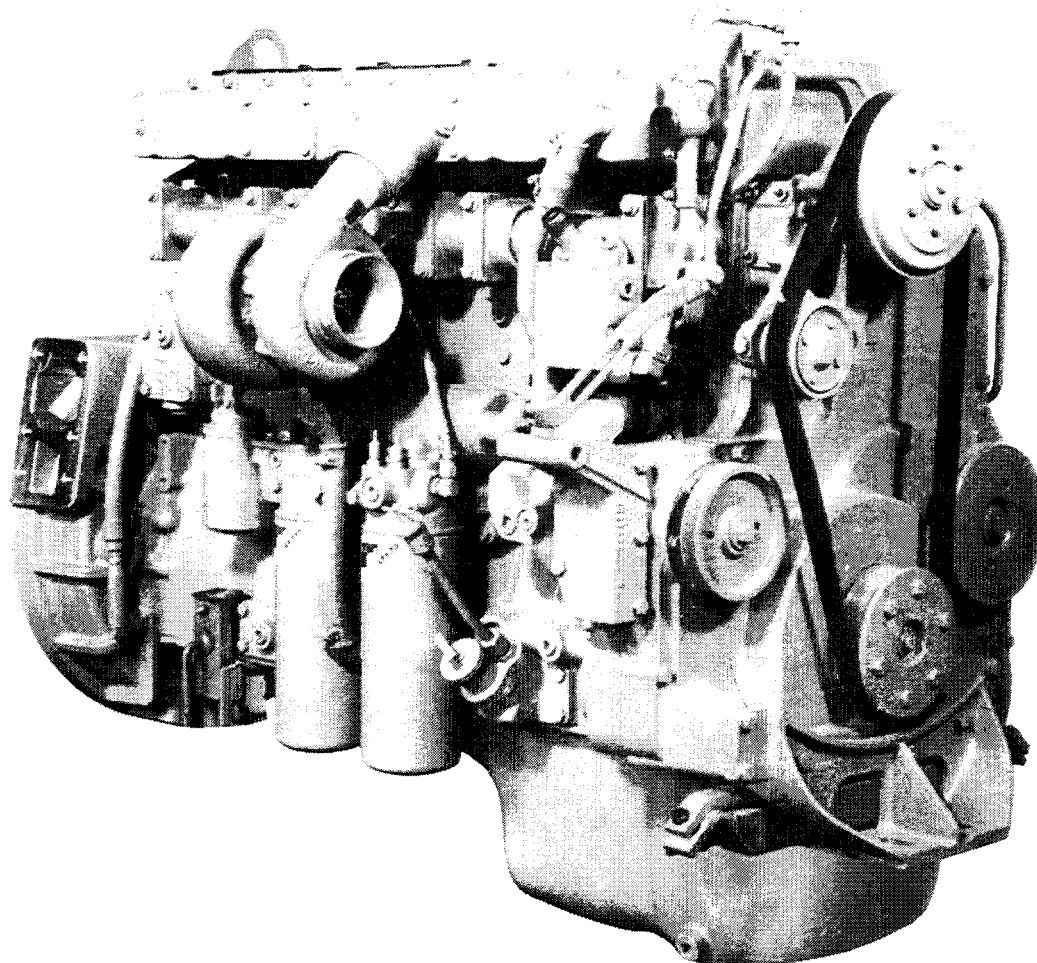




Troubleshooting and Repair Manual L10 Series Engines



Foreword

This manual provides instructions for troubleshooting and repairing the L10 Engine in the chassis. Component and assembly rebuild procedures are provided in the L10 Engine Shop Manual. Refer to page 2 in the Introduction for instructions on how to use this manual.

The manual is organized to guide a service technician through the logical steps of identifying and correcting problems related to the engine.

This manual does **not** cover vehicle or equipment problems. Consult the vehicle or equipment manufacturer for repair procedures.

The repair procedures used in this manual are recommended by Cummins Engine Company, Inc. Some service procedures require the use of special service tools. Use the correct tools as described.

The information, specifications, and recommended repair procedures in this publication are based on the information in effect at the time this manual was printed. Cummins Engine Company, Inc. reserves the right to make changes at any time without notice.

Reporting of errors, omissions, and recommendations for improving this publication is encouraged. Please send all suggestions and comments to:

CUMMINS ENGINE COMPANY, INC.

Box 3005

Columbus, Indiana 47202-3005

ATTENTION: L10 Product Service & Support

Mail Code - 80205

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Section I - Introduction

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About the Manual

This L10 Troubleshooting and Repair Manual is intended to aid in determining the cause of engine-related problems and to provide recommended repair procedures. The manual is divided into sections. Some sections contain reference numbers and procedure numbers. The reference numbers provide general information, specifications, diagrams, and service tools, where applicable. The procedure numbers describe specific repair procedures and are referred to in the Troubleshooting Logic Charts.

How to Use the Manual

The manual is organized to provide an easy flow from problem identification to problem correction. A list of troubleshooting symptoms containing the most common engine problems is on Page T-2 in the Troubleshooting Section. Complete the following steps to locate and correct the problem:

- (STEP 1.) Locate the symptom on the list.
Reference is made to the page number where the "Troubleshooting Logic Chart" is found.
- (STEP 2.) The left column of the "Troubleshooting Logic Chart" indicates a probable cause, starting at the top with the simplest and easiest to repair, and continuing downward to the most difficult.
The right column provides a brief description of the corrective action with a procedure number reference for the repair procedure.
- (STEP 3.) Locate the probable cause in the left column, and then turn to the procedure referenced in the right column.
The repair procedures are listed by system (cooling, lubricating oil, combustion air, compressed air, fuel, electrical, and base engine components).
- (STEP 4.) The Troubleshooting Logic Charts are based on the following assumptions:
1. The engine has been installed according to the manufacturer's specifications.
 2. The easiest repairs are done first.
 3. "Generic" solutions to cover problems with the most common applications and OEM's (Original Equipment Manufacturer).

Symbols Used in This Manual

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.

Simbolos Usados En Este Manual

Los símbolos siguientes son usados en este manual para clarificar el proceso de las instrucciones. Cuando aparece uno de estos símbolos, su significado se especifica en la parte inferior.



ADVERTENCIA - Serios daños personales o daño a la propiedad puede resultar si las instrucciones de Advertencia **no** se consideran.



PRECAUCION - Daños menores pueden resultar, o de piezas del conjunto o el motor puede averiarse si las instrucciones de Precaución **no** se siguen.



Indica un paso de **REMOCION** o **DESMONTAJE**.



Indica un paso de **INSTALACION** o **MONTAJE**.



Se requiere **INSPECCION**.



LIMPIESE la pieza o el montaje.



EJECUTESE una **MEDICION** mecánica o del tiempo.



LUBRIQUESE la pieza o el montaje.



Indica que se dará una **LLAVE DE TUERCAS** o el **TAMAÑO DE HERRAMIENTA**.



APRIETESE hasta un par torsor específico.



EJECUTESE una **MEDICION** eléctrica.



Para información adicional refiérase a otro emplazamiento de este manual o a otra publicación anterior.



El componente pesa 23 kg [50 lb] o mas. Para evitar dano corporal empleen una cabria u obtengan ayuda para elevar el componente.

Symbole

In diesem Handbuch werden die folgenden Symbole verwendet, die wesentliche Funktionen hervorheben. Die Symbole haben folgende Bedeutung:



WARNUNG - Wird die Warnung **nicht** beachtet, dann besteht erhöhte Unfall- und Beschädigungsgefahr.



VORSICHT - Werden die Vorsichtsmassnahmen **nicht** beachtet, dann besteht Unfall- und Beschädigungsgefahr.



AUSBAU bzw. **ZERLEGEN**.



EINBAU bzw. **ZUSAMMENBAU**.



INSPEKTION erforderlich.



Teil oder Baugruppe **REINIGEN**.



DIMENSION - oder **ZEITMESSUNG**.



Teil oder Baugruppe **ÖLEN**.



WERKZEUGGRÖSSE wird angegeben.



ANZUG auf vorgeschriebenes Drehmoment erforderlich.



Elektrische **MESSUNG DURCHFÜHREN**.



Weitere Informationen an anderer Stelle bzw. in anderen Handbüchern.



Das teil weigt 23 kg [50 lb] oder mehr. Zur vermeidung von koerperverletzung winde benutzen oder hilfe beim heben des teils in anspruch nehmen.

Symboles Utilises Dans Ce Manuel

Les symboles suivants sont utilisés dans ce manuel pour aider à communiquer le but des instructions. Quand l'un de ces symboles apparaît, il évoque le sens défini ci-dessous:



AVERTISSEMENT - De graves lésions corporelles ou des dommages matériels considérables peuvent survenir si les instructions données sous les rubriques "Avertissement" **ne sont pas** suivies.



ATTENTION - De petites lésions corporelles peuvent survenir, ou bien une pièce, un ensemble ou le moteur peuvent être endommagés si les instructions données sous les rubriques "Attention" **ne sont pas** suivies.



Indique une opération de **DEPOSE**.



Indique une opération de **MONTAGE**.



L'INSPECTION est nécessaire.



NETTOYER la pièce ou l'ensemble.



EFFECTUER une **MESURE** mécanique ou de temps.



GRAISSER la pièce ou l'ensemble.



Indique qu'une **DIMENSION DE CLE** ou **D'OUTIL** sera donnée.



SERRER à un couple spécifique.



EFFECTUER une **MESURE** électrique.



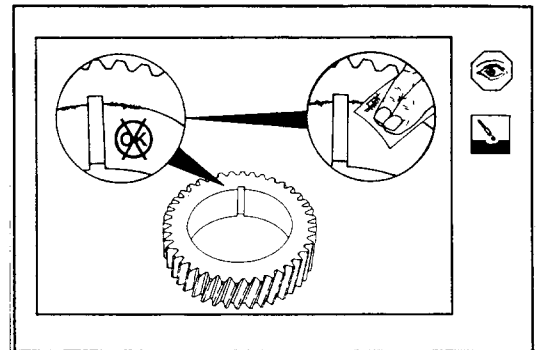
Se reporter à un autre endroit dans ce manuel ou à une autre publication pour obtenir des informations plus complètes.



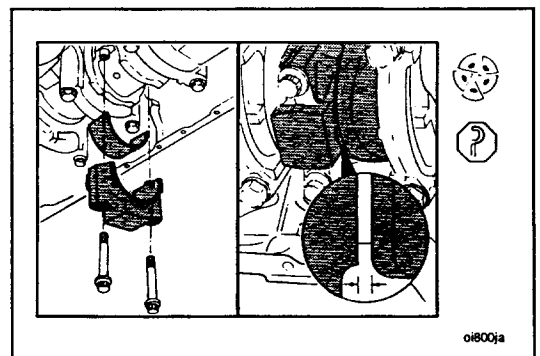
Le composant pese 23 kg [50 lb] ou davantage. Pour éviter toute blessure, employer un appareil de levage ou demander de l'aide pour le soulever.

Illustrations

The illustrations used in the "Repair Sections" of this manual are intended to give an example of a problem and to show what to look for and where the problem can be found. Some of the illustrations are "generic" and might **not** look exactly like the engine or parts used in your application. The illustrations may contain symbols to indicate an action required and an acceptable or **not** acceptable condition.



The illustrations are intended to show repair or replacement procedures with the engine "in-chassis." The illustration may differ from your application, but the procedure given will be the same.



Definition of Terms

The following is a list of guidelines for each procedure in the "Repair Sections" of the Troubleshooting and Repair Manual. The procedure will be given first, followed by a definition of the step or steps involved.

Checking - Examine a component or system for damage, excessive wear, accuracy, safety, or performance.

Inspection - Examine a component or dimension to make sure it meets the required specifications.

Testing - Check or compare the performance of a component or system to established specifications.

Adjustment - Complete the necessary steps to set or adjust the component, assemblies, or system in the required setting or position.

Visually Inspect - Look for any obvious damage or problem.

Removal - Take off a component or assembly.

Cleaning - Remove dirt, grease, or other contamination.

Disassemble - Take apart the component or assembly.

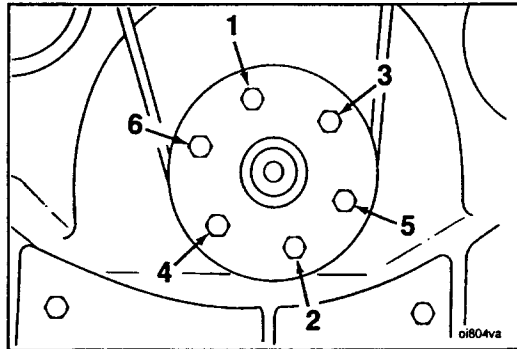
Repairing - Restore a component or assembly to a serviceable condition within the established specifications.

NOTE: Only the easiest and simplest repairs will be made to a component or assembly. If a component or assembly **must** be rebuilt, it **must** be replaced with a new or Cummins Diesel ReCon[®], Inc. replacement or be rebuilt at a Cummins Authorized Repair Location.

Replacment - Install a new, correctly rebuilt, or Cummins Diesel ReCon[®], Inc. component or assembly in place of the one which is removed.

Installation - Place a component or assembly in the correct position.

Star Pattern Torque Sequence -



General Repair Instructions

The L10 engine incorporates the latest diesel technology; yet, it is designed to be repaired using normal repair practices performed to quality standards.



Warning: 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. 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. **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 and 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 L10 Series Engine Shop Manual, Bulletin No. 3379347, which can be ordered or purchased from a Cummins Authorized Repair Location. Refer to Page 12-1 in the Additional Service Literature Section for ordering instructions.

General Cleaning Instructions

Solvent and Acid Cleaning

Several solvent and acid-type cleaners can be used to clean the engine parts. **Cummins Engine Company, Inc. does not recommend any specific cleaners. Always** follow the cleaner manufacturer's instructions.

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.



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: The use of acid can be extremely dangerous to personnel, and can 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

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: - Use U.S. size No. 16-20 for piston cleaning with plastic bead media, Part No. 3822735.
- Use U.S. size No. 70 for piston domes with glass media.
- Use U.S. size No. 60 for general purpose cleaning with glass media.
2. Operating Pressure: - Glass: Use 620 kPa [90 psi] for general purpose cleaning.
- 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.

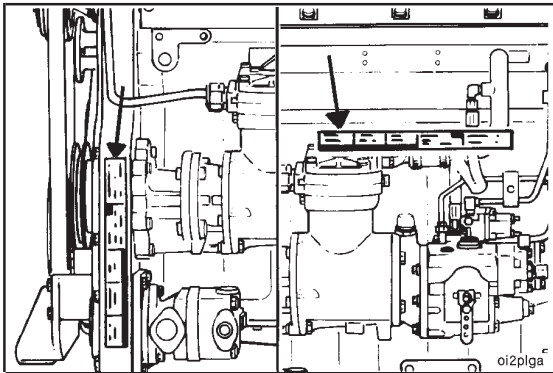
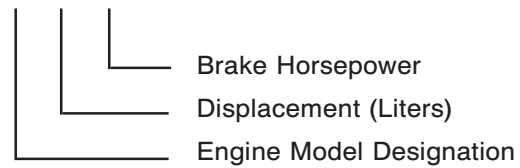
Section E - Engine Identification

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The model name provides the following data:

L 10-240



Engine Dataplate

On present production engines, the engine dataplate is located on the fuel pump side of the gear cover.

On earlier production engines, the engine dataplate is located on the cylinder block below the cylinder head mounting surface on the fuel pump side of the engine.

The engine dataplate provides model identification as well as 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 (E.S.N.)
2. Control Parts List (CPL)
3. Model
4. Horsepower and RPM Rating

Engine No.		S.O. No.		E.C.S.			VEHICLE EMISSION CONTROL INFORMATION: This engine conforms to U.S. EPA regulations applicable to Model Year New Heavy-Duty Engines. This engine has a primary intended service application as a heavy-duty diesel engine.		
Model		Ref. No.		Injection timing code			Injector torque Inch-Lbs.		
Advised HP	at	RPM	Engine Cert. Ident.	C.I.D.	Family	CPL	Injector travel	Inch	
Date of mfg.		Warranty start date		Valve lash cold		Int.	EXH:	Idle Speed	RPM
Manufactured by Cummins Engine Company, Inc., U.S.A. 3045551						Fuel rate at advised HP		mm ³ stroke	WARNING Injury may result and warranty is voided if fuel rate, RPM or altitudes exceed published maximum values for this model and application.

Typical Engine Dataplate

ap8plga

FUEL PUMP DATAPLATE		
CPL	Fuel Code	Revision Serial No.
0749	4219-A	840508
3043327		3052282
Service Part No.	Pump Production Part No.	

fp8plga

Fuel Pump Dataplate (Nameplate)

The fuel pump dataplate is located on the top of the fuel pump. It provides information for fuel pump calibration.

Engine Specifications

General Engine Data

Metric [U.S. Customary]

Horsepower (Refer to the engine dataplate)

Engine speed @ Maximum Output:

- Standard Rating (RPM) 2100
- Formula Rating (RPM) 1900

Bore and Stroke 125 mm [4.921 in] X 136 mm [5.354 in]

Displacement 10 liters [611 C.I.D.]

Compression Ratio:

- Engines Built before 1988 Model Year (49 State)16.3:1
- Engines Built before 1988 Model Year (California).....18.0:1
- Engines Built beginning in Model Year 1988 (50 State)17.0:1

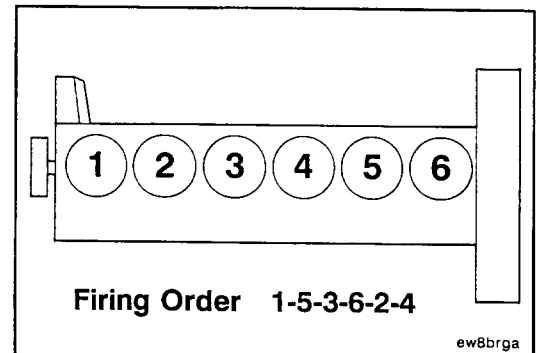
Firing Order 1-5-3-6-2-4

Engine Weight (with Standard Accessories):

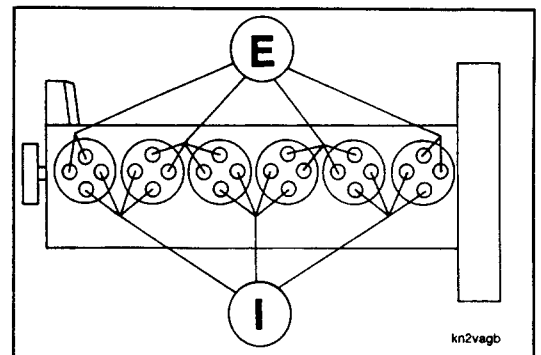
- Dry Weight 876 kg [1930 lb]
- Wet Weight 922 kg [2030 lb]

Crankshaft Rotation - (viewed from the front of the engine).....Clockwise

Cylinder Location and Firing Order



Intake and Exhaust Valve Locations



Engine Specifications (Continued)

Air Induction System

Metric [U.S. Customary]

Maximum Allowable Intake Restriction with Clean Air Filter Element:

- Heavy Duty Dry Type Cleaner 38 cm H₂O [15 in. H₂O]

Maximum Allowable Intake Restriction with Dirty Air Filter Element 64 cm H₂O [25 in. H₂O]

Lubricating Oil System

Oil Pressure - Low Idle (Minimum Allowable) 70 kPa [10 psi]

- At 1300 RPM or Torque Peak (Minimum Allowable) 207 kPa [30 psi]

Oil Capacity of Standard Engine:

- Bypass Filter 2.8 liters [0.75 U.S. gallon]
- Full-Flow Filter 3.5 liters [0.93 U.S. gallon]
- Oil Pan
 - Automotive (High-Low) 26.5 to 19 liters [7 to 5 U.S. gallon]
 - Construction (High-Low) 26.5 to 23 liters [7 to 6 U.S. gallon]

*Total System Capacity including Bypass Filter 34 liters [9 U.S. gallon]

*If an oil pan spacer is used, the total lubricating system capacity is increased by 7.6 liters [2 U.S. Gallon].

Cooling System

Coolant Capacity (Engine Only) 11 liters [12 U.S. quarts]

Standard Modulating Thermostat Range:

- Conventional Aftercooling 82 to 93°C [180 to 200°F]
- Optimized Aftercooling 79 to 91°C [175 to 195°F]

Maximum Coolant Cylinder Block Pressure (Pressure Cap Removed):

Closed Thermostat 275 kPa [40 psi]

Maximum Allowable Top Tank Temperature 100°C [212°F]

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

Minimum Recommended Pressure Cap 50 kPa [7 psi]

Engine Specifications (Continued)

Exhaust System

Metric [U.S. Customary]

Maximum Allowable Back Pressure Created by Piping and Silencer:

- Hg 75 mm [3 inch]
- H₂O 1016 mm [40 inch]

Exhaust Pipe Size (Normally Acceptable Inside Diameter) 102 mm [4 inch]

Fuel System

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

Maximum Allowable Restriction to Pump:

- With **Clean** Filter 102 mm Hg [4 in Hg]
- With **Dirty** Filter 204 mm Hg [8 in Hg]

Maximum Allowable Return Line Restriction 63 mm Hg [2.5 in Hg]

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

Electrical System

Minimum Recommended Battery Capacity

Battery Size	Ambient Temperatures			
		-18°C (0°F)		0°C (32°F)
	Cold Cranking Amperes	Reserve Capacity * Amperes	Cold Cranking Amperes	Reserve Capacity Amperes
12 Volt	1800	640	1280	480
24 Volt **	900	320	640	240

* The number of plates within a given battery size determines reserve capacity. Reserve capacity determines the length of time sustained cranking can occur.

** CCA ratings are based on two, 12 volt batteries in series.

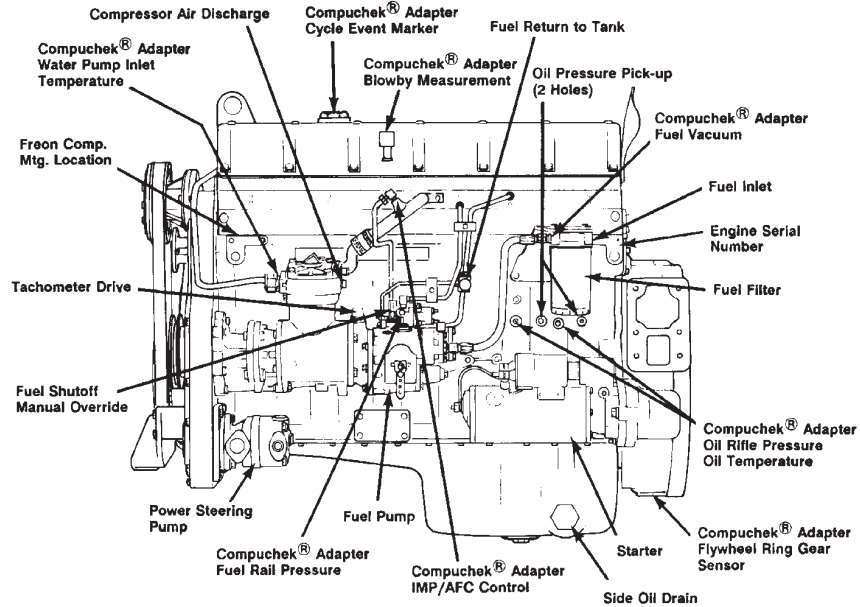
Batteries (Specific Gravity)

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

Engine Diagrams

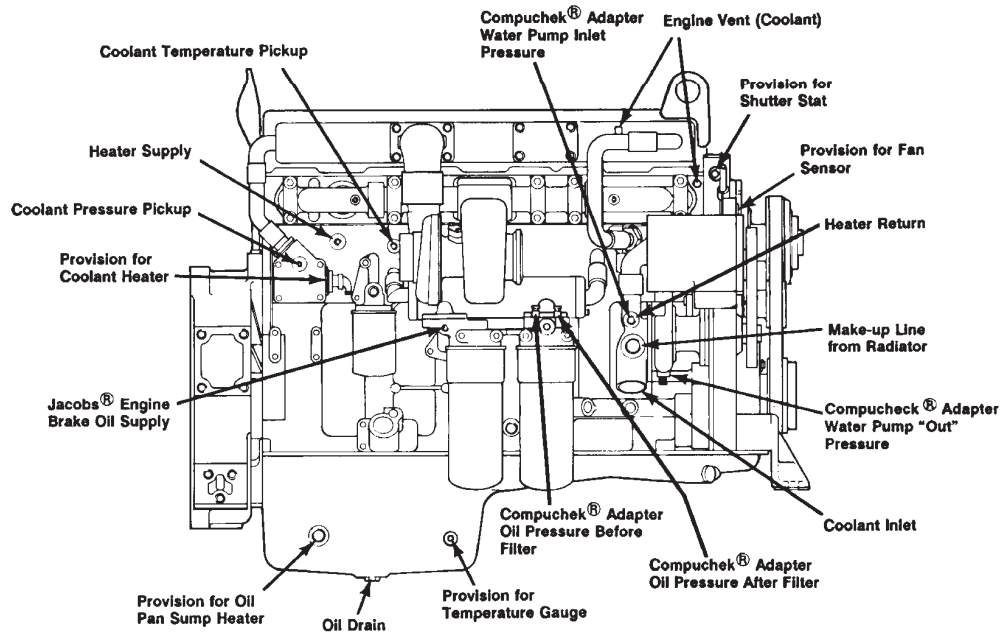
The following illustrations contain information about engine components, filter locations, drain points and access locations for instrumentation and engine controls:

The information and configuration of components shown in these drawings are of a general nature. Some component locations will vary depending on applications and installations.



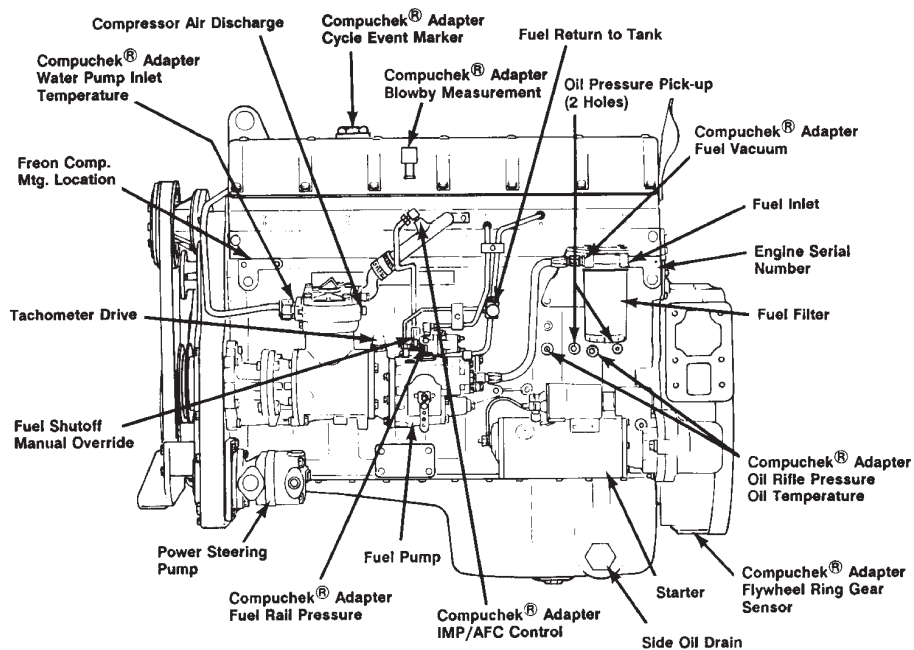
**CONVENTIONAL AFTERCOOLING
(FUEL PUMP SIDE)**

ew200gx



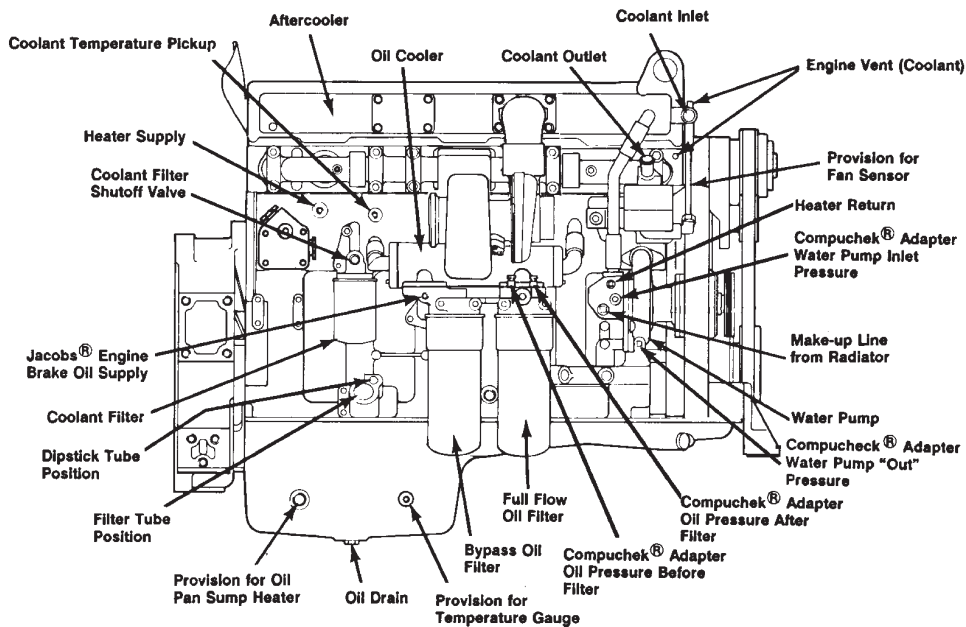
**CONVENTIONAL AFTERCOOLING
(EXHAUST SIDE)**

ew200gy



**OPTIMIZED AFTERCOOLING
(FUEL PUMP SIDE)**

ew200gw



**OPTIMIZED AFTERCOOLING
(EXHAUST SIDE)**

ew200gz