek
Propower, Namibia
P.O. Box 3637, Windhoek 9000
Namibia (Southwest Africa)
Location:
7 Nasmyth Street
Southern Inudustria
Telephone: (264-61) 37693

NEPAL

Pune (Office in India)
Cummins Diesel Sales & Service (India) Ltd.
35A/1/2, Erandawana
Pune, - 411 038, (State of Maharashtra) India
Telephone: (91-212) 331234, 331554, 331635, 330066, 330166, 330356, 331703

NETHERLANDS

Dordrecht
Cummins Diesel Sales & Service, b.v.
Galvanistraat 35
3316 GH Dordrecht
Netherlands
Telephone: (31-78) 18-12-00

NETHERLANDS ANTILLES

Miami (Office in U.S.A.)
Cummins Southeastern Power, Inc.
9900 N.W. 77 Court
Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

NEW CALEDONIA
- See South Pacific Regional Office - Melbourne

NEW GUINEA
- See Papua New Guinea

NICARAGUA

Managua
F. Alf. Pellas & Cia.
Apartado Postal No. 46
Managua, Nicaragua
Location:
6a. Calle
30 y 31 Avs. N.O., Zona 5
Telephone: (505-2) 660616

NIGERIA

Lagos
SCOATRAC MOSEL
P.M.B. 21108
Ikeja, Lagos
Nigeria
Location:
Apapa-Oshodi Expressway
Isolo Industrial Estate,
Isolo
Telephone: (234-1) 52-15-39, 52-19-31, 52-46-70

Paris (Office in France)
SCOATRAC MOSEL
c/o SCOA
9 et 11 rue Robert de Flers
75740 Paris, Cedex 15
France
Telephone: (33-1) 40-58-48-48

NORTHERN IRELAND
- See United Kingdom

NORWAY

Oslo
Cummins Diesel Salg & Service A/S
P.O. 6288
Etterstad 0603, Oslo 6
Norway
Location:
Verkseler Furulunds vei 11
Telephone: (47) 22326110

OMAN

Ruwi
Universal Engineering Services L.L.C.
P.O. Box 5688
Ruwi
Sultanate of Oman
Telephone: (968) 590830, 591304

PAKISTAN

Karachi
- See Middle East Regional Office - Daventry

PANAMA

Panama City
Grupo Tiesa, S.A.
Apartado Postal #55-0549
Partillo, Panama
Telephone: (507) 67-3866

PAPUA NEW GUINEA

Sydney (Office in Australia)
Cummins Diesel Sales & Service
P.O. Box 150
Cabramatta, 2166
New South Wales, Australia

PARAGUAY

Asuncion
Automotores y Maquinaria, S.R.L.
Yegros y Fulgencio R. Moreno
P.O. Box 1160
Asuncion, Paraguay
Telephone: (595-21) 493111, 493115

PERU

Lima
Comercial Diesel del Peru S.A.
P.O. Box 14-0234
Lima, Peru
Location:
Ave. V.R. Haya
de la Torre 2648
Lima 3, Peru
Telephone: (51-14) 74-3173/4374/3144/2281

PHILIPPINES

EDSA
Power Systems, Inc. EDSA
P.O. Box 3241
Manila
Philippines 1501
Location:
79E. Delos Santos Ave.
Mandaluyong, Metro Manila
Telephone: (63-2) 791769, 791771, 5311945, 5315448, 5311934, 5312531, 53414513

POLAND
- See Germany Regional Office - Gross-Gerau

PORTUGAL

Lisbon
Electro Central Vulcanizadora, Lda.
P.O. Box 3077
1302 Lisbon, Portugal
Location:
Rua Conselheiro
Martins de Carvalho
Lote 1480
1400 Lisboa (Restelo)
Telephone: (351-1) 3015361

QATAR

Doha
Jaidah Motors & Trading Co.
P.O. Box 150
Doha, Qatar (Arabian Gulf)
Telephone: (974) 810000

REUNION
- See Lyon Regional Office - Lyon

RIO DE ORO
- See Spain

ROMANIA

- See Germany Regional Office - Gross-Gerau

RUSSIA

- See Moscow Regional Office - Moscow

RWANDA

Brussels (Office in Belgium)

Bia, S.A.
Rameistraat, 123
B-3090 - Overijse, Belgium
Telephone: (32-2) 6892811

ST. LUCIA

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Cummins Southeastern Power, Inc.
9900 N.W. 77 Court
Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

ST. VINCENT

Miami (Office in U.S.A.)

Cummins Southeastern Power, Inc.
9900 N.W. 77 Court
Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

SAN MARINO

- See Italy

SAO TOME AND PRINCIPE

- See North/West Africa Regional Office - Daventry

SAUDI ARABIA

Dammam

General Contracting Company
P.O. Box 5111
Dammam 31422, Saudi Arabia
Telephone: (966-3) 842-1216

SCOTLAND

- See United Kingdom

SENEGAL

Dakar

Matforce
B.P. 397
Dakar, Senegal
Location:
10 Avenue Faidherbe
Telephone: (221) 22-30-40

SEYCHELLES

- See East/Southern Africa Regional Office - Harare

SIERRA LEONE

- See North/West Africa Regional Office - Daventry

SINGAPORE

Singapore

Applied Diesel Sales & Service Pte Ltd
8 Tanjong Penjuru
Jurong Industrial Estate
Singapore 2260
Telephone: (65) 261-3555

SLOVAKIA

- See European Regional Office - Mechelen

SOLOMON ISLANDS

- See South Pacific Regional Office - Melbourne

SOMALIA

- See East and Southern Africa Regional Office - Harare

SOUTH AFRICA

Johannesburg

Propower Pty. Ltd.
Private Bag X4
Wendywood 2144
South Africa
Location:
13 Eastern Service Roade
Kelvin 2054
Telephone: (27-11) 444-3225

SOUTHWEST AFRICA

- See Namibia

SPAIN

Madrid

Cummins Ventas y
Servicio S.A.
Torrelaguna, 56
28027 Madrid, Spain
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SPANISH GUINEA

- See Spain

SRI LANKA

Colombo

Trade Promoters Ltd
P.O. Box 321
69, Walukarama Road
Colombo 3
Sri Lanka
Telephone: (94-1) 573927, 574651, 575005

SUDAN

Khartoum

Bittar Engineering Ltd.
P.O. Box 1011
Gamhouria Street
Khartoum, Sudan
Telephone: (249-11) 70952, 71245, 70306

SURINAM

Miami (Office in U.S.A.)

Cummins Southeastern Power, Inc.
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Telephone: (305) 821-4200

SWAZILAND

- See South Africa

SWEDEN

Stockholm

SMA Maskin AB
Aggelundavagen 7
S-17562 Jarfalla
Sweden
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SWITZERLAND

Regensdorf

Robert Aebi AG
Riedthofstrasse 100
8105 Regensdorf
Switzerland
Telephone: (41-1) 842-5111

SYRIA

Damascus

Puzant Yacoubian & Sons
P.O. Box 3617
Damascus, Syria
Location:
Abou Baker El Saddik Street
Kafar Sousse Square
Telephone: (963-11) 231547/8/9

TAHITI, ISLAND OF

- See French Polynesia

TAIWAN

Taipei

Cummins Corporation - Taiwan Branch
12th Floor, No. 149
Min-Sheng E. Road, Sec. 2
Taipei, Taiwan
Telephone: (886-2) 515-0891

TANZANIA

Dar es Salaam

Riddoch Motors 1987 Ltd
P.O. Box 40040
Dar es Salaam
Tanzania
Location:
92 Kipawa-Pugu Road
Dar es Salaam
Telephone: (255-51) 44493, 41140

THAILAND

Bangkok

Diethelm & Company Ltd.
1696 New Petchburi Road
Bangkok 10310, Thailand
Telephone: (66-2) 254-4900

TOGO (and BENIN)

Lome
Togomat
B.P. 1641
Lome, Togo
Location:
Zone Industrielle CNPPME
Telephone: (228) 21-23-95

TONGA, ISLAND OF
- See South Pacific Regional Office - Melbourne

TRINIDAD and TOBAGO

Miami (Office in U.S.A.)
Cummins Southeastern Power Inc.
9900 N.W. 77 Court
Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

TURKEY

Istanbul
Hamamcioglu Muesseseleri
Ticaret T.A.S.
P.K. 136
80222 Sisli
Istanbul, Turkey
Location:
Buyukdere Caddesi, 13/A
80260 Sisli
Istanbul, Turkey
Telephone: (90-1) 231-3406, 234-5123

UKRAINA
- See Moscow Regional Office - Moscow

UNITED ARAB EMIRATES

Abu Dhabi
Technical Oilfield Supplies Centre
P.O. Box 2647
Abu Dhabi,
United Arab Emirates
Telephone: (971-2) 723863, 723298

UNITED KINGDOM

Wellingborough
Cummins Diesel
Denington Estate
Wellingborough
Northants NN8 2QH, England
Telephone: (44-933) 276231

UPPER VOLTA
- See Burkina - Faso

URUGUAY

Montevideo
Santaro S.A.
P.O. Box 379
Montevideo
Uruguay
Location:
Avenida Millan No. 2441
Telephone:(598-2) 293908

U.S.S.R.
- See Moscow Regional Office - Moscow

VATICAN CITY
- See Italy

VENEZUELA

Caracas
Sudimat
Apartado Postal 1322
Carmelitas
Caracas 1010
Venezuela
Location:
Final Avenida San Martin
Urb. la Quebradita
Caracas 1061
Telephone: (58-2) 442-6161/2647

VIETNAM

Hanoi
Diethelm & Co. Ltd. Engineering
Room No. 1, 2nd Floor
8 Trang Thi Street
Hanoi, Vietnam
Telephone: (84-4) 260-332, 244-394

Ho Chi Minh City
Diethelm & Co. Ltd. Engineering
3rd Floor, IBC Building
1 Me Linh Square
District 1
Ho Chi Minh City, Vietnam
Telephone: (84-8) 294-102, 294-103

WESTERN SAMOA
- See South Pacific Regional Office - Melbourne

YEMEN ARAB REPUBLIC

Sana'a
Zubieri Trading Co.
P.O. Box 535
Sana'a, Yemen Arab Republic
Location:
Zubieri Street
Telephone: (967-1) 244400/79149

YEMEN, SOUTH
- See Middle East Regional Office - Daventry

YUGOSLAVIA
- See Southeastern Europe

ZAIRE

Brussels (Office in Belgium)
N.V. Bia, S.A.
Rameistraat, 123
B-3090 - Overijse, Belgium
Telephone: (32-2) 689-28-11

ZAMBIA

Ndola
N.E.I. (Zambia) Ltd.
P.O. Box 71501
Ndola, Zambia
Telephone: (260-2) 610729

ZIMBABWE

Harare
Cummins Zimbabwe (Pvt) Ltd.
P.O. Box ST363
Southerton
Harare, Zimbabwe
Location:
72 Birmingham Road
Southerton, Harare
Telephones: (263-4) 67645, 69220

Section TS - Troubleshooting Symptoms

Section Contents

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Troubleshooting Procedures and Techniques

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

⚠ WARNING ⚠

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

Follow the suggestions below for troubleshooting:

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

Troubleshooting Symptoms Charts

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

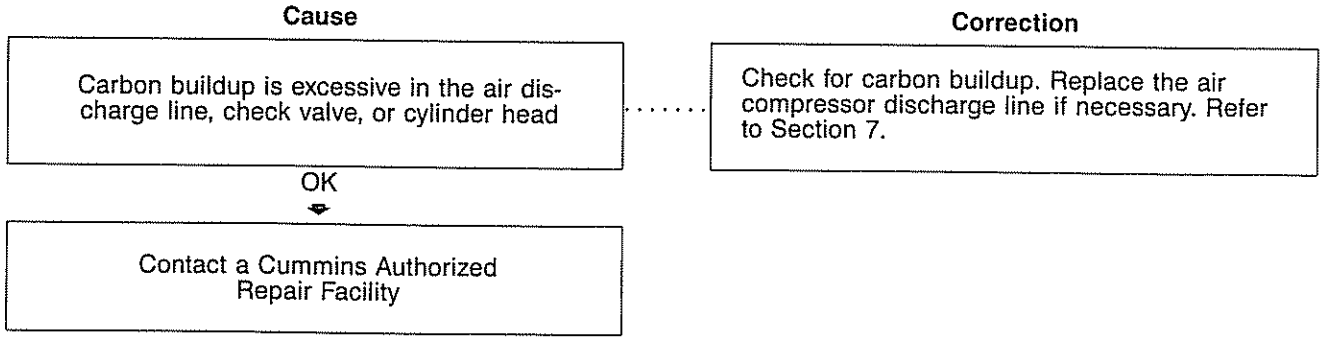
⚠ WARNING ⚠

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
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 Section 3 and 4.
OK ↓	
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, and valves. Refer to the OEM service manuals.
OK ↓	
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 Section 7.
OK ↓	
Contact a Cummins Authorized Repair Facility	

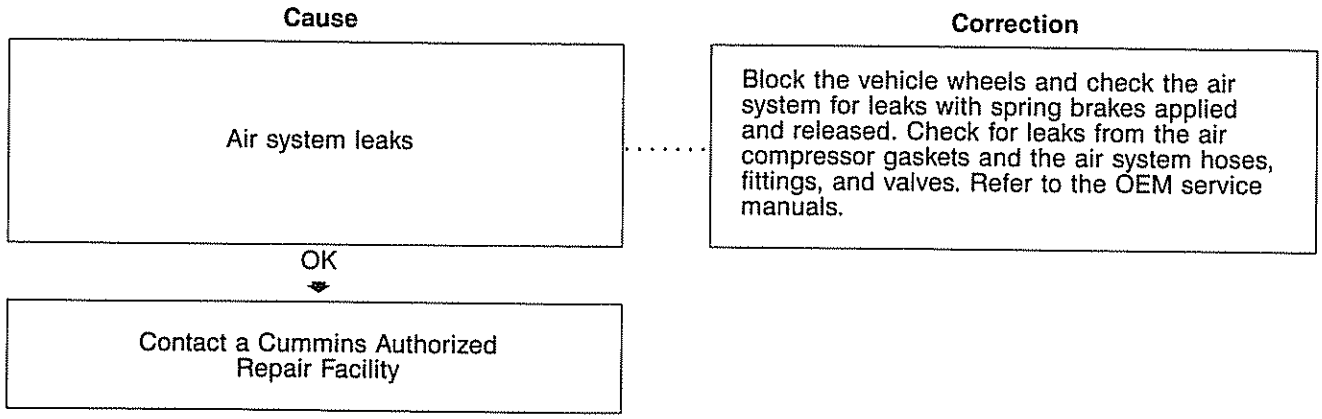
Air Compressor Noise is Excessive



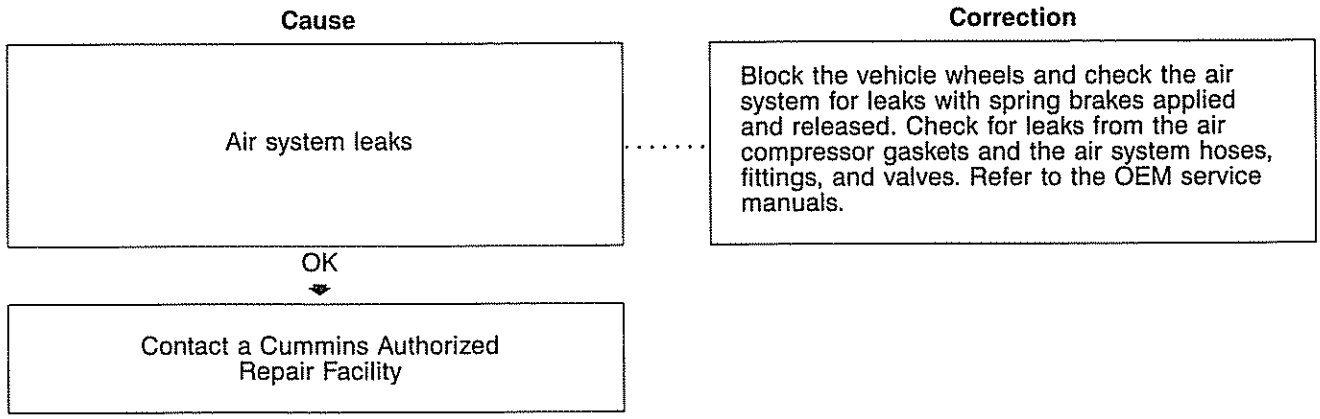
Air Compressor Pumping Excess Lubricating Oil into the Air System

Cause	Correction
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 Section 3 and 4.
OK ▼	
Air compressor pumping time is excessive	Replace the desiccan t cartridge on the Turbo/CR 2000 air dryer (if equipped). Refer to the OEM service manual. Check the air compressor duty cycle. Install a larger air compressor, if necessary. Refer to Section G in the Master Repair Manual, Holset® Air Compressors, Bulletin No. 3666121.
OK ▼	
Contact a Cummins Authorized Repair Facility	

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



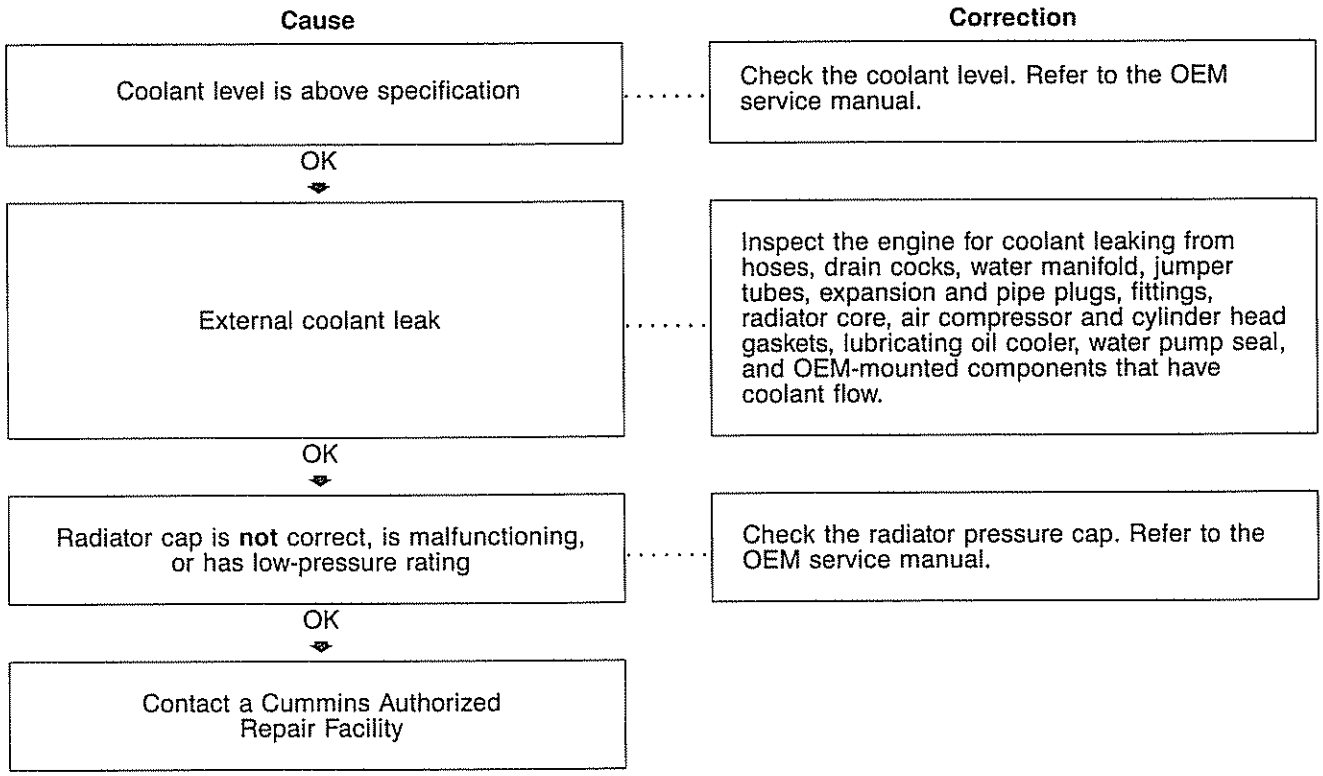
Air Compressor Will Not Stop Pumping



Alternator Not Charging or Insufficient Charging

Cause	Correction
Alternator belt is loose	Check the alternator belt tension. Refer to Section V.
OK ⇩	
Battery cables or connections are loose, broken, or corroded (excessive resistance)	Check the battery cables and connections.
OK ⇩	
Batteries have failed	Check the condition of the batteries. Replace the batteries, if necessary. Refer to the OEM service manual.
OK ⇩	
Alternator pulley is loose on the shaft	Tighten the pulley. Refer to Section V.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

Coolant Loss – External



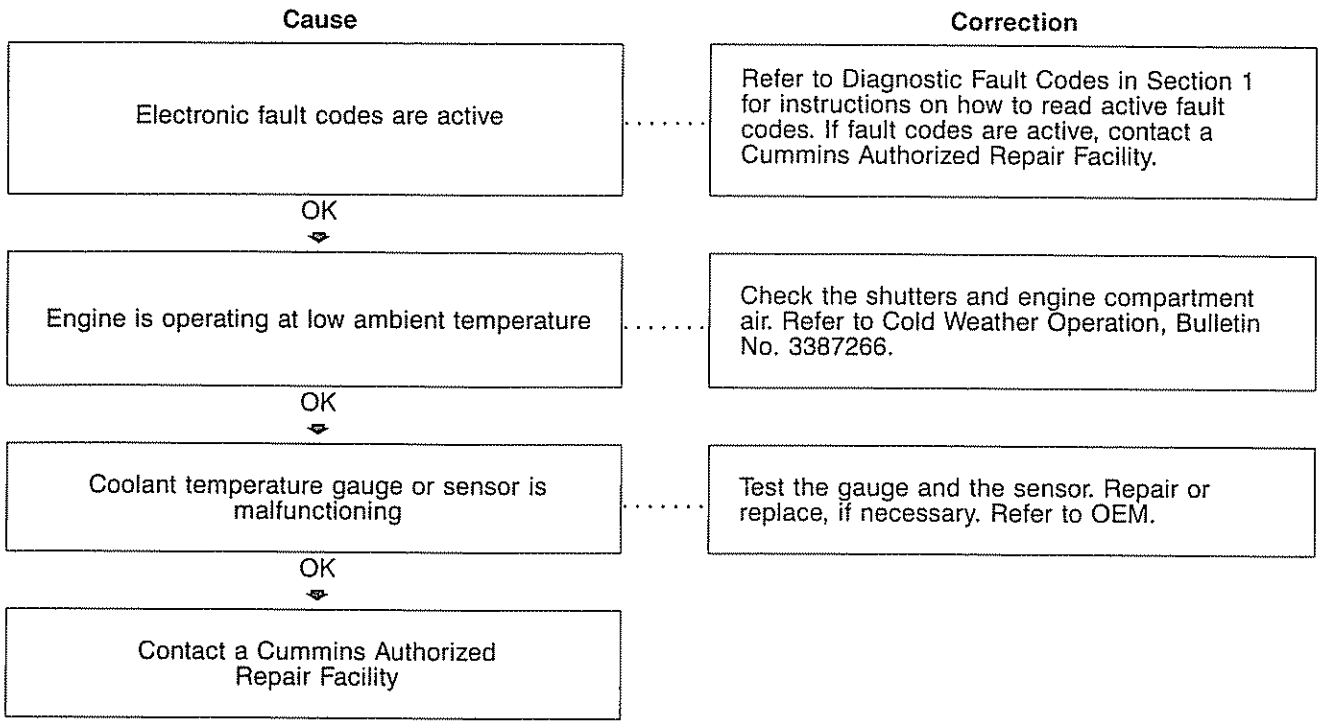
Coolant Temperature Above Normal – Gradual Overheat

Cause	Correction
Coolant level is below specification	Inspect the engine and cooling system for external coolant leaks. Repair if necessary. Add coolant. Refer to Section 5.
OK ⇩	
Cold weather radiator cover or winterfront is closed	Open the cold weather radiator cover or the winterfront. Maintain a minimum of 784 cm^2 [120 in^2], or approximately 28 x 28 cm [11 x 11 in], of opening at all times. Refer to Section 1.
OK ⇩	
Cooling system hose is collapsed, restricted, or leaking	Inspect the radiator hoses. Refer to Section 5.
OK ⇩	
Fan drive belt or water pump belt is loose	Check the belt tension and tighten if necessary. Refer to Section V.
OK ⇩	
Lubricating oil level is above or below specification	Check the oil level. Add or drain oil, if necessary. Refer to Section 5.
OK ⇩	
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 ⇩	
Radiator cap is **not** correct, is malfunctioning, or has low-pressure rating	Check the radiator pressure cap. Refer to the OEM service manual.
OK ⇩	
Supplemental coolant additive (SCA) level is above specification or the coolant is overconcentrated with antifreeze	Check the SCA level. Verify the antifreeze concentration. Refer to Section 5 and Section V.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

Coolant Temperature is Above Normal – Sudden Overheat

Cause	Correction
Electronic fault codes are active	Refer to Diagnostic Fault Codes in Section 1 for instructions on how to read active fault codes. If fault codes are active, contact a Cummins Authorized Repair Facility.
OK ▼	
Coolant level is below specification	Inspect the engine and cooling system for external coolant leaks. Repair if necessary. Add coolant. Refer to Section 5.
OK ▼	
Cooling system hose is collapsed, restricted, or leaking	Inspect the radiator hoses. Refer to Section 5.
OK ▼	
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 Section A.
OK ▼	
Radiator cap is **not** correct, is malfunctioning, or has low-pressure rating	Check the radiator pressure cap. Refer to the OEM service manual.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Coolant Temperature is Below Normal

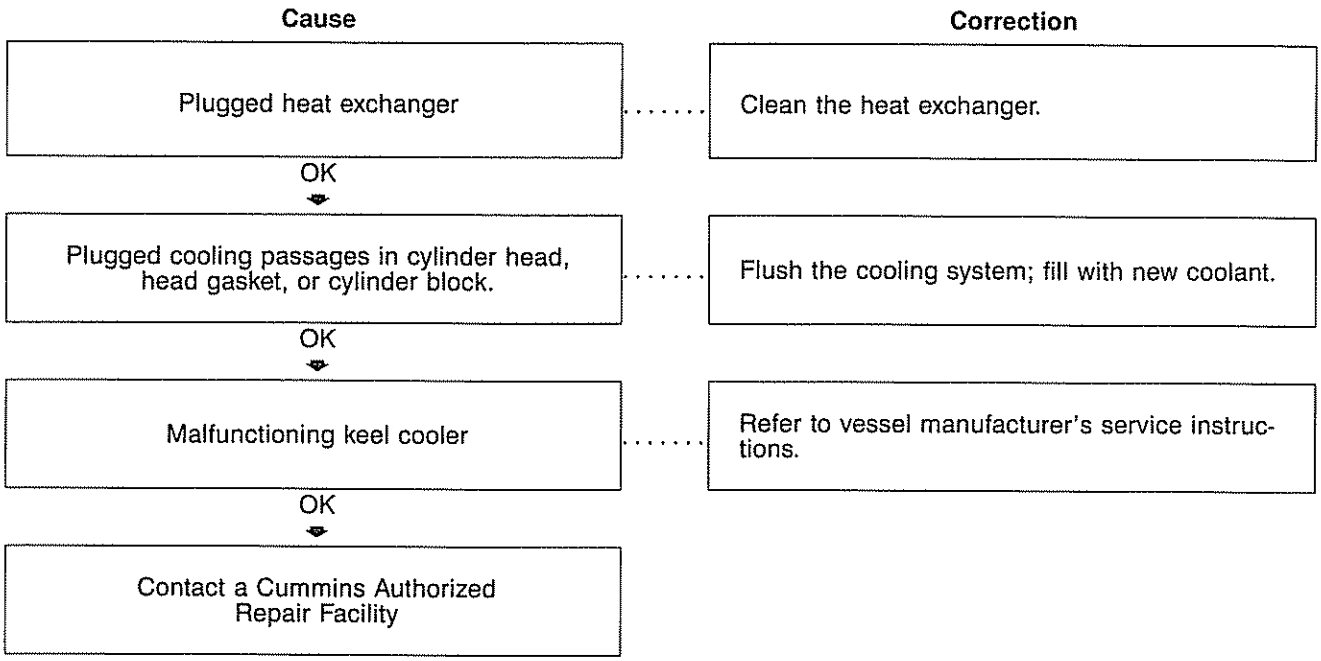


Coolant Temperature Above Normal (Marine)

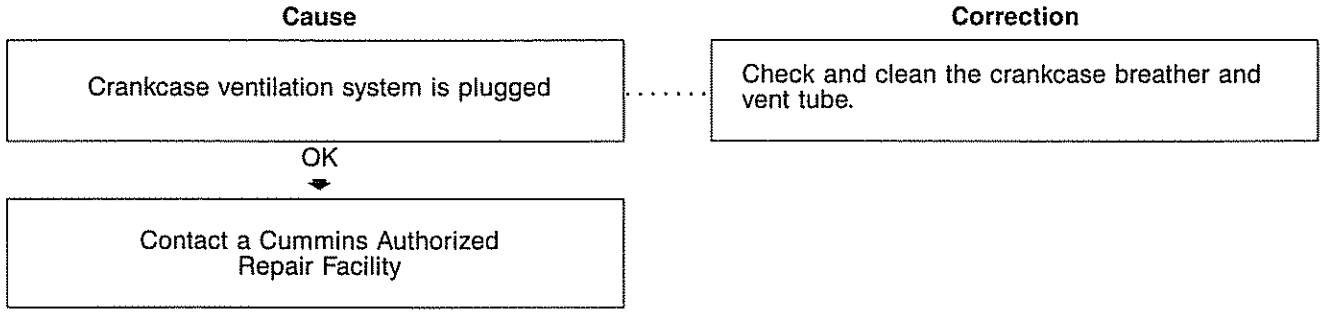
Cause	Correction
Coolant level is below specification	Inspect the engine and cooling system for external coolant leaks. Repair if necessary. Add coolant. Refer to Section V.
OK ↓	
Air trapped in coolant	Vent the cooling system to remove air. Check engine vent lines.
OK ↓	
Improper oil level	Add or drain oil to the proper level.
OK ↓	
Malfunctioning sea water pump	Inspect the pump. Check the sea water inlet and outlet piping and strainer for restriction.
OK ↓	
Incorrect or malfunctioning pressure cap	Replace the cap with one rate at 48 kPa [7 psi].
OK ↓	
Malfunctioning temperature sensor or gauge	Check/replace the sensor/gauge.
OK ↓	
Malfunctioning or incorrect thermostat	Check/replace the thermostat.
OK ↓	
Malfunctioning engine water pump	Check/correct the water pump.
OK ↓	
Air in the cooling system	Check hose clamps for leaks on the suction side of the pump. Check for compression leak through the cylinder head gasket.
OK ↓	

(Continued)

Coolant Temperature Above Normal (Marine) (Continued)



Crankcase Gases (Blowby) Excessive



Engine Decelerates Slowly (PT)

Cause	Correction
Throttle linkage or return spring is binding	Check the fuel pump throttle linkage and return spring for free movement. Adjust if necessary.
OK ⇩	
Fuel drain line is restricted	Inspect the fuel drain lines for restrictions. Remove any restrictions found.
OK ⇩	
Fuel tank vents are plugged or damaged	Remove and clean the tank vents. Replace the vents if necessary. Refer to the OEM service manuals.
OK ⇩	
Overhead fuel tank check valve is restricted or is **not** opening	Check the fuel tank check valve for debris. Check the valve for the correct plumbing arrangement. Refer to Section 5 - General Information.
OK ⇩	
OEM rail pressure lines are excessively long or trapped with air, which causes an accumulator effect (vehicles equipped with cab rail pressure gauges **only**)	Bleed the air from the OEM devices. Refer to the OEM service manuals.
OK ⇩	
Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank stand pipe, and fuel filters as necessary.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

Engine Decelerates Slowly (CELECT™ or CELECT™ Plus)

Cause	Correction
Electronic fault codes are active	Refer to Diagnostic Fault Codes in Section 1 for instructions on how to read active fault codes. If fault codes are active, contact a Cummins Authorized Repair Facility.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

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

Cause	Correction
Electronic fault codes are active	Refer to Diagnostic Fault Codes in Section 1 for instructions on how to read active fault codes. If fault codes are active, contact a Cummins Authorized Repair Facility.
OK ⇩	
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 ⇩	
Engine-driven units are engaged	Disengage engine-driven units.
OK ⇩	
Starting aid is necessary for cold weather, or starting aid is malfunctioning	Check for the correct operation of the starting aid. Refer to the manufacturer's instructions. Refer to Cold Weather Starting Aids in Section 1.
OK ⇩	
Fuel filter or fuel suction line is restricted	Replace the fuel filter. Refer to Section 5. Check the fuel suction line for restriction.
OK ⇩	
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 Section 4.
OK ⇩	
Exhaust system restriction	Check the exhaust system for any restrictions. Refer to Section V for specifications.
OK ⇩	
Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank stand pipe, and fuel filters as necessary.
OK ⇩	

(Continued)

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

Cause	Correction
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

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

Cause	Correction
Fuel level is low in the tank	Fill the supply tank.
OK	
Starting motor rotation is **not** correct	Check the direction of crankshaft rotation. Replace the starting motor if necessary.
OK	
Fuel shutoff valve (FSOV) is closed	Check the fuel shutoff valve and the electrical circuit.
OK	
Auxiliary shutdown device (Skinner valve) is closed. External governor is malfunctioning or **not** installed correctly	Repair or replace the shutdown device or external governor.
OK	
Battery voltage supply to the electronic control module (ECM) is low, interrupted, or open	Check the battery connections.
OK	
Fuel filter or fuel suction line is restricted	Replace the fuel filter. Refer to Section 5. Check the fuel suction line for restriction.
OK	
Fuel connections on the suction side of the pump are loose	Tighten all the fuel fittings and connections between the fuel tanks and fuel pump.
OK	
Fuel drain line is restricted	Inspect the fuel drain lines for restrictions. Remove any restrictions found.
OK	
Fuel suction stand pipe in the fuel tank is broken	Check and repair the stand pipe, if necessary. Refer to the OEM service manual.
OK	
Contact a Cummins Authorized Repair Facility	

Engine Noise Excessive

Cause	Correction
Lubricating oil pressure is below specification	Check the oil pressure. If the pressure is low, refer to the Lubricating Oil Pressure Low symptom tree.
OK ▼	
Lubricating oil is thin or diluted	Refer to the Lubricating Oil Specifications in Section V. Refer to the Lubricating Oil Contaminated symptom tree.
OK ▼	
Fan drive belt is loose, tight, or **not** in alignment	Check the fan drive belt. Refer to Section 3.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Engine Noise Excessive — Combustion Knocks

Cause	Correction
Engine is operating at low ambient temperature	Check the shutters and engine compartment air. Refer to Cold Weather Operation, Bulletin No. 3387266.
OK ⇩	
Ether starting aid is malfunctioning	Repair or replace the ether starting aids. Refer to the manufacturer's instructions.
OK ⇩	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

Engine Power Output Low

Cause	Correction
Electronic fault codes are active	Refer to Diagnostic Fault Codes in Section 1 for instructions on how to read active fault codes. If fault codes are active, contact a Cummins Authorized Repair Facility.
OK ↓	
Drivetrain is **not** correctly matched to the engine	Check for correct gearing and drivetrain components. Refer to the OEM vehicle specifications.
OK ↓	
Engine is operating above recommended altitude	Engine power decreases above recommended altitude. Refer to the Engine Data Sheet for specifications.
OK ↓	
Turbocharger is **not** correct	Check the turbocharger part number and compare it to the Control Parts List (CPL), Bulletin No. 3379133. Replace the turbocharger if necessary. Refer to Section A.
OK ↓	
Fuel pump incorrect	Check fuel pump dataplate for correct code.
OK ↓	
Air intake or exhaust leaks	Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting 4.
OK ↓	
Throttle lever, return spring, linkage or air throttle cylinder damaged or improperly adjusted	Check for proper operation of components. Refer to Section 6.
OK ↓	
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 Section 4.
OK ↓	

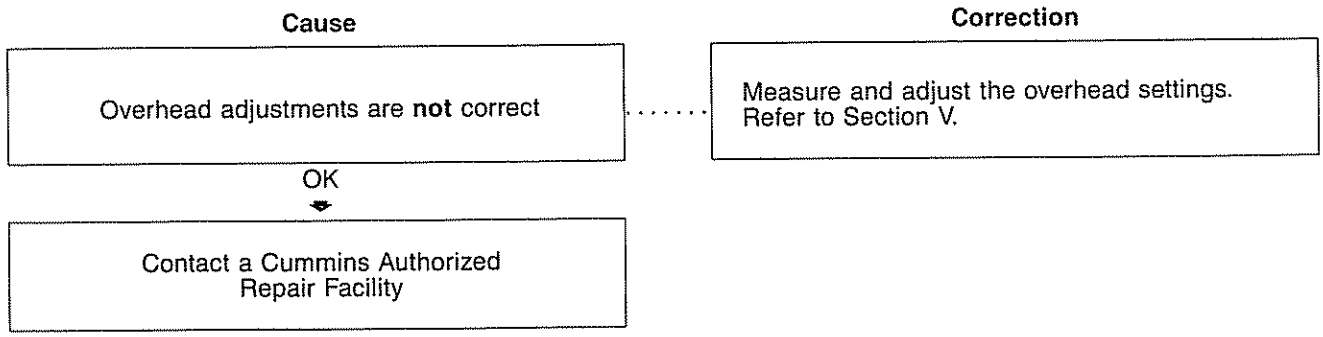
(Continued)

Engine Power Output Low (Continued)

Cause	Correction
Exhaust system restriction	Check the exhaust system for any restrictions. Refer to Section V for specifications.
OK ⬇	
Fuel shutoff lever (mechanical) partially engaged	Check or replace shutoff lever in run position.
OK ⬇	
Fuel filter or fuel suction line is restricted	Replace the fuel filter. Refer to Section 5. Check the fuel suction line for restriction.
OK ⬇	
Fuel drain line is restricted	Inspect the fuel drain lines for restrictions. Remove any restrictions found.
OK ⬇	
Fuel tank vents are plugged or damaged	Remove and clean the tank vents. Replace the vents if necessary. Refer to the OEM service manuals.
OK ⬇	
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 Section 5.
OK ⬇	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ⬇	
Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank stand pipe, and fuel filters as necessary.
OK ⬇	

(Continued)

Engine Power Output Low (Continued)



Engine Runs Rough at Idle

Cause	Correction
Engine is operating at low ambient temperature	Check the shutters and engine compartment air. Refer to Cold Weather Operation, Bulletin No. 3387266.
OK ⇩	
Idle characteristics of CELECT™ and CELECT™ Plus systems are different than characteristics of the PT system	Normal performance. No corrections are necessary.
OK ⇩	
Electronic fault codes are active	Refer to Diagnostic Fault Codes in Section 1 for instructions on how to read active fault codes. If fault codes are active, contact a Cummins Authorized Repair Facility.
OK ⇩	
Engine mounts are worn, damaged, or **not** correct	Check the engine mounts. Refer to the OEM service manual.
OK ⇩	
Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank stand pipe, and fuel filters as necessary.
OK ⇩	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

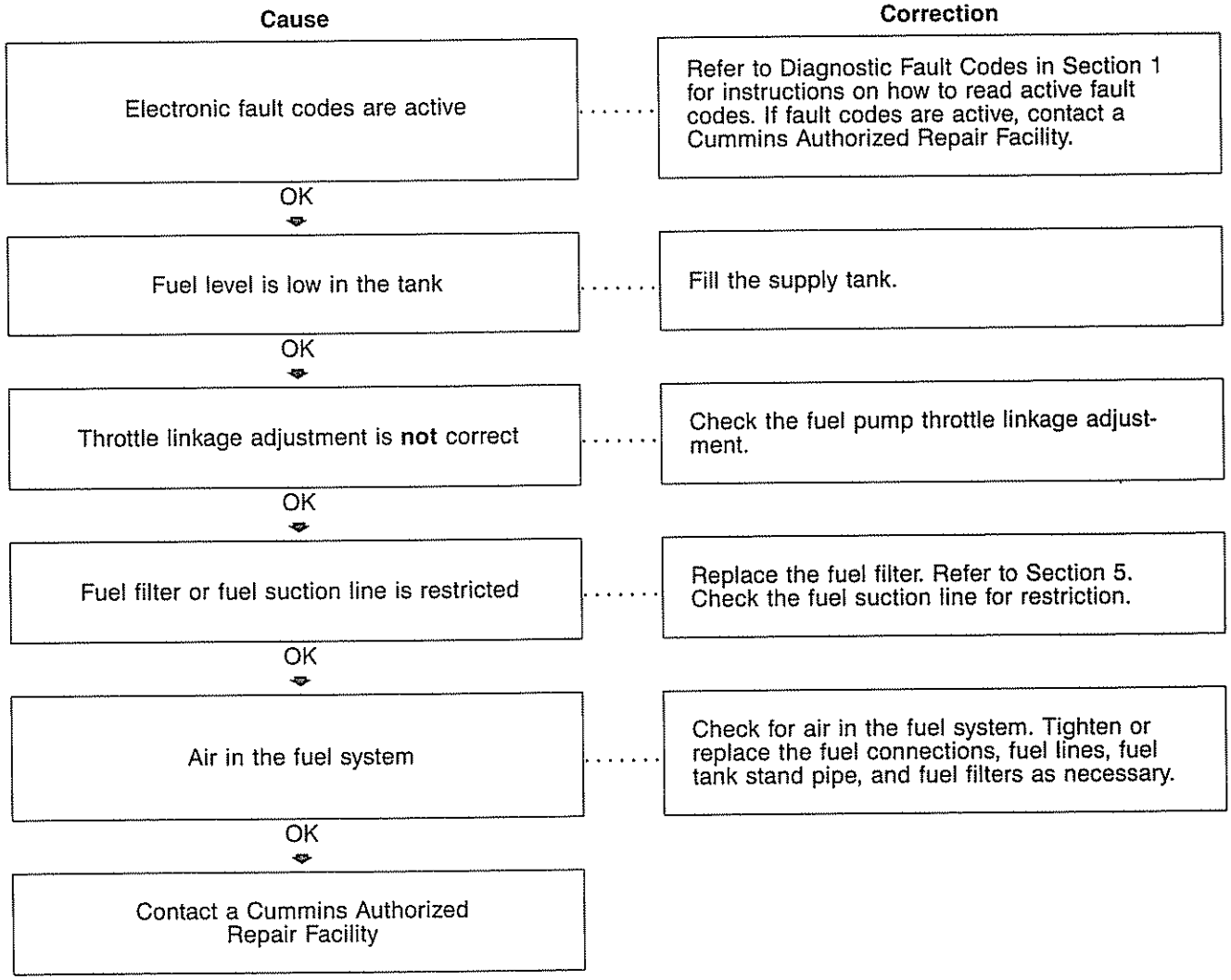
Engine Runs Rough or Misfires

Cause	Correction
Condition occurs **only** at idle	Refer to the Engine Runs Rough at Idle symptom tree.
OK ⇩	
Engine is operating at low ambient temperature	Check the shutters and engine compartment air. Refer to Cold Weather Operation, Bulletin No. 3387266.
OK ⇩	
Electronic fault codes are active	Refer to Diagnostic Fault Codes in Section 1 for instructions on how to read active fault codes. If fault codes are active, contact a Cummins Authorized Repair Facility.
OK ⇩	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ⇩	
Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank stand pipe, and fuel filters as necessary.
OK ⇩	
Fuel supply line restriction between the fuel pump and the injectors	Check the fuel supply line from the fuel pump to the cylinder head for sharp bends that can cause restrictions.
OK ⇩	
Overhead adjustments are **not** correct	Measure and adjust the overhead settings. Refer to Section V.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

Engine Shuts Off Unexpectedly or Dies During Deceleration

Cause	Correction
Electronic fault codes are active	Refer to Diagnostic Fault Codes in Section 1 for instructions on how to read active fault codes. If fault codes are active, contact a Cummins Authorized Repair Facility.
OK ⇩	
Idle shutdown or PTO shutdown features are activated	Refer to Electronically Controlled Fuel System in Section 1.
OK ⇩	
Engine will **not** restart	Refer to the Engine Difficult to Start or Will **Not** Start symptom tree.
OK ⇩	
Fuel inlet restriction	Check for fuel inlet restriction. Contact a Cummins Authorized Repair Facility.
OK ⇩	
Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank stand pipe, and fuel filters as necessary.
OK ⇩	
Battery voltage is low	Check the batteries and the unswitched battery supply circuit. Refer to .
OK ⇩	
Fuel shutoff valve (FSOV) is closed	Check for loose wires. Check for at least 9.5 volts from the battery during cranking.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

Engine Speed Surges at Low or High Idle



Engine Speed Surges Under Load or in Operating Range

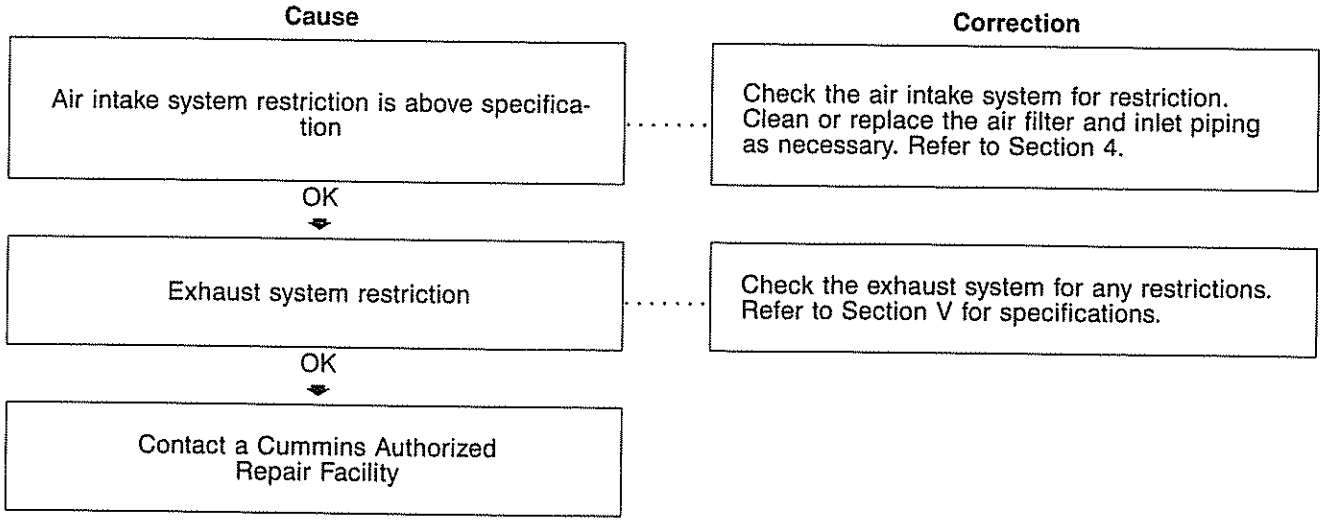
Cause	Correction
Electronic fault codes are active	Refer to Diagnostic Fault Codes in Section 1 for instructions on how to read active fault codes. If fault codes are active, contact a Cummins Authorized Repair Facility.
OK ⇩	
Fuel level is low in the tank	Fill the supply tank.
OK ⇩	
Throttle linkage adjustment is **not** correct	Check the fuel pump throttle linkage adjustment.
OK ⇩	
Variable speed (VS) governor air actuated throttle - air pressure is low	Maintain the system air pressure at a minimum of 552 kPa [80 psi].
OK ⇩	
Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank stand pipe, and fuel filters as necessary.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

Engine Starts But Will Not Keep Running

Cause	Correction
Idle shutdown or PTO shutdown features are activated	Refer to Electronically Controlled Fuel System in Section 1.
OK ↓	
Fuel level is low in the tank	Fill the supply tank.
OK ↓	
Engine-driven units are engaged	Disengage engine-driven units.
OK ↓	
Fuel filter or fuel suction line is restricted	Replace the fuel filter. Refer to Section 5. Check the fuel suction line for restriction.
OK ↓	
Fuel is waxing due to cold weather	Check the fuel heater, if installed. Weather conditions sometimes require a fuel heater.
OK ↓	
Fuel inlet restriction	Check the fuel filter. Refer to Section 3.
OK ↓	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ↓	
Engine idle speed is set too low	Adjust the idle speed. Refer to Section V.
OK ↓	
Air in the fuel system	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank stand pipe, and fuel filters as necessary.
OK ↓	

(Continued)

Engine Starts But Will Not Keep Running (Continued)



Engine Vibration Excessive

Cause	Correction
Engine is misfiring	Refer to the Engine Runs Rough or Misfires symptom tree.
OK ⇩ Engine idle speed is set too low (mechanical fuel systems)	Adjust the fuel pump idle speed.
OK ⇩ Fan is loose, damaged, or **not** balanced	Check the fan. Refer to Section 3.
OK ⇩ Belt-driven accessories are malfunctioning	Check the fan hub, alternator, freon compressor, and hydraulic pump for interference. Isolate belt-driven accessories, and check for vibration.
OK ⇩ Contact a Cummins Authorized Repair Facility	

Engine Will Not Crank or Cranks Slowly

Cause	Correction
Engine-driven units are engaged	Disengage engine-driven units.
OK	
Air pressure is low in the air tanks	Increase air pressure with an external air source.
OK	
Battery cables or connections are loose, broken, or corroded (excessive resistance)	Check the battery cables and connections.
OK	
Battery voltage is low	Check the batteries and the unswitched battery supply circuit. Refer to .
OK	
Battery capacity is below specification	Refer to Electrical System Specifications in Section V. Replace the batteries if necessary.
OK	
Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Section 5. Use the oil recommended in Section V.
OK	
Lubricating oil temperature is below specification	Install an oil pan heater, or drain the oil and fill the system with warm oil.
OK	
Battery temperature is below specification	Check the battery heater (if equipped) for correct operation. Refer to the manufacturer's instructions.
OK	
Contact a Cummins Authorized Repair Facility	

Engine Will Not Reach Rated Speed (RPM)

Cause	Correction
Excessive load for engine horsepower rating	Reduce vehicle load or use low gear if the engine is industrial. If engine is marine, change propeller(s).
OK ⇩	
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 ⇩	
Fuel suction line restricted	Inspect the fuel lines.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

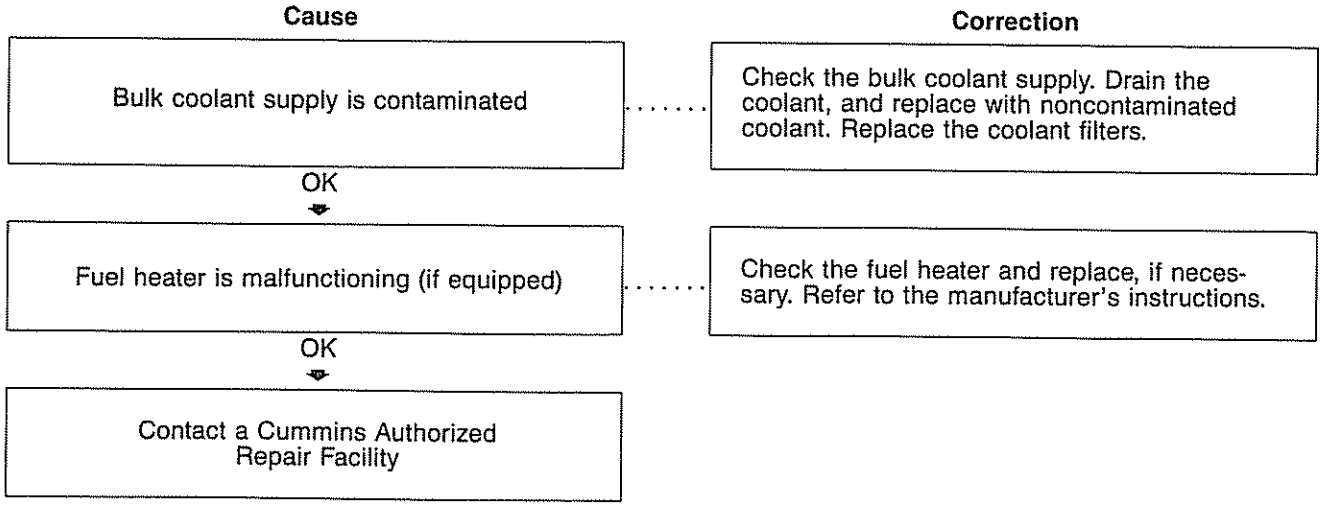
Engine Will Not Shut Off

Cause	Correction
Keyswitch circuit is malfunctioning	Check the vehicle keyswitch circuit. Refer to the OEM service manuals.
OK ⇩	
Fuel shutoff valve (FSOV) is stuck open	Verify that the solenoid or coil is **not** being energized by a short in the wiring.
OK ⇩	
Fuel pump manual override open	Check to make sure manual override screw is out to maximum travel.
OK ⇩	
Engine is running on fumes drawn into the air intake	Check the air intake ducts. Locate and isolate the source of the fumes. Repair as necessary. Refer to the OEM service manuals.
OK ⇩	
Fuel tank vents are plugged or damaged	Remove and clean the tank vents. Replace the vents if necessary. Refer to the OEM service manuals.
OK ⇩	
Fuel drain line is restricted	Inspect the fuel drain lines for restrictions. Remove any restrictions found.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

Fuel Consumption Excessive

Cause	Correction
Verify the complaint	If low power is relevant, refer to the Engine Power Output Low symptom tree. If acceleration is poor, refer to the Engine Acceleration or Response Poor symptom tree. If fuel consumption is relevant, continue with this tree.
OK	
Lubricating oil level is above or below specification	Check the oil level. Add or drain oil, if necessary. Refer to Section 3.
OK	
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 Section 4.
OK	
Fuel leak	Check the fuel lines, fuel connections, and fuel filters for leaks. Check the fuel lines to the supply tanks. Refer to OEM service manual.
OK	
Operator technique is **not** correct	Explain the correct engine operation to the operator. Refer to the OEM.
OK	
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	
Contact a Cummins Authorized Repair Facility	

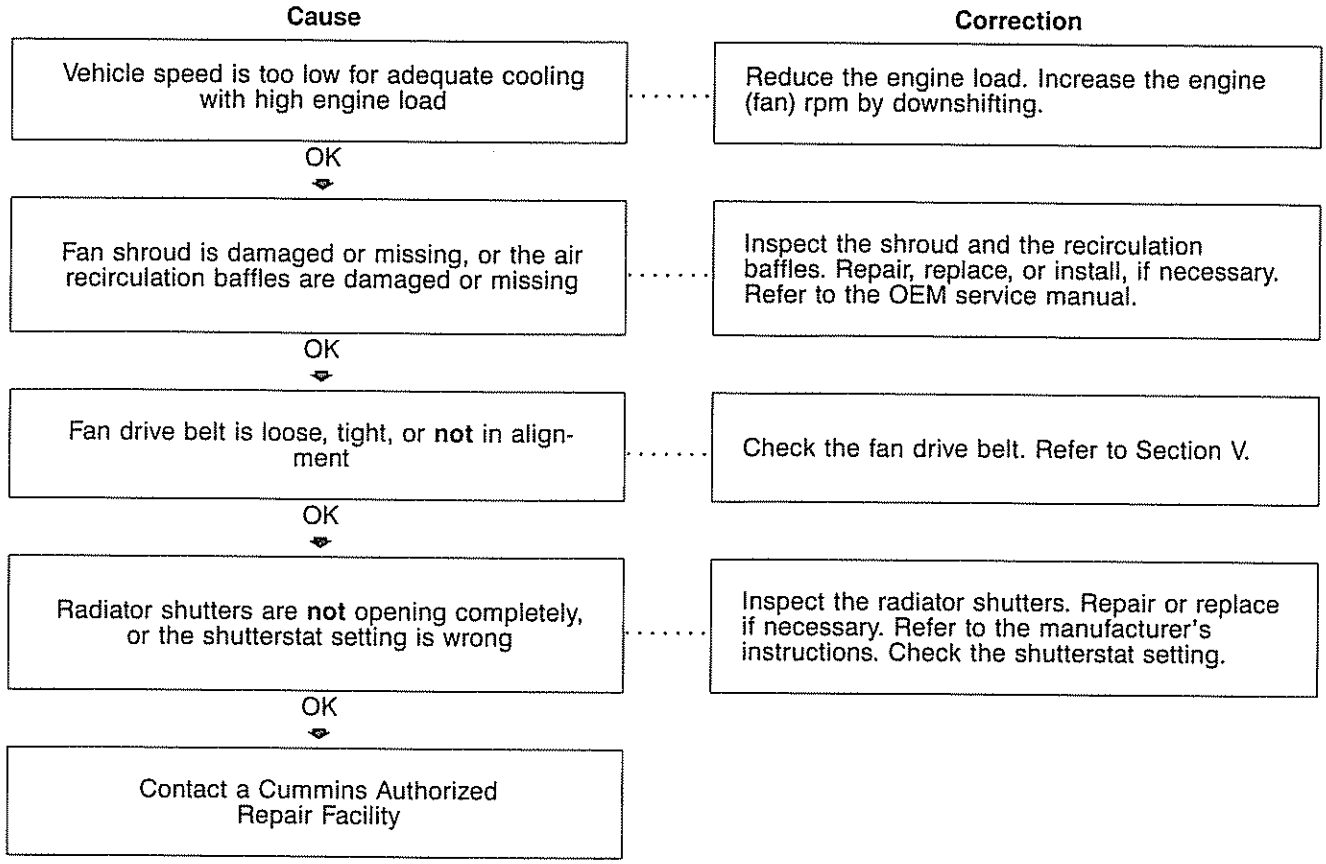
Fuel in Coolant



Fuel in the Lubricating Oil

Cause	Correction
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 ↓ Contact a Cummins Authorized Repair Facility	

Intake Manifold Air Temperature Above Specification



Intake Manifold Pressure (Boost) is Below Normal

Cause	Correction
Turbocharger is **not** correct	Check the turbocharger part number and compare it to the Control Parts List (CPL), Bulletin No. 3379133. Replace the turbocharger if necessary. Refer to Section A.
OK ⇩	
Air intake or exhaust leaks	Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting 4.
OK ⇩	
Air compressor connection is loose or damaged	Check the connection between the manifold and the air compressor. Repair or replace if necessary.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

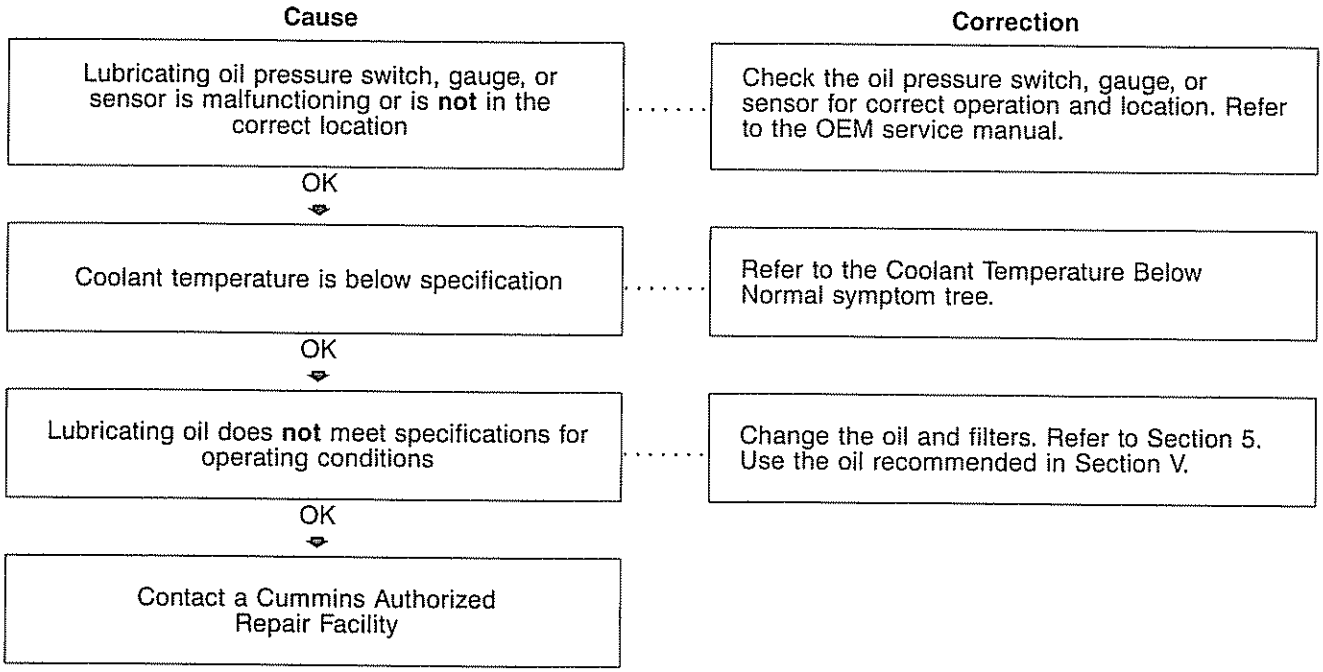
Lubricating Oil Consumption Excessive

Cause	Correction
Verify the oil consumption rate	Check the amount of oil added versus the mileage.
OK ↓	
Lubricating oil leak (external)	Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to Section V for specifications.
OK ↓	
Lubricating oil drain interval is excessive	Verify the correct lubricating oil drain interval. Refer to Section V.
OK ↓	
Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Section 5. Use the oil recommended in Section V.
OK ↓	
Crankcase ventilation system is plugged	Check and clean the crankcase breather and vent tube.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Lubricating Oil Contaminated

Cause	Correction
Identify lubricating oil contamination	Perform an oil analysis to determine the contaminants.
OK ↓	
Bulk oil supply is contaminated	Check the bulk oil supply. Drain the oil, and replace with noncontaminated oil. Replace the oil filters.
OK ↓	
Coolant is leaking into the combustion chamber	Refer to the Coolant Loss - Internal symptom tree.
OK ↓	
Lubricating oil sludge is excessive	Refer to the Lubricating Oil Sludge in the Crankcase is Excessive symptom tree.
OK ↓	
Fuel in the lubricating oil	Refer to the Fuel in the Lubricating Oil symptom tree.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Lubricating Oil Pressure High



Lubricating Oil Pressure Low

Cause	Correction
Lubricating oil level is above or below specification	Check the oil level. Add or drain oil, if necessary. Refer to Section 5.
OK ↓	
Lubricating oil leak (external)	Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to Section V for specifications.
OK ↓	
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 ↓	
Engine angularity during operation exceeds specification	Refer to the Engine Specification data sheet.
OK ↓	
Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Section 5. Use the oil recommended in Section V.
OK ↓	
Lubricating oil temperature is above normal (120°C [250°F])	Refer to the Coolant Temperature Above Normal chart.
OK ↓	
Lubricating oil is contaminated with coolant or fuel	Contact a Cummins Authorized Repair Facility.
OK ↓	
Lubricating oil filter is plugged	Change the oil and filter. Refer to Section 5. Review the oil change interval. Refer to Section V.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Lubricating Oil Sludge in the Crankcase Excessive

Cause	Correction
Bulk oil supply is contaminated	Check the bulk oil supply. Drain the oil, and replace with noncontaminated oil. Replace the oil filters.
OK ↓	
Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Section 5. Use the oil recommended in Section V.
OK ↓	
Lubricating oil drain interval is excessive	Verify the correct lubricating oil drain interval. Refer to Section V.
OK ↓	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ↓	
Coolant temperature is below specification	Refer to the Coolant Temperature Below Normal symptom tree V.
OK ↓	
Lubricating oil is contaminated with coolant or fuel	Contact a Cummins Authorized Repair Facility.
OK ↓	
Crankcase ventilation system is plugged	Check and clean the crankcase breather and vent tube.
OK ↓	
Contact a Cummins Authorized Repair Facility	

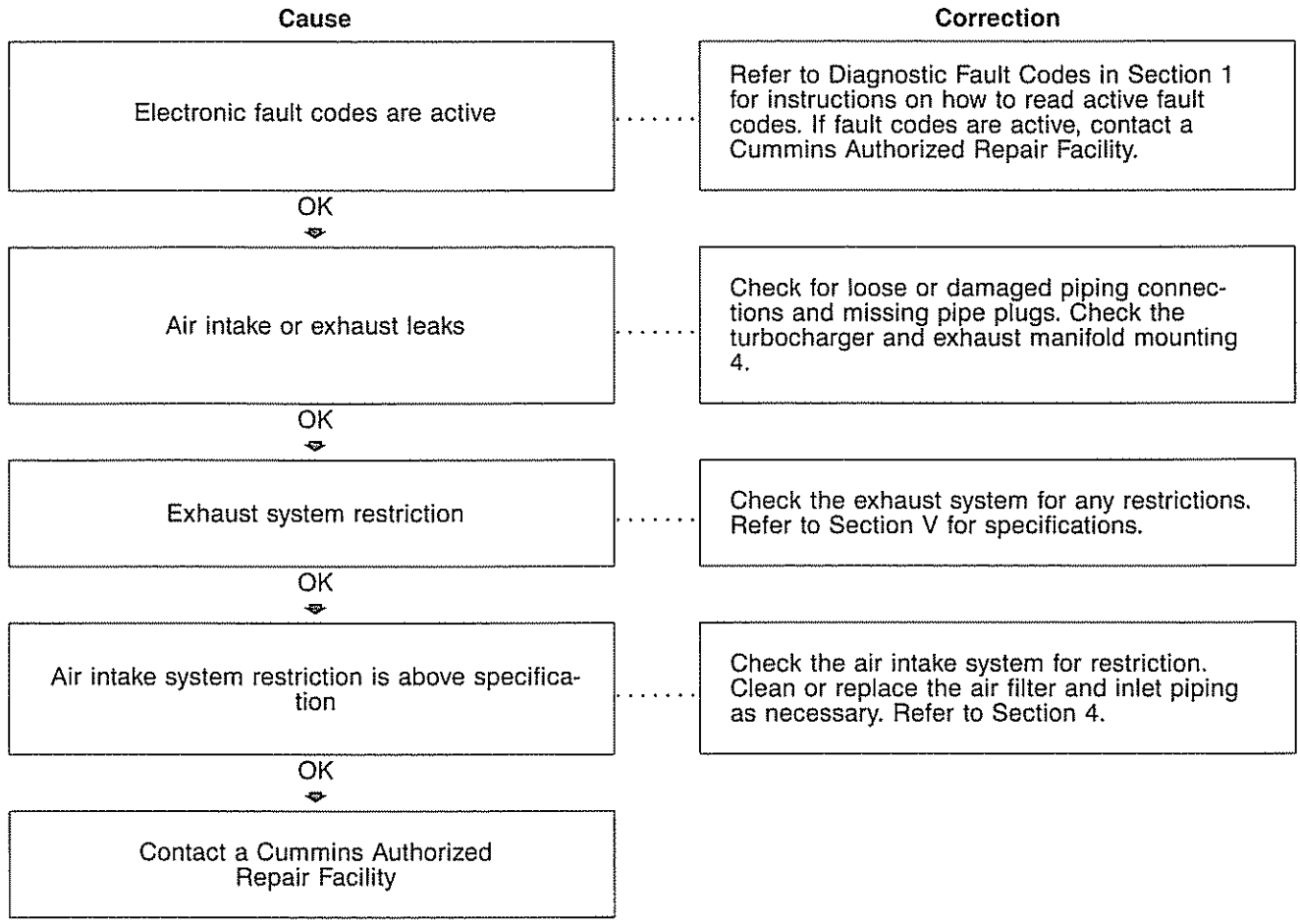
Lubricating Oil Temperature Above Specification

Cause	Correction
Lubricating oil level is above or below specification	Check the oil level. Add or drain oil, if necessary. Refer to Section 3.
OK ↓	
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 ↓	
Lubricating oil temperature switch, gauge, or sensor malfunctioning or **not** in the correct location	Check the oil temperature switch, gauge, or sensor for correct operation and location.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Lubricating or Transmission Oil in the Coolant

Cause	Correction
Bulk coolant supply is contaminated	Check the bulk coolant supply. Drain the coolant, and replace with noncontaminated coolant. Replace the coolant filters.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Smoke, Black — Excessive



Smoke, White — Excessive

Cause	Correction
Electronic fault codes are active	Refer to Diagnostic Fault Codes in Section 1 for instructions on how to read active fault codes. If fault codes are active, contact a Cummins Authorized Repair Facility.
OK ⇩	
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 manuals.
OK ⇩	
Engine is operating at low ambient temperature	Check the shutters and engine compartment air. Refer to Cold Weather Operation, Bulletin No. 3387266.
OK ⇩	
Coolant temperature is below specification	Refer to the Coolant Temperature Below Normal symptom tree.
OK ⇩	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ⇩	
Lubricating oil rifle pressure during cold start is below specification	Check the viscosity sensor. Refer to Section V.
OK ⇩	
Overhead adjustments are **not** correct	Measure and adjust the overhead settings. Refer to Section 6.
OK ⇩	
Contact a Cummins Authorized Repair Facility	

Turbocharger Leaks Engine Oil or Fuel

Cause	Correction
Engine is operating for extended periods under light- or no-load conditions (slobbering)	Review the engine operating instructions in Section 1.
OK	
Lubricating oil or fuel is entering the turbocharger	Remove the intake and exhaust piping, and check for oil or fuel.
OK	
Turbocharger drain line is restricted	Remove the turbocharger drain line and, check for restriction. Clean or replace the drain line.
OK	
Contact a Cummins Authorized Repair Facility	

NOTES

Section V - Maintenance Specifications

Section Contents

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Specifications

General Specifications

NOTE: Listed below are general specifications for this engine.

Horsepower ..... Refer to the engine dataplate

Engine Speed ..... Refer to the engine dataplate

Displacement ..... 14 liters [855 C.I.D.]

Bore and Stroke ..... 140 mm [5.5 in] x 152 mm [6.0 in]

Compression Ratio:
- 310, 320, 335, 345, 350, 360 ..... 18.5:1
- 400, 410, 425, 430, 440, 460, 475, 480, 485, 525E 16.5:1

Dry Engine Weight ..... 1316 kg [2901 lb]

Wet Engine Weight ..... 1371 kg [3022 lb]

Firing Order 1-5-3-6-2-4

Crankshaft Rotation (viewed from front of engine) ..... **Clockwise**

Valve and Injector Settings:
- Intake Valve Adjustment ..... 0.35 mm [0.014 in]
- Exhaust Valve Adjustment ..... 0.68 mm [0.027 in]
- Injector Lash Adjustment ..... 0.56 mm [0.022 in]
- Engine Brake Settings ..... 0.58 mm [0.023 in]

Fuel System

NOTE: For performance and fuel rate values, consult the engine data sheet or the fuel pump code for the particular model involved.

Maximum Allowable Restriction toPump with or without Fuel Cooler:
- STC
  - With Clean Filter ..... 102 mm Hg [4 in Hg]
  - With Dirty Filter ..... 204 mm Hg [8 in Hg]
- CELECT™ Plus
  - With Clean Filter ..... 152 mm Hg [6 in Hg]
  - With Dirty Filter ..... 254 mm Hg [10 in Hg]

Maximum Allowable Return Line Restriction with Check Valves and/or Overhead Tanks ... 165 mm Hg [6.5 in Hg]

Maximum Allowable Fuel Return Line Restriction without Check Valves ..... 89 mm Hg [3.5 in Hg]

Minimum Allowable Fuel Tank Vent Capability ..... 0.85 m^3/hr [30 ft^3/hr]

Maximum Allowable Fuel Inlet Temperature ..... 71°C [160°F]

Lubricating Oil System

Oil Pressure at Idle (minimum allowable at 93°C [200°F] oil temperature) ..... 70 kPa [10 psi]

Oil Pressure at 1200 rpm or Torque Peak (minimum allowable) ..... 172 kPa [25 psi]

Oil Capacity of Standard Engine
- Combination Full-Flow/Bypass Filter Capacity ..... 2.7 liters [0.7 U.S. gal]
- Oil Pan Capacity (high-low) ..... 36 to 30 liters [9.5 to 8 U.S. gal]
- Oil Change Capacity (oil pan and filter filled to capacity) ..... 37.7 to 32.9 liters [10.2 to 8.7 U.S. gal]

Total Lubricating Oil System Capacity Including Filter ..... 42 liters [11.0 U.S. gal]

Cooling System

Coolant Capacity (engine **only**) ..... 20.81 liters [21 qt]

Standard Modulating Thermostat Range ..... 82 to 93°C [180 to 200°F]

Maximum Coolant Cylinder Block Pressure (pressure cap removed):
- At 2300 rpm ..... 317 kPa [46 psi]
- At 1700 rpm ..... 165 kPa [24 psi]

Maximum Allowable Coolant Temperature Engine Outlet:
- CELECT™ Plus ..... 100°C [212°F]
- STC ..... 100°C [212°F]

Coolant Alarm Activation Temperature:
- CELECT™ Plus ..... 101°C [215°F]
- STC ..... 102 ±2°C [215 ±2°F]

Maximum External Resistance in Aftercooler Circuit (CELECT™ Plus **only**) ..... 35 kPa [5 psi]

Minimum Coolant Flow Through Aftercooler Circuit (open thermostat CELECT™ Plus **only**)
Liters per Minute [U.S. gallons per minute] ..... 83 [22]

Coolant Temperature at Aftercooler Radiator Inlet at Maximum Engine Coolant Out Temperature (CELECT™ Plus **only**) ..... 93°C [199°F]

Maximum Water Temperature into Aftercooler at Maximum Engine Coolant Out Temperature (CELECT™ Plus **only**) ..... 72°C [162°F]

Minimum Recommended Top Tank Temperature ..... 70°C [158°F]

Minimum Recommended Pressure Cap Pressure ..... 50 kPa [7 psi]

Air Intake System

△ CAUTION △

Engine intake air must be filtered to prevent dirt and debris from entering the engine. If air intake piping is damaged or loose, unfiltered air will enter the engine and cause premature wear.

Maximum Temperature Rise between Ambient Air and Engine Air Inlet (ambient above 0°C [32°F]) .. 15°C [30°F]

Maximum Inlet Restriction (clean filter) Normal-Duty Element ..... 250 mm H_2O [10 in H_2O]

Maximum Inlet Restriction (dirty filter) ..... 635 mm H_2O [25 in H_2O]

Maximum Allowable Pressure Drop across Charge Air Cooler:
- psi ..... 21 kPa [3 psi]
- Hg (mercury) ..... 152 mm Hg [6 in-Hg]

Exhaust System

Maximum Back Pressure at Turbocharger:
- Mercury ..... 76 mm Hg [3 in Hg]
- Water ..... 1016 mm H_2O [40 in H_2O]

Exhaust Pipe Size (normally acceptable inside diameter) ..... 127 mm [5 in]

Compressed Air System

Holset® SS338/QE338 A/C Models

Cylinders	1
Compressor Capacity @ 1250 rpm	6.2 l per sec. [13.20 cfm]
Piston Displacement	296 cc [18.06 C.I.D.]
Bore	92.08 mm [3.625 in]
Stroke	44.45 mm [1.750 in]
Speed	Engine speed
Cooling	Engine coolant
Lubrication	Engine lubricating oil

FBO

Cylinders	1
Compressor Capacity @ 1250 rpm	7.08 l per sec. [15.0 cfm]
Piston Displacement	338 cc [20.63 C.I.D.]
Bore	98.4 mm [3.875 in]
Stroke	44.5 mm [1.75 in]
Speed	Engine speed
Cooling	Engine coolant
Lubrication	Engine lubricating oil

Holset® ST676 A/C Model

Cylinders	2
Compressor Capacity @ 1250 rpm	14.2 l per sec. [30.00 cfm]
Piston Displacement	676 cc [41.3 C.I.D.]
Bore	92.08 mm [3.625 in]
Stroke	50.8 mm [2.00 in]
Speed	Engine speed
Cooling	Engine coolant
Lubrication	Engine lubricating oil

Holset® ST773 A/C Model

Cylinders	2
Compressor Capacity @ 1250 rpm	16.05 l per sec. [34.00 cfm]
Piston Displacement	773 cc [47.16 C.I.D.]
Bore	98.4 mm [3.875 in]
Stroke	50.8 mm [2.00 in]
Speed	Engine speed
Cooling	Engine coolant
Lubrication	Engine lubricating oil

Electrical System

Minimum Recommended Battery Capacity

System Voltage	Ambient Temperatures			
	−18°C [0°F]		0°C [32°F]	
	Cold Cranking Amperes	Reserve Capacity[1] Amperes	Cold Cranking Amperes	Reserve Capacity[1] Amperes
12 VDC	1800	640	1280	480
24 VDC[2]	900	320	640	240

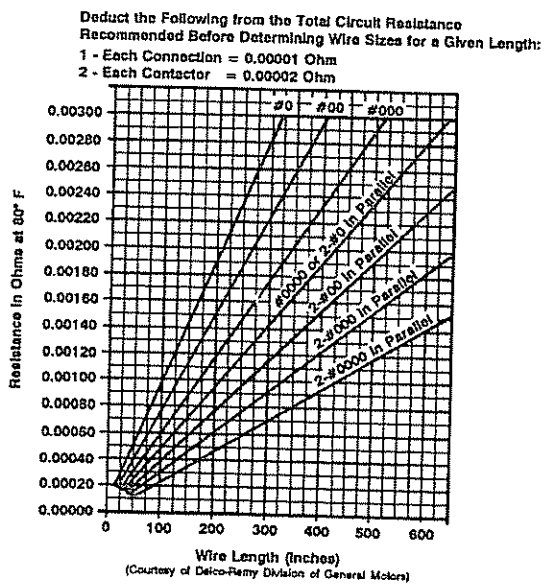
(1) The number of plates within a given battery size determines reserve capacity. Reserve capacity determines the duration of sustained cranking.

(2) CCA ratings are based on two 12-VDC batteries in series.

A minimum of 6.0 VDC at the 3-pin power connector is required to power up the ECM on CELECT™ Plus engines.

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



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Maximum Resistance of Starting Motor Circuit

12-VDC Starting Motor (Ohms) 0.00075
24-VDC Starting Motor (Ohms) 0.002

Cable resistances can be obtained in the accompanying Battery Cable Resistance Chart. If the frame is in ground circuit, the frame length **must** be considered, to be cable of the same size as that used in the balance of the system.

Item	Resistance Ohms
Connection	0.00001
Additional Contacter (Series-Parallel Switch, Relays, etc.)	0.00020

Cummins/Fleetguard®/Nelson Filter Specifications

Fleetguard® is a subsidiary of Cummins Engine Company, and Fleetguard® filters are developed through joint testing at Cummins and Fleetguard®. Fleetguard® filters are standard on new Cummins engines and Cummins recommends their use.

Fleetguard® products meet all of Cummins source approval test standards to provide the quality filtration necessary to achieve the engine's design life. If other brands are substituted, the purchaser **must** 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 Recommendations and Specifications

⚠ WARNING ⚠

Do not mix gasoline or alcohol with diesel fuel. This mixture can cause an explosion.

Cummins Engine Company, Inc. recommends the use of ASTM No. 2 D fuel. The use of No. 2 diesel fuel will result in optimum engine performance. At operating temperatures below 0°C [32°F], acceptable performance can be obtained by using blends of No. 2 D and No. 1 D. The use of lighter fuels can reduce fuel economy.

The viscosity of the fuel **must** be kept above 1.3 cSt at 100°C [212°F] to provide adequate fuel system lubrication.

For a more detailed description of fuel properties, refer to Fuel for Cummins Engines, Bulletin No. 3379001. See ordering information in the back of this manual.

Lubricating Oil Recommendations and Specifications

General Information

The use of quality engine lubricating oils, combined with appropriate oil drain and filter change intervals, is a critical factor in maintaining engine performance and durability.

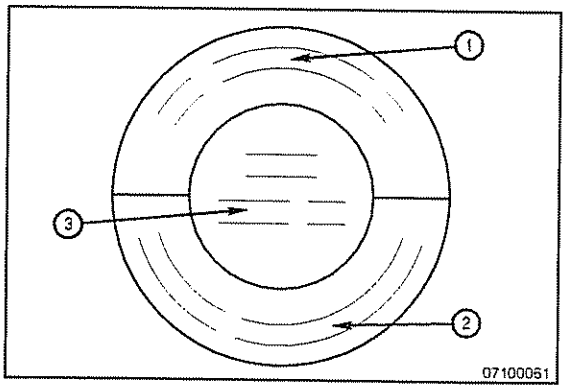
Cummins Engine Company, Inc. recommends the use of a high-quality 15W-40 multiviscosity heavy-duty engine oil that meets the requirements of Cummins Engineering Specification CES 20071 or CES 20076, such as Valvoline® Premium Blue® and Premium Blue® 2000. American Petroleum Institute (API) specification CH-4 can be used as an alternative to CES 20071. Oils that meet API specification CG-4 can be used, but at a reduced drain interval according to the Oil Drain Intervals by Severity of Service [km] mi chart listed in this section. The oil grades CC, CD, CE, and CF are obsoleted by API and should **not** be used.

Shortened drain intervals are often required with monograde oils as determined by close monitoring of the oil condition with scheduled oil sampling. Use of single-grade oils can affect engine oil control.

Synthetic engine oils, API category III, are recommended for use in Cummins engines operating in ambient temperature conditions consistently below -25°C [-13°F]. Above this temperature it is recommended that petroleum-based multigrade lubricants be used. Synthetic 0W-30 oils that meet API category III can be used in operations where the ambient temperature never exceeds 0°C [32°F]. 0W-30 oils do **not** offer the same level of protection against fuel dilution as do higher multigrade oils. Higher cylinder wear can be experienced when using 0W-30 oils in high-load situations.

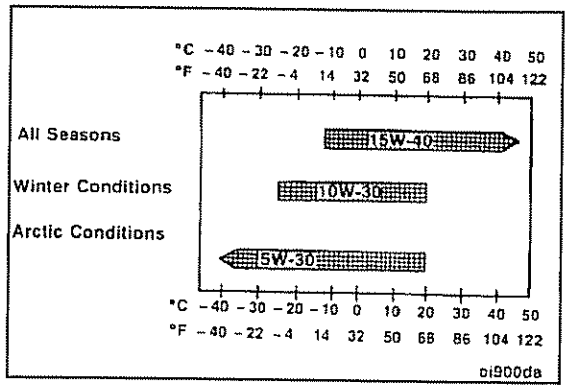
For further details and an explanation of engine lubricating oils for Cummins engines, refer to Cummins Engine Oil Recommendations, Bulletin No. 3810340.

Additional information regarding lubricating oil availability throughout the world is available in the Engine Manufacturing Association (EMA) Lubricating Oils Data Book for Heavy-Duty Automotive and Industrial Engines. The data book can be ordered from Engine Manufacturers Association, One Illinois Center, 111 East Wacker Drive, Chicago, IL 60601, U.S.A.; (312) 644-6610.



The API service symbols are shown in the accompanying illustration.

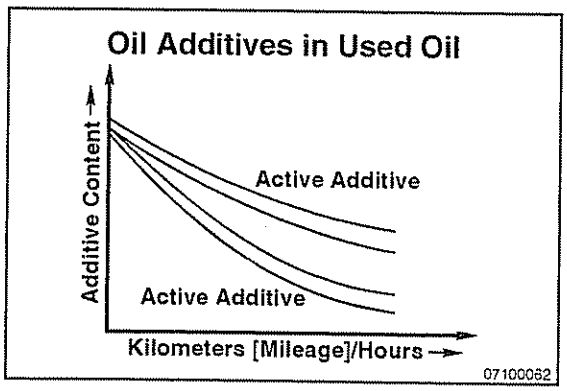
1. The upper half of the symbol displays the appropriate oil categories.
2. The lower half contains words to describe oil energy-conserving features.
3. The center section identifies the SAE oil viscosity grade.



Oil viscosity should be chosen according to the typical climate conditions experienced by the user. Use of 15W-40 is recommended for the best engine durability at higher ambient temperatures. For cold temperature conditions, 10W-30 or 5W-30 viscosity can be used for easier starting, improved oil flow, and improved fuel economy.

New Engine Break-in Oil

Special "break-in" engine lubricating oils are **not** recommended for new or rebuilt Cummins engines. In general, use the same oil during break-in that is used in normal operation. Synthetic or partially synthetic engine lubricating oils, however, can **not** be used during break-in of a new or rebuilt engine. To make sure the piston rings seat properly, use a high-quality, petroleum-based engine lubricating oil during the first engine oil drain period.



Oil Drain Interval

As the engine oil becomes contaminated, essential oil additives are depleted. Lubricating oils protect the engine as long as these additives are functioning properly. Progressive contamination of the oil between oil and filter change intervals is normal. The amount of contamination will vary depending on the operation of the engine, kilometers or miles on the oil, fuel consumed, and new oil added.

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

Refer to the oil drain chart in section 2 to determine which oil drain interval to use for your application.

Specifications

Cummins Engine Company, Inc. requires a lubricating oil filter(s) be used that meets the specifications given in the table below.

Lubricating Oil Filter Specifications			
Cummins Source Approval Method (SAM)	**Combination (LF3000)/(LF9009) 10,634**	**Full Flow (LF670) 10,509**	**Bypass (LF777) 10,547**
Flow vs. Restriction • Pressure differential at 40 GPM maximum	21 kPa [3 psi]	21 kPa [3 psi]	N/A
Element Collapse • Pressure differential	1034 kPa [150 psi]	1034 kPa [150 psi]	1034 kPa [150 psi]
Particle Retention • Absolute retention, percent of 40 micrometer and above, minimum	N/A	100%	N/A
• Percent retention of 20 to 30 micrometer	N/A	95%	N/A
Hydrostatic Pressure • Pressure, minimum	1724 kPa [250 psi]	1724 kPa [250 psi]	1724 kPa [250 psi]
Cold Flow vs. Restriction • Pressure differential at 6 GPM maximum	413 kPa [60 psi]	N/A	N/A

NOTE: A Fleetguard® LF9009 or equivalent lubricating oil filter **must** be used for drain intervals beyond 500 hours or 6 months; otherwise, a Fleetguard LF3000 or equivalent oil filter can be used for drain intervals less than 500 hours or 6 months.

Coolant Recommendations and Specifications

General Information

Cummins recommends the use of fully formulated antifreeze or coolant containing a precharge of supplemental coolant additive (SCA). The antifreeze or coolant **must** meet the specifications outlined in The Maintenance Council (TMC) Recommended Practice RP 329 (ethylene glycol) or RP 330 (propylene glycol). The use of fully formulated antifreeze or coolant significantly simplifies cooling system maintenance.

Copies of TMC specifications can be obtained through Cummins Engine Company, Inc., or by contacting:

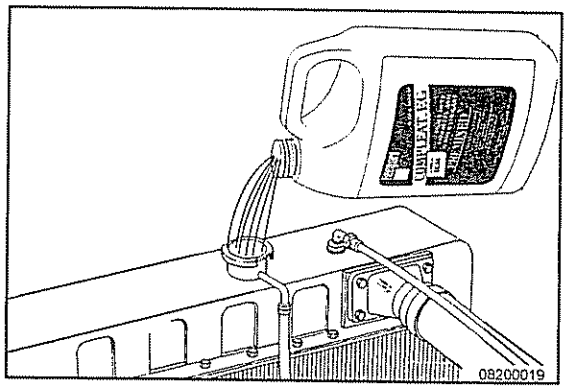
The Maintenance Council
American Trucking Association
2200 Mill Road
Alexandria, VA 22314-5388
Phone: (703) 838-1763
Fax: (703) 836-6070

Fully formulated **antifreeze** contains balanced amounts of antifreeze, SCA, and buffering compounds, but does **not** contain 50-percent water. Fully formulated **coolant** contains balanced amounts of antifreeze, SCA, and buffering compounds already premixed 50/50 with deionized water.

The following pages will give an explanation of water, antifreeze, and SCAs. They will also explain how to test antifreeze and SCA levels.

This section also contains information on cooling system maintenance and a coolant treatment chart that is used to determine the correct SCA service filter.

Alternative maintenance practices for cooling systems can be found in Cummins Coolant Requirements and Maintenance, Bulletin No. 3666132.



Fully Formulated Coolant/Antifreeze

Cummins Engine Company, Inc. recommends using either a 50/50 mixture of good-quality water and fully formulated antifreeze, or fully formulated coolant when filling the cooling system. The fully formulated antifreeze or coolant **must** meet TMC RP 329 or TMC RP 330 specifications. For complete explanation of Cummins coolant requirements and maintenance, refer to Bulletin No. 3666132.

Water Quality	
Calcium Magnesium (Hardness)	Maximum 170 ppm as ($CaCO_3$ + $MgCO_3$)
Chloride	40 ppm as(Cl)
Sulfur	100 ppm as (SO_4)

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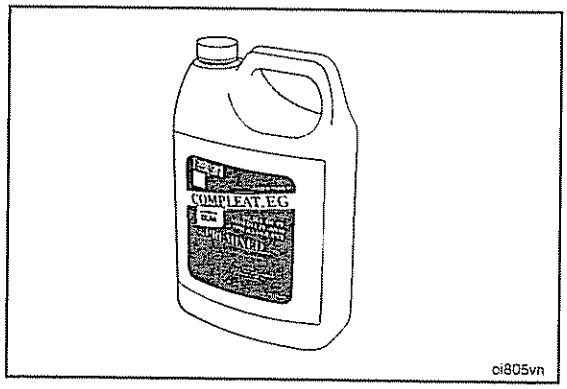
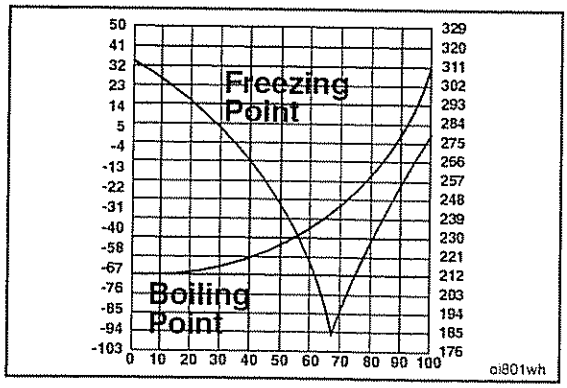
Good-quality water is important for cooling system performance. Excessive levels of calcium and magnesium contribute to scaling problems, and excessive levels of chlorides and sulfates cause cooling system corrosion.

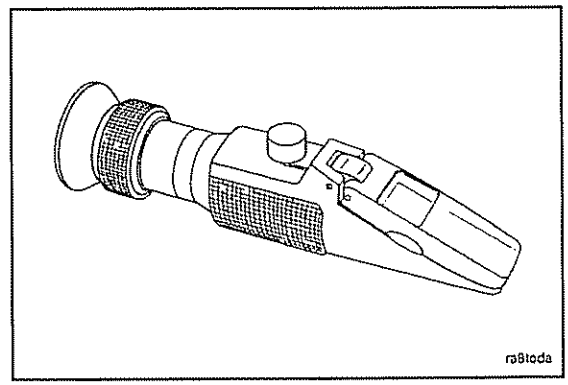


Cummins Engine Company, Inc. recommends using Fleetguard® Compleat. It is available in both glycol forms (ethelyne and propylene) and complies with TMC standards.

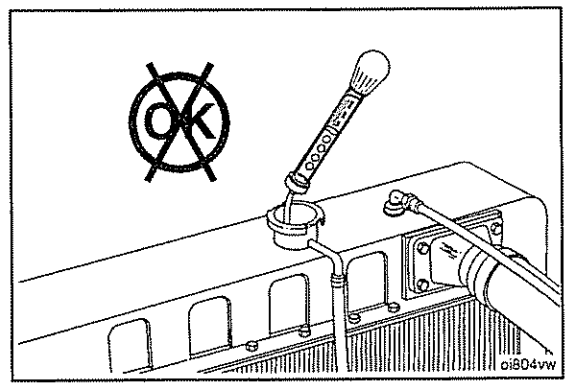


Fully formulated antifreeze **must** be mixed with quality water at a 50/50 ratio (40-percent to 60-percent working range). A 50/50 mixture of antifreeze and water gives a -36°C [-34°F] freezing point and a boiling point of 110°C [228°F], which is adequate for locations in North America. The actual lowest freezing point of ethylene glycol antifreeze is at 68 percent. Using higher concentrations of antifreeze will raise the freezing point of the solution and increase the possibility of a silica gel problem.

A refractometer **must** be used to measure the freezing point of the coolant **accurately**.



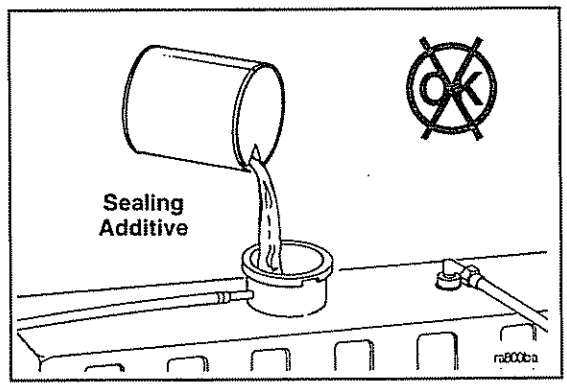
Do **not** use floating ball hydrometers. Using floating ball hydrometers can give incorrect readings.



Cooling System Sealing Additives

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

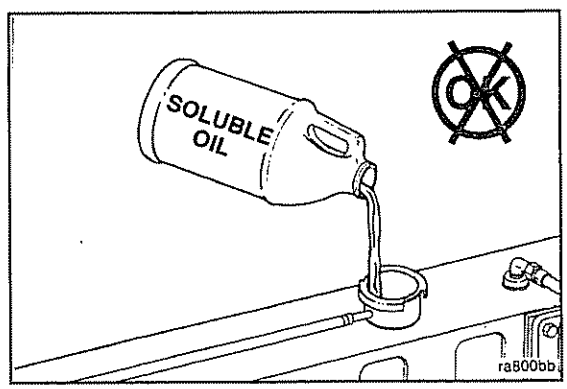
- Build up in coolant low-flow areas
- Clog coolant filters
- Plug radiator and oil cooler.



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.



Fleetguard® Nelson® DCA4 Service Filters and Liquid Precharge

DCA4 [1]Service Filters:		DCA [1](Fleetcool) Service Filters:	
Part No.	SCA Units	Part No.	SCA Units
WF2070	2	WF2050	2
WF2071	4	WF2051	4
WF2072	6	WF2052	6
WF2073	8	WF2053	8
WF2074	12	Not Available	12
WF2075	15	WF2054	15
WF2076	23	WF2055	23
WF2077	(blank filter without SCAs)	WF2077	(blank filter without SCAs)

Notes:

(1) DCA4 (phosphate/nitrite/molybdate chemistry) and DCA (borate/nitrite chemistry) meets Cummins requirements for supplemental coolant additives.

DCA4[1] Liquid			DCA [1](Fleetcool) Liquid		
Part No.	Size	SCA Units	Part No.		SCA Units
DCA60L	0.47 liters [1 pt]	5	DCA30L	0.47 liters [1 pt]	5
DCA65L	1.89 liters [2 pt]	20	DCA35L	1.89 liters [2 pt]	20
DCA70L	3.78 liters [1 gal]	40	DCA40L	3.78 liters [1 gal]	40
DCA75L	18.9 liters [5 gal]	200	DCA45L	18.9 liters [5 gal]	200
DCA80L	208 liters [55 gal]	2200	DCA50L	208 liters [55 gal]	2200

Notes:

(1) DCA4 (phosphate/nitrite/molybdate chemistry) and DCA (borate/nitrite chemistry) meets Cummins requirements for supplemental coolant additives.

Maintenance Intervals for Cooling Systems up to 76 Liters [20 U.S. Gallons]

Service Interval			Install service filter(s) and/or liquid containing number of SCA units below: System Size in Liters [U.S. Gallons]			
Kilometers	[Miles]	[Hours]	4 to19 [1 to 5]	19 to38 [6 to 10]	42 to 57 [11 to 15]	60 to 76 [16 to 20]
72001 to 80000	[45001 to 50000]	1126 to 1250	8	12	23	30
64001 to 72000	[40001 to 45000]	1001 to 1125	4	12	15	26
56001 to 64000	[35001 to 40000]	876 to 1000	4	8	12	23
48001 to 56000	[30001 to 35000]	751 to 875	4	6	12	20
40001 to 48000	[25001 to 30000]	626 to 750	4	6	10	18
32001 to 40000	[20001 to 25000]	501 to 625	2	6	8	15
24001 to 32000	[15001 to 20000]	376 to 500	2	4	6	12
16001 to 24000	[10001 to 15000]	251 to 375	2	4	6	8
0 to 16000	[0 to 10000]	0 to 250	2	2	4	6

Maintenance Intervals for Cooling System up to 1514 Liters [400 U.S. Gallons]

Service Interval	Install service filter(s) and/or liquid containing number of SCA units below: System Size in Liters [U.S. Gallons]									
Hours	79 to 144 [21 to 30]	117 to 189 [31 to 50]	193 to 284 [51 to 75]	288 to 378 [76 to 100]	382 to 568 [101 to 150]	572 to 757 [151 to 200]	761 to 946 [201 to 250]	950 to 1135 [251 to 300]	1139 to 1325 [301 to 350]	1329 to 1574 [351 to 400]
751 to 1000	25	50	80	100	150	200	250	300	350	400
501 to 750	20	35	60	75	110	150	190	225	260	300
251 to 500	15	25	40	50	75	100	125	150	175	200
0 to 250	10	15	20	25	40	50	65	75	90	100

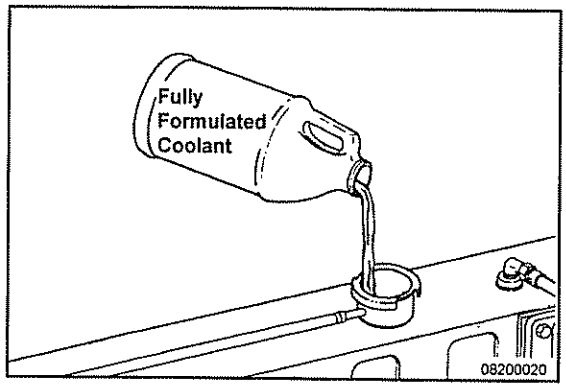
Notes:

A. Consult the vehicle equipment manufacturer's maintenance information for total cooling system capacity.

B. When draining and replacing the coolant, **always** precharge the cooling system to an SCA level of 1.5 units per gallon. This concentration level **must never** be allowed to go below 1.2 units and **must** be controlled when the level is greater than 3 units. Action needed when the level goes below 1.2 is a filter and liquid precharge; from 1.2 to 3.0 units, filter **only**; above 3.0, test at every oil change until level falls to 3.0 or below.

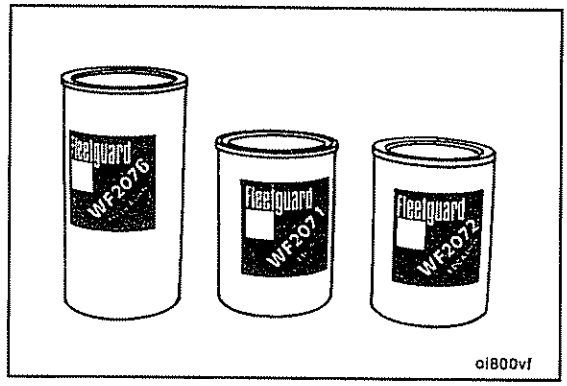
NOTE: When performing service that requires draining the cooling system, take special precautions to collect it in a clean container, seal it to prevent contamination, and save for reuse.

C. Change coolant filters at each oil change to protect the cooling system. Consult the coolant capacity chart to determine the correct coolant filter for a given cooling system capacity and oil drain interval.



Supplemental Coolant Additive (SCA)

Fully formulated products contain SCAs and are required to protect the cooling system from fouling, solder blooming, and general corrosion. The coolant filter is required to protect the cooling system from abrasive materials, debris, and precipitated coolant additives.

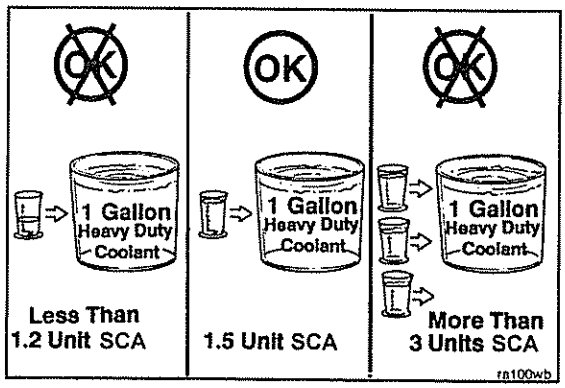


Supplemental coolant additives, or equivalent, are used to prevent liner pitting, corrosion, and scale deposits in the cooling system.

Use the correct Fleetguard® coolant filter to maintain the recommended SCA concentration in the system.

Maintain the correct concentration by changing the service filter at each oil drain interval.

NOTE: The correct filter is determined by the total cooling system capacity and oil drain interval. Refer to the Coolant Capacity Charts.



△ CAUTION △

Insufficient concentration of the coolant additives will result in liner pitting and engine failure.

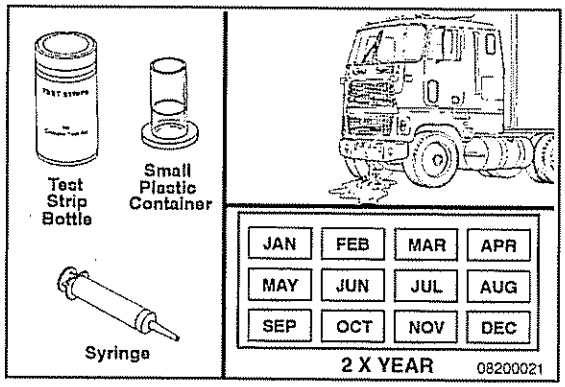
The SCA concentration **must not** fall below 1.2 units or exceed 3 units per gallon of cooling system capacity.

Testing SCA Concentration Level CC-2602 Test Kit

Carefully follow the instructions to test the coolant and take the appropriate action recommended by the kit.

Precautions and Instructions for Proper Kit Use

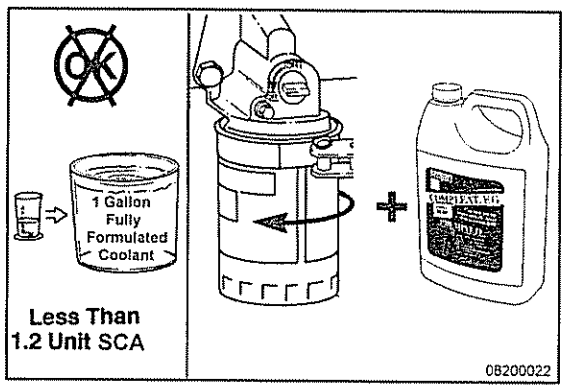
- The coolant sample to be tested **must** be between 10 and 54°C [50 and 130°F]. If the sample is too cold or too hot, you will get incorrect results.
- To get the best color match results, compare test strip pads to the color chart in daylight or under cool white fluorescent lighting. If unsure about a specific color match when a test does fall between two colors on the color chart, choose the lower numbered block. It is safer to underestimate your results than to overestimate.
- The test strips do have a limited shelf life and are sensitive to humidity and extreme heat. Proper handling and storage is necessary to protect the life of the strips.
- Keep the cap tightly sealed on the test strip bottle **except** when removing a strip. Store away from direct sunlight and in an area where the temperature will generally stay below 32°C [90°F].
- Do **not** use the test strips after the expiration date stamped on the bottle.
- Discard the kit if any of the pads on the unused strips have turned light brown or pink.
- Use one strip at a time, and take care **not** to touch any of the pads on the strip. Doing so will contaminate the pads and affect the test results.
- If the strip container is left uncapped for 24 hours, moisture in the air will render the strips useless, although no discoloration will be evident.
- **Only** use the color chart supplied with the kit.
- Clean and dry the sample cup and syringe after each use. This will prevent contaminating future samples.
- Following the correct test times is very important. Use a clock or stopwatch.



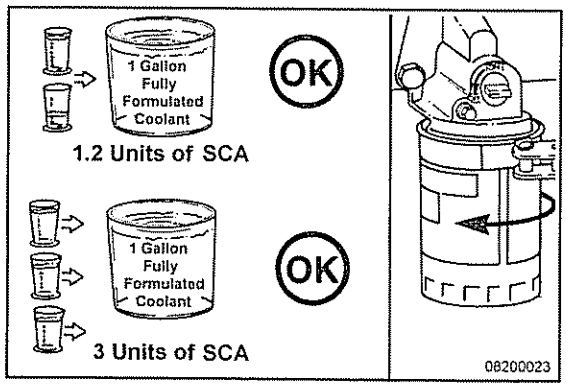
Test Intervals

Testing is recommended if the operator is **not** sure of his cooling system condition due to leaks, uncontrolled topping off of the system, or major coolant loss.

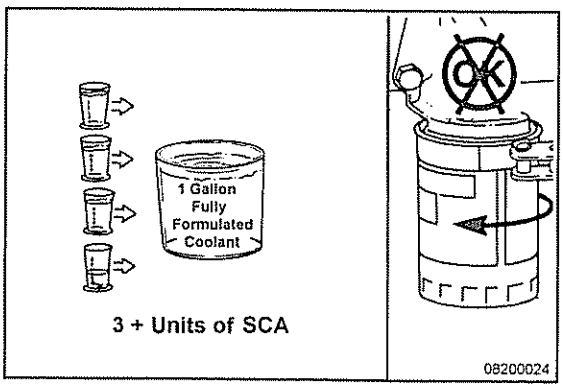
Testing is also recommended twice a year to monitor the SCA level. If the SCA level is above 3 units, test at subsequent oil drain intervals until the concentration is back under 3 units. When the concentration is back under 3 units, start installing the correct service filters at each drain interval.



If the concentration is below 1.2 units per gallon, replace the filter and precharge with liquid.



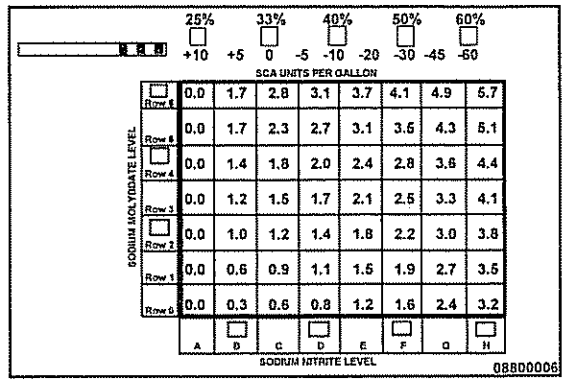
If the concentration is 1.2 to 3 units per gallon, replace the filter.



If the concentration is above 3 units per gallon, do **not** replace the service filter. Test the coolant at subsequent oil drain intervals until the concentration is back under 3 units. When the concentration is back under 3 units, start installing service filters at each oil change interval.

NOTE: Do **not** utilize the test kit to maintain minimum SCA concentration levels (i.e., 1.2 units).

NOTE: In some instances the A or B reading can be high. However, it is the combined reading that is important. **So always follow the chart.**



CC2602 Coolant Test Kit	– Works with any SCA formulation
Probablizer:	
3318169S Plug	– Installs on the engine for easy coolant sampling
3318168S Cap	– Use with Monitor C™ bottle to sample coolant
CC2700 Monitor C	– Lab analysis of coolant samples

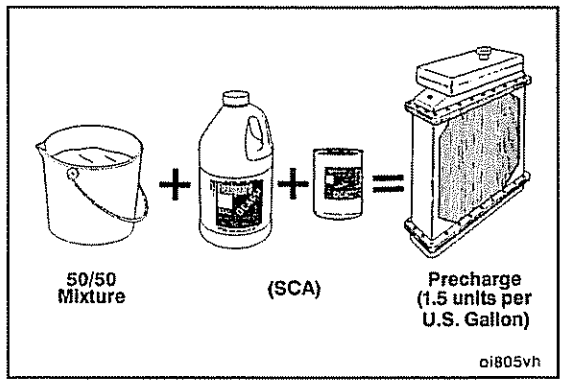
Call the following numbers to get answers to any questions you have about cooling system maintenance.

Cummins:	**1-800-DIESELS** 1-800-343-7357	**1-800-22-FILTERS** 1-800-223-4583

Coolant Replacement Requirements

Drain and flush the cooling system after 6000 hours, or 2 years of service. Refill with either new **fully formulated coolant** or a 50/50 mixture of good-quality water and fully formulated antifreeze, and install the correct service coolant filter.

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



Drive Belt Tension

SAE Belt Size	Belt Tension Gauge Part No.		Belt Tension New		Belt Tension Range Used*	
	Click-type	Burroughs	N	lbf	N	lbf
0.380 in	3822524		620	140	270 to 490	60 to 110
0.440 in	3822524		620	140	270 to 490	60 to 110
1/2 in	3822524	ST-1138	620	140	270 to 490	60 to 110
11/16 in	3822524	ST-1138	620	140	270 to 490	60 to 110
3/4 in	3822524	ST-1138	620	140	270 to 490	60 to 110
7/8 in	3822524	ST-1138	620	140	270 to 490	60 to 110
4 rib	3822524	ST-1138	620	140	270 to 490	60 to 110
5 rib	3822524	ST-1138	670	150	270 to 530	60 to 120
6 rib	3822525	ST-1293	710	160	290 to 580	65 to 130
8 rib	3822525	ST-1293	890	200	360 to 710	80 to 160
10 rib	3822525	3823138	1110	250	440 to 890	100 to 200
12 rib	3822525	3823138	1330	300	530 to 1070	120 to 240
12 rib K section	3822525	3823138	1330	300	890 to 1070	200 to 240

NOTE: This chart does not apply to automatic belt tensioners.

* A belt is considered used if it has been in service for ten minutes or longer.
* If used belt tension is less than the minimum value, tighten the belt to the maximum used belt value.

Engine Component Torque Values

Component	Wrench Size	Torque Value		
		N•m	in-lb	ft-lb
Oil Pan Drain Plug	1-1/4	88		65
Turbocharger Mounting Nuts	9/16	70		50
Air Compressor Unloader Valve Capscrews	1/2	14	124	
Fuel Pump Housing Primer Plug	9/16	30		20
Vibration Damper	7/8	260		190
Water Pump Idler Pulley Shaft Locknut	1-1/16	70		50
Fan Hub Mounting Capscrews	N/A	110		80
Fuel Pump Mounting Capscrews	7/16 (12 point)	45		35
Rocker Cover Capscrews	7/16	12	105	
Injector Hold-Down Capscrews	3/8 (12 point)	40		30
Rocker Lever Shaft Capscrews	9/16 (12 point)	155		115
Injector Adjust Screw Locknut	7/8	70		50

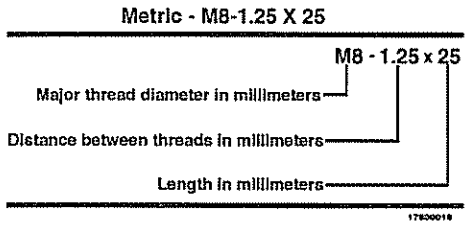
Capscrew Markings and Torque Values

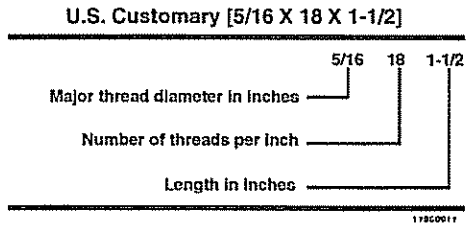
△ CAUTION △

When replacing capscrews, always use a capscrew of the same measurement and strength as the capscrew being replaced. Using the wrong capscrews can result in engine damage.

Metric capscrews and nuts are identified by the grade number stamped on the head of the capscrew or on the surface of the nuts. U.S. Customary capscrews are identified by radial lines stamped on the head of the capscrew.

The following examples indicate how capscrews are identified:

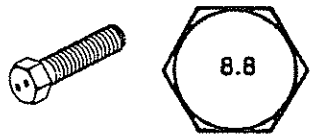
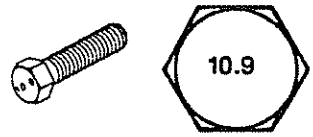
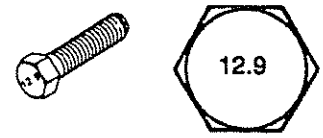




NOTES:

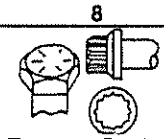
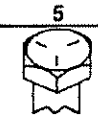
1. **Always** use the torque values listed in the following tables when specific torque values are **not** available.
2. Do **not** use the torque values in place of those specified in other sections of this manual.
3. The torque values in the table are based on the use of lubricated threads.
4. When the ft-lb value is less than 10, convert the ft-lb value to in-lb to obtain a better torque with an in-lb torque wrench. Example: 6 ft-lb equals 72 in-lb.

Capscrew Markings and Torque Values - Metric

Commercial Steel Class	8.8	10.9	12.9
Capscrew Head Markings			

Body Size	Torque				Torque				Torque			
Diameter	Cast Iron		Aluminum		Cast Iron		Aluminum		Cast Iron		Aluminum	
mm	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
6	9	5	7	4	13	10	7	4	14	9	7	4
7	14	9	11	7	18	14	11	7	23	18	11	7
8	23	17	18	14	33	25	18	14	40	29	18	14
10	45	33	30	25	65	50	30	25	70	50	30	25
12	80	60	55	40	115	85	55	40	125	95	55	40
14	125	90	90	65	180	133	90	65	195	145	90	65
16	195	140	140	100	280	200	140	100	290	210	140	100
18	280	200	180	135	390	285	180	135	400	290	180	135
20	400	290	—	—	550	400	—	—	—	—	—	—

Capscrew Markings and Torque Values - U.S. Customary

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

Capscrew Body Size	Cast Iron		Aluminum		Cast Iron		Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1/4 - 20	9	7	8	6	15	11	8	6
1/4 - 28	12	9	9	7	18	13	9	7
5/16 - 18	20	15	16	12	30	22	16	12
5/16 - 24	23	17	19	14	33	24	19	14
3/8 - 16	40	30	25	20	55	40	25	20
3/8 - 24	40	30	35	25	60	45	35	25
7/16 - 14	60	45	45	35	90	65	45	35
7/16 - 20	65	50	55	40	95	70	55	40
1/2 - 13	95	70	75	55	130	95	75	55
1/2 - 20	100	75	80	60	150	110	80	60
9/16 - 12	135	100	110	80	190	140	110	80
9/16 - 18	150	110	115	85	210	155	115	85
5/8 - 11	180	135	150	110	255	190	150	110
5/8 - 18	210	155	160	120	290	215	160	120
3/4 - 10	325	240	255	190	460	340	255	190
3/4 - 16	365	270	285	210	515	380	285	210
7/8 - 9	490	360	380	280	745	550	380	280
7/8 - 14	530	390	420	310	825	610	420	310
1 - 8	720	530	570	420	1100	820	570	420
1 - 14	800	590	650	480	1200	890	650	480

Fraction, Decimal, Millimeter Conversions

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 Conversion Chart

N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1	8.850756 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
1	0.737562 ft-lb	90	66	190	140
12	9	95	70	195	144
14	10	100	74	200	148
15	11	105	77	205	151
16	12	110	81	210	155
18	13	115	85	215	159
20	15	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

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

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 Size
60%	75%	
		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 Size
60%	75%	
		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 Size
60%	75%	
		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 Size
60%	75%	
		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

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Weights and Measures - Conversion Factors

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

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Off-Highway Engines United States and Canada

Coverage

Products Warranted

This warranty applies to new Engines sold by Cummins and delivered to the first user on or after April 1, 1999, that are used in industrial (off-highway) applications in the United States* and Canada, except for Engines used in marine, generator drive and certain defense applications, for which different warranty coverage is provided.

Base Engine Warranty

This warranty covers any failures of the Engine, under normal use and service, which result from a defect in material or factory workmanship (Warrantable Failures).

Coverage begins with the sale of the Engine by Cummins. Coverage continues for two years or 2,000 hours of operation, whichever occurs first, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first. If the 2,000 hour limit is exceeded during the first year, Coverage continues until the end of the first year.

Extended Major Components Warranty

The Extended Major Components Warranty covers Warrantable Failures of the Engine cylinder block, camshaft, crankshaft and connecting rods (Covered Parts).

Bushing and bearing failures are not covered.

This Coverage begins with the expiration of the Base Engine Warranty and ends three years or 10,000 hours of operation from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or from when the Engine has been operated for 50 hours, whichever occurs first.

Consumer Products

The warranty on Consumer Products in the United States is a LIMITED warranty. **CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.** Any implied warranties applicable to Consumer Products in the United States terminate concurrently with the expiration of the express warranties applicable to the product. In the United States, some states do not allow the exclusion of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the limitations or exclusions herein may not apply to you.

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

Cummins' Responsibilities

During The Base Engine Warranty

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

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

Cummins will pay reasonable costs for mechanics to travel to and from the equipment site, including meals, mileage and lodging, when the repair is performed at the site of the failure.

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

During The Extended Major Components Warranty

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

Owner's Responsibilities

During The Base Engine Warranty

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

During The Extended Major Components Warranty

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

to repair the part.

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

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

During The Base Engine and Extended Major Components Warranties

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

Before the expiration of the applicable warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility. Locations in the United States and Canada are listed in the Cummins Off Highway Authorized Dealer Directory.

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

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

Limitations

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

For power units and fire pumps (package units), this warranty applies to accessories, except for clutches and filters, supplied by Cummins which bear the name of another company.

Except for power units and fire pumps, this warranty does not apply to accessories which bear the name of another company. Such non-warranted accessories include, but are not limited to: alternators, starters, fans**, air conditioning compressors, clutches, filters, transmissions, torque converters, steering pumps, and non-Cummins fan drives, engine compression brakes and air compressors.

Cummins Compusave units are covered by a separate warranty.

Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failures of belts and hoses supplied by Cummins are not covered beyond the first 500 hours or one year of operation, whichever occurs first.

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

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

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

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

Emission Warranty

Products Warranted

This emission warranty applies to new Engines marketed by Cummins that are used in the United States* in vehicles designed for Industrial off-highway use. This warranty applies to Engines delivered to the ultimate purchaser on or after April 1, 1999 for engines up to 750 horsepower, on or after January 1, 2000 for engines 751 horsepower and over.

Coverage

Cummins warrants to the ultimate purchaser and each subsequent purchaser that the Engine is designed, built and equipped so as to conform at the time of sale by Cummins with all U.S. Federal emission regulations applicable at the time of manufacture and that it is free from defects in workmanship or material which would cause it not to meet these regulations within the longer of the following periods: (A) Five years or 3,000 hours of operation, whichever occurs first, as measured from the date of delivery of the Engine to the ultimate purchaser, or (B) The Base Engine Warranty.

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

Limitations

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

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

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

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

** Alternators, starters, and fans ARE covered for the duration of the base engine warranty on B3.3 engines.

Off-Highway Engines International

Coverage

PRODUCTS WARRANTED

This warranty applies to new Engines sold by Cummins and delivered to the first user on or after April 1, 1999, that are used in industrial (off-highway) applications anywhere in the world where Cummins-approved service is available, except the United States* and Canada. Different warranty coverage is provided for Engines used in marine, generator drive and certain defense applications.

BASE ENGINE WARRANTY

This warranty covers any failures of the Engine, under normal use and service, which result from a defect in material or factory workmanship (Warrantable Failure).

Coverage begins with the sale of the Engine by Cummins. Coverage continues for two years or 2,000 hours of operation, whichever occurs first, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first. If the 2,000 hour limit is exceeded during the first year, coverage continues until the end of the first year.

EXTENDED MAJOR COMPONENTS WARRANTY

The Extended Major Components Warranty covers Warrantable Failures of the Engine cylinder block, camshaft, crankshaft and connecting rods (Covered Parts).

Bushing and bearing failures are not covered.

This coverage begins with the expiration of the Base Engine Warranty and ends three years or 10,000 hours of operation, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or from when the Engine has been operated for 50 hours, whichever occurs first.

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

Cummins' Responsibilities

DURING THE BASE ENGINE WARRANTY

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

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

Cummins will pay reasonable costs for mechanics to travel to and from the equipment site, including meals, mileage and lodging, when the repair is performed at the site of the failure.

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

DURING THE EXTENDED MAJOR COMPONENTS WARRANTY

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

Owner's Responsibilities

DURING THE BASE ENGINE WARRANTY

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

DURING THE EXTENDED MAJOR COMPONENTS WARRANTY

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

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

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

DURING THE BASE ENGINE AND EXTENDED MAJOR COMPONENTS WARRANTIES

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

Before the expiration of the applicable warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the product available for repair by such facility. Locations are listed in the Cummins International Sales and Service Directory.

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

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

Limitations

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

For power units and fire pumps (package units) the warranty applies to accessories, except for clutches and filters supplied by Cummins which bear the name of another company.

Starters, alternators, power steering pumps and non-Cummins air compressors supplied by Cummins on B or C Series Engines that are not supplied as part of a package unit are covered for six months* from the date of delivery of the Engine to the first user, or the date the Engine is first leased, rented or loaned, or from when the Engine has been operated for 50 hours, whichever occurs first.

Except for the accessories noted previously, Cummins does not warrant accessories which bear the name of another company. Such non-warranted accessories include, but are not limited to: alternators, starters, fans*, air conditioning compressors, clutches, filters, transmissions, torque converters, steering pumps, non-Cummins fan drives, and air cleaners.

Cummins Compusave units are covered by a separate warranty.

Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failures of belts and hoses supplied by Cummins are not covered beyond the first 500 hours or one year of operation, whichever occurs first.

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

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

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

In case of consumer sales, in some countries, the Owner has statutory rights which cannot be affected or limited by the terms of this warranty.

Nothing in this warranty excludes or restricts any contractual rights the Owner may have against third parties.

* Alternators, starters, and fans ARE covered for the duration of the base engine warranty on B3.3 engines.

Recreational Applications Marine Propulsion Products

Coverage

Products Warranted

This warranty applies to new Engines sold by Cummins Engine Company, Inc., herein after 'Cummins', that are used in Marine propulsion applications anywhere in the world where Cummins approved service is available* and delivered to the first user on or after January 1, 1994, except for the 315 hp B and 420 hp C Engines designated as 'Diamond Edition' Engines for which different warranty coverage is provided. The 'Product' consists of a new Cummins Engine, as well as accessories, as listed below, which are approved and supplied by Cummins and which are either installed by Cummins or a Cummins authorized distributor. These Products have the following designation:

Recreational/Light Duty Commercial Rating

This power rating is designated for engines powering commercial boats which meet the conditions as set forth below, and for engines powering pleasure craft for personal use only.

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 power rating is an ISO3046 Fuel Stop Power Rating and is for applications that operate less than 750 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 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.

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.

Warranty Coverage						
	Coverage Duration*		Repair Charge Paid by Cummins			
Coverage Category	Months	Hours	Parts	Labor	Removal & Installation Labor	Travel
Base Engine Warranty**	24	1000	Yes	Yes	Yes	Yes - Up to 6 hours
Extended Major Components	60	2000	Yes***	Yes	Yes	No

Warranty Coverage		
	Coverage Duration*	Repair Charge Paid by Cummins

* Whichever occurs first.

** The Engine's Sea Water Pump, Gear Oil Cooler, and Heat Exchanger are covered for a period of 24 months or 1000 hours, whichever occurs first. Other accessories, ie. Marine Gear and Drive Plate, Instruments, Instrument Panel, Gage Senders, Starter, Alternator, Vibration Isolators, and Fuel/Water Separator are covered for a period of twelve (12) months or 750 hours, whichever occurs first.

*** Covered Parts as listed above.

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 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 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 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 required for the repair except for 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 Engine available for repair by such facility. Locations in the United States and Canada are listed in the Cummins U.S. and Canada Sales and Service Directory; other locations are listed in the Cummins International Sales and Service Directory.

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.

Cummins is not responsible for failures of maintenance components supplied by Cummins 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.

Except for the accessories noted previously, Cummins 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. 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 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.

* Locations in the United States and Canada are listed in the Cummins United States and Canada Sales and Service Directory; other locations are listed in the Cummins International Sales and Service Directory.

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

Commercial Applications Marine Propulsion Products

Coverage

Products Warranted

This warranty applies to new Engines sold by Cummins Engine Company, Inc., herein after "Cummins", that are used in Marine propulsion applications anywhere in the world where Cummins approved service is available* and delivered to the first user on or after January 1, 1994. The 'Product' consists of a new Cummins Engine, as well as accessories, which are approved and supplied by Cummins and which are either installed by Cummins or a Cummins authorized distributor. These Products have the following designation:

Intermittent Rating

This power rating is intended for intermittent use in variable load applications where full power is limited to two hours out of every eight hours of operation. Also, reduced power operations must be at or below 200 RPM of the maximum rated RPM. This rating is an ISO3046 Fuel Stop Power Rating and is for applications that operate less than 1500 hours per year.

Medium Continuous Rating

This power rating is intended for continuous use in variable load applications where full power is limited to six hours out of every twelve hours of operation. Also, reduced power operations must be at or below 200 RPM of the maximum rated RPM. This rating is an ISO3046 Fuel Stop Power Rating and is for applications that operate less than 3000 hours per year.

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 Cummins material or factory workmanship (Warrantable Failure). Coverage begins with the sale of the Engine by Cummins 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	1500
Medium Continuous	1	3000
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 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. **CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.** Any implied warranties applicable to Consumer Products terminate concurrently with the expiration of the express warranties applicable to the Product. In the United States, some states do not allow the exclusion of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the limitations or exclusions herein may not apply to you.

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

Cummins Responsibilities

During Base Engine Warranty

Cummins will pay for all parts and labor needed to repair the damage to the 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 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 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 cost for Engine removal and reinstallation. When Cummins elects to repair a part instead of replacing it, the Owner is not responsible for the labor needed to repair the part.

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

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

During the Base Engine and Extended Major Components Warranties

Owner is responsible for the operation and maintenance of the 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 Engine available for repair by such facility. Locations in the United States and Canada are listed in the Cummins U.S. and Canada Sales and Service Directory; other locations are listed in the Cummins International Sales and Service Directory.

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.

Cummins is not responsible for failures of maintenance components supplied by Cummins 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 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. date.

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 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.

* Locations in the United States and Canada are listed in the Cummins United States and Canada Sales and Service Directory; other locations are listed in the Cummins International Sales and Service Directory.

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

Worldwide Generator Drive

Engines Warranted

This warranty applies to new Engines sold by Cummins and delivered to the first user on or after April 1, 1999 that are used in generator drive application anywhere in the world where Cummins approved service is available. These Engines will have the following rating designations:

Standby Power Rating

Engines of this rating are applicable for supplying emergency power for the duration of the utility power outage. No overload capability is available for this rating. Under no condition is an Engine allowed to operate in parallel with the public utility at the Standby Power rating. This rating should be applied where reliable utility power is available. A standby rated engine is to be sized for a maximum of an 80 percent average load factor and 200 hours of operation per year. This includes less than 25 hours per year at the Standby Power rating. Standby rating should never be applied except in true emergency power outages. Negotiated power outages contracted with a utility company are not considered an emergency.

Unlimited Time Running Prime Power Rating

Engines with this rating are available for an unlimited number of hours per year in a variable load application. Variable load is not to exceed a 70 percent average of the Prime Power Rating during any operating period of 250 hours. Total operating time at 100 percent Prime Power shall not exceed 500 hours per year.

A 10 percent overload capability is available for a period of one hour within a twelve hour period of operation. Total operating time at the 10 percent overload power shall not exceed 25 hours per year.

Limited Time Running Prime Power Rating

Engines of this rating are available for a limited number of hours in a non-variable load application. It is intended for use in situations where power outages are contracted, such as in utility power curtailment. Engines may be operated in parallel to the public utility up to 750 hours per year at power levels never to exceed the Prime Power rating.

Limited Time Running Prime Power ratings differ from Unlimited Time Running in that even though the maximum power output of the engines are the same, the Limited Time Running allows the Engine to be parallel to Public Utility and run at the full Prime Power rating and must never exceed the Prime Power rating.

Continuous/Base Power Rating

Engines with this rating are available for supplying utility power at a constant 100 percent load for an unlimited number of hours per year. No overload capability is available for this rating.

Continuous/Base Power ratings differ from Unlimited Time Running Prime Power ratings in that the Continuous/Base Load ratings are significantly reduced from the Prime Power ratings. Continuous/Base Load ratings have no load factor or application restrictions.

Coverage

Base Engine Warranty

This warranty covers any failures of the Engine, under normal use and service, which result from a defect in material or factory workmanship (Warrantable Failure).

Coverage begins with the sale of the Engine by Cummins and continues for the Duration stated below. The Duration commences either on the date of delivery of the Engine to the first user, or on the date the Engine is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first.

Base Engine Warranty

Rating	Duration Whichever Occurs First	
	Months	Hours
Standby Power	24	400
Unlimited Prime Power	12	Unlimited
Limited Prime Power	12	750
Continuous/Base Power	12	Unlimited

Extended Major Components Warranty

The Extended Major Components Warranty applies to Engines other than B and C series and covers Warrantable Failures of the Engine cylinder block, camshaft, crankshaft and connecting rods (Covered Parts). Bushing and bearing failures are not covered. This coverage begins with the expiration of the Base Engine Warranty and continues for the following stated Duration. The Duration commences either on the date of delivery of the Engine to the first user, or on the date the Engine is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first.

Extended Major Components Warranty

	Duration Whichever Occurs First	
Rating	Months	Hours
Standby Power	36	600
Unlimited Prime Power	36	10,000
Limited Prime Power	36	2,250
Continuous/Base Power	36	10,000

Consumer Products

This warranty on Consumer Products in the United States is a LIMITED warranty. **CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.** Any implied warranties applicable to Consumer Products terminate concurrently with the expiration of the express warranties applicable to the product. In the United States, some states do not allow the exclusion of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the limitations or exclusions herein may not apply to you.

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

Cummins Responsibilities

During Base Engine Warranty

Cummins will pay for all parts and labor needed to repair the damage to the Engine resulting from a Warrantable Failure when performed during normal business hours. All labor costs will be paid in accordance with Cummins published Standard Repair Time guidelines.

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

Cummins will pay reasonable travel expenses for mechanics to travel to and from the Engine site, including meals, mileage, and lodging when the repair is performed at the site of the failure.

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

During the Extended Major Components Warranty

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

Owner's Responsibilities

During the Base Engine Warranty

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

During the Extended Major Components Warranty

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

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

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

During the Base Engine and Extended Major Components Warranties

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

Before the expiration of the applicable warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility. Locations in the United States* and Canada are listed in the Cummins United States and Canada Sales and Service Directory; other locations are listed in the Cummins International Sales and Service Directory.

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

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

Owner is responsible for providing sufficient access to and reasonable ability to remove the Engine from the installation in the event of a Warrantable Failure.

Owner is responsible for maintaining an operating Engine hourmeter. If the hourmeter is not operational, engine usage will be estimated at 400 hours per month.

Limitations

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

This warranty does not apply to accessories supplied by Cummins which bear the name of another company. Such non-warranted accessories include, but are not limited to: alternators, starters, fans**, air conditioning compressors, clutches, filters, transmissions, air cleaners and safety shutdown switches.

Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failure of belts and hoses supplied by Cummins are not covered beyond the first 500 hours or one year of operation, whichever occurs first after the warranty start date.

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

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

Cummins is not responsible for Engine performance problems or failures resulting from:

1. Use or application of the Engine inconsistent with its rating designation as set forth above.
2. Inadequate or incorrect installations deviating from Cummins Generator Drive Installation Guidelines.

CUMMINS IS NOT RESPONSIBLE FOR WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

In the United States* and Canada, this warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Outside the United States* and Canada, in case of consumer sales, in some countries, the Owner has statutory rights which cannot be affected or limited by the terms of this warranty.

Nothing in this warranty excludes or restricts any contractual rights the owner may have against third parties.

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

** Alternators, starters, and fans ARE covered for the duration of the base engine warranty on B3.3 engines.

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 M11 and N14 emission control parts:

Fuel Pump
- AFC Plunger
- AFC Spring
- AFC/ASA Valve
- AFC Setting
- Throttle Shaft
- No Air Setting
- Static Timing

Injectors (STC)
- Cup
- Calibration
- Top Stop
- Spring
- Spring Retainer
- Sleeve
- Check Ball Spring
- Retainer Clip

Turbocharger
- Compressor Wheel
- Turbine Wheel
- Turbine Oil Seal

Intake Manifold
- Charge Air Cooler
- Aftercooler

Exhaust Manifold

Oil Control Valve (STC)
- Plunger
- Spring
- Oil Transfer Connection
- Assembly

Injectors (CELECT™)
- Body
- Cup
- Needle
- Nozzle Spring
- Barrel

Electronic Control System
- Control Module
- Boost Pressure Sensor
- Coolant Temperature Sensor

Owner's Warranty Responsibilities

As the off-road diesel engine owner, you are responsible for the performance of the required maintenance listed in your Cummins Operation and Maintenance Manual. Cummins recommends that you retain all receipts covering maintenance on your off-road diesel engine, but Cummins cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

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

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

Your engine is designed to operate on diesel fuel only. Use of any other fuel may result in your engine no longer operating in compliance with California's emissions requirements.

If you have any questions regarding your warranty rights and responsibilities, you should contact Cummins Customer Relation Department at 1-800-343-7357 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

NOTES

Cummins Customized Parts Catalog

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

Customers can call Gannett Marketing Services at 1-800-646-5609 and order by credit card. Ask for bulletin 3672139 the Customized Parts Catalog. North American customers can mail in the attached postage pre-paid order card.

ATTENTION: INTERNATIONAL CUSTOMERS (outside U.S.A.) insert the completed Customized Catalog order form in an envelope and mail to the address printed on the order form. Or, use the E-mail address **catalog@gdms.com** to place an order for a Customized Parts Catalog.

Contact GDMS for the current price; Freight will be an additional expense.

This information is required to provide a Customized Parts Catalog:

- Name
- Street Address
- Company Name (optional)
- Telephone no.
- Credit Card No.
- Cummins Engine Serial Number (located on the engine dataplate)

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.

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 15, COLUMBUS INDIANA

–POSTAGE WILL BE PAID BY ADDRESSEE–

CUMMINS ENGINE COMPANY, INC.
MAIL CODE 40905
BOX 3005
COLUMBUS, IN 47202-3005

Customized Parts Catalog Order Form

Customer Name _____

Street _____

City _____ State _____ Zip _____

Company Name (Optional) _____

Telephone _____

Credit Card Number _____ Expires _____

Signature _____

Engine Serial Number _____

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Cummins Engine Co., Inc.
Service Engineering
Mail Code 41302
Box 3005
Columbus, IN 47202-9982

Literature Survey Form

We are always open to any suggestions or recommendations that will aid in improving our manuals. Use this postage paid survey form to evaluate this manual. Please check the appropriate response and use the space provided below to list any additional comments:

	Yes	No
Is the needed information easy to locate in the manual?		
Is the information easy to read?		
Is the information easy to understand?		
Does the information sufficiently cover the subject?		
Are subjects in the Index specific enough to locate in the manual?		
Are the important points sufficiently emphasized?		
Are the illustrations easy to understand?		
Does the text support the operation being illustrated?		
Do you use the Table of Contents?		
Do you use the Index?		

Please comment on any response(s) marked "No" in this survey.

Do you have any other comments that you feel would **help** improve the manual?

Name: _____

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Please note the bulletin No. and the printing date on the **back** of the manual you are referencing and fill in the blanks below:

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