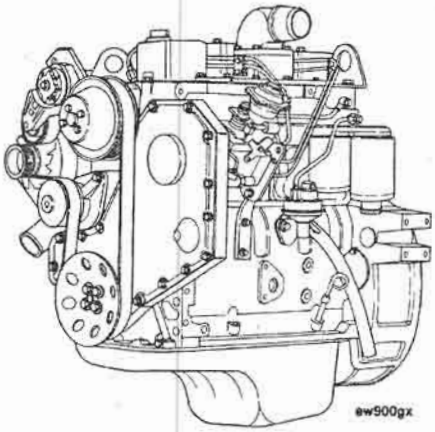
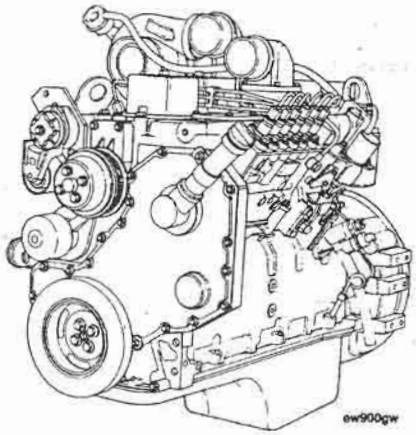
B Series Shop Manual
1991 and 1994 Certification Levels



Four Cylinder
4BT3.9



Six Cylinder
6BT5.9

Bulletin 3666017-01
Printed in U.S.A. 11/94 (996)

Foreword

This manual contains complete rebuild specifications and information for the B Series engines, and all associated components manufactured by Cummins Engine Company, Inc. A listing of accessory and component suppliers' addresses and telephone numbers is located in Section C. Suppliers can be contacted directly for any information not covered in this manual.

Read and follow all safety instructions. Refer to the WARNING in the General Safety Instructions in this section.

The repair procedures in this manual are based on the engine being installed on an approved engine stand. Some rebuild procedures require the use of special service tools. Make sure the correct tools are used as described in the procedures.

When a specific brand name, number, or special tool is referenced in this manual, an equivalent product can be used in place of the recommended item.

A series of specific service manuals (Troubleshooting and Repair, Specifications, Alternative Repair, and so on.) are available and can be ordered by filling out and mailing the Literature Order Form located in the Service Literature Section L.

Reporting of errors, omissions, and recommendations for improving this publication by the user is encouraged. Please use the postage paid, self-addressed Literature Survey Form in the back of this manual for communicating your comments.

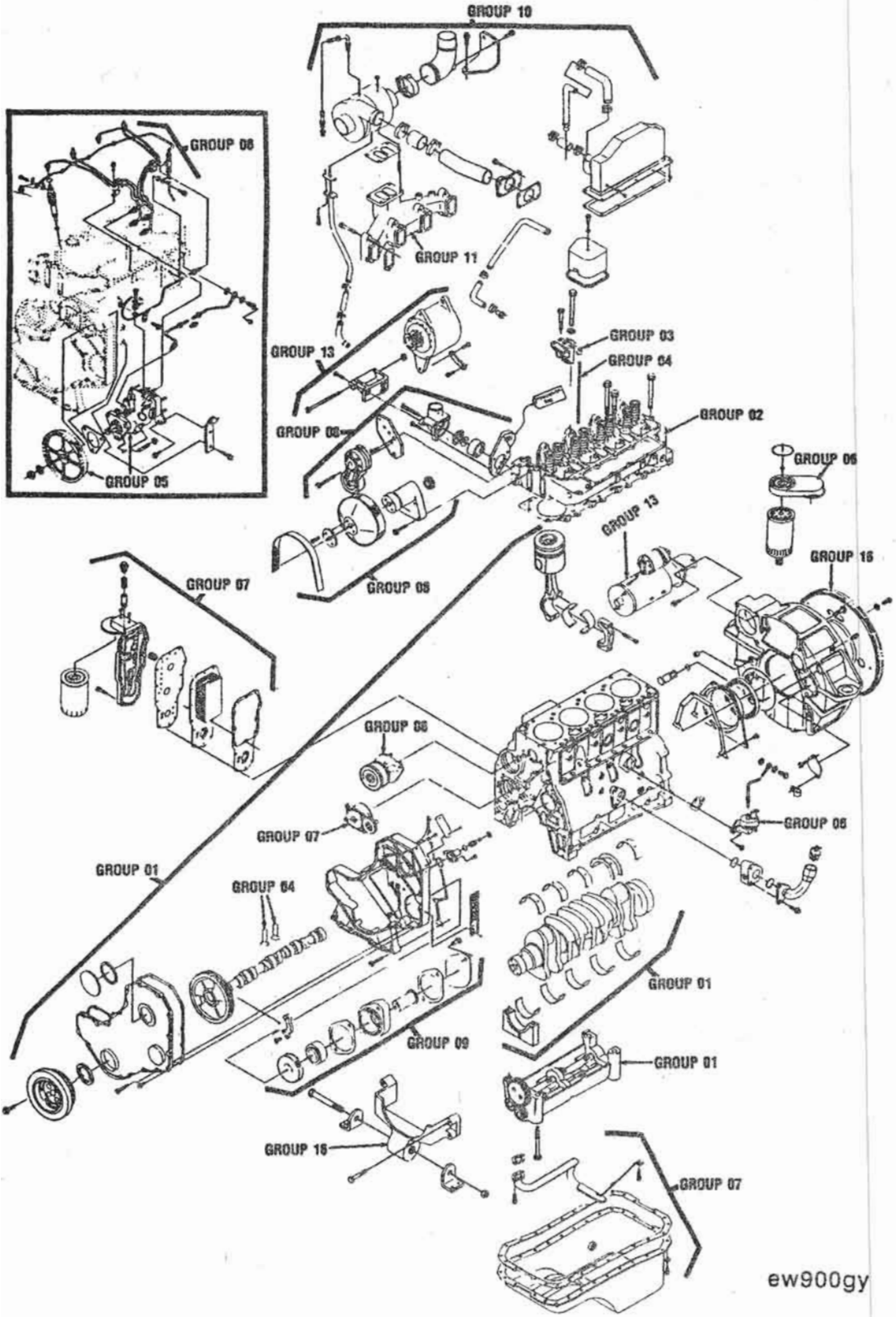
The specifications and rebuild information in this manual is based on the information in effect at the time of printing. Cummins Engine Company, Inc. reserves the right to make any changes at any time without obligation. If differences are found between your engine and the information in this manual, contact a Cummins Authorized Repair Location, a Cummins Division Office, or the factory.

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

Cummins Cummins HOLSET Fleetguard® Premium Blue®

Table of Contents

Cummins 22-Group System Exploded Diagram



How To Use The Manual

All references to engine components in this manual are divided into 22 specific groups. The organization is consistent with the service bulletins, service parts topics, and the parts catalogs for your convenience in updating the shop manual.

Table of Contents

The Table of Contents in the front of the manual contains a quick page reference for each group number

Group Contents

Each group contains the following information:

- A group index page at the beginning of each group to quickly aid in locating the information desired.
- General information to aid in rebuilding the component and an explanation of design change differences.
- Step-by-step rebuild instructions for disassembly cleaning, inspection, and assembly of the component.
- Symbols which represent the action outlined in the instructions. The definitions of the symbols, listed in four languages (English, Spanish, French, and German), appear on pages 1-5 through 1-8.

Index

An alphabetical index is in the back of the manual to aid in locating specific information.

Metric Information

Both metric and U.S. customary values are used in this manual. The metric value is listed first, followed by the U.S. customary in brackets. An example is 60°C [140°F].

Generic Symbols

The following group of 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.

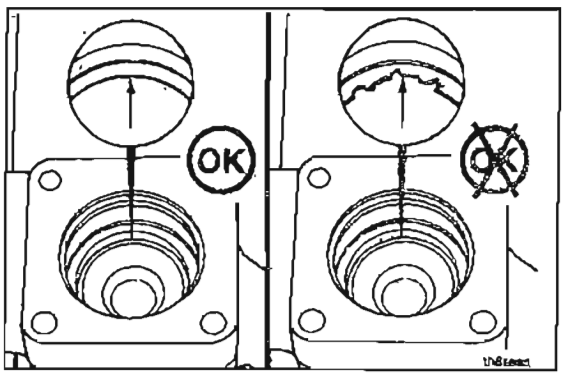
PERFORM an electrical **MEASUREMENT**

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

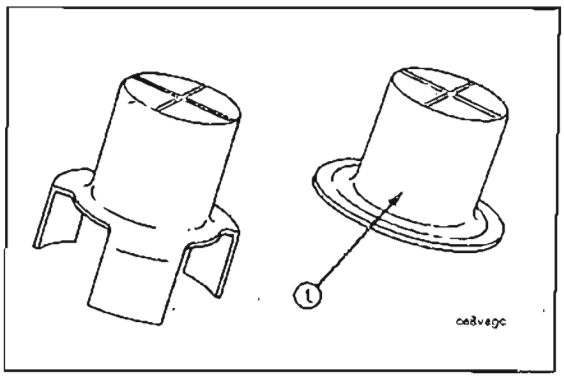
The component weighs 23 kg [50 lb] or more. To avoid personal injury use a hoist or get assistance to lift the component.

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 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 illustration can differ from your application, but the procedure given will be the same.



Section i - Introduction

Section Contents

About the Manual

This manual contains information for 1991 and newer engines starting with ESN 44566920. For information on prior built engines refer to the B Series Shop Manual, Bulletin No. 3810206-02.

The procedures in this manual were developed for a shop environment with engine disassembly and assembly being performed on a rollover stand. A Group System has been used to subdivide the instructions by major components and systems. Refer to the Table of Contents (page 1-1) for the various groups. The information is presented in very basic terms to make sure the instructions are easily understood. Wrench sizes and shop tooling are identified in the procedure when needed.

Each group contains the following in sequence:

- An Alphabetical Table of Contents (Index).
- Exploded view(s) of all the components in the group.
- General Information Section(s) containing the basic service, maintenance, and design information necessary to assist in the rebuild of the engine or a component.
- Procedural instructions for the disassembly, inspection, repair, and assembly that can be required to rebuild an engine. Additional repairs that are not essential during every rebuild, but can be necessary, are included. These repairs depend on the length of time an engine has been in service and the condition of the parts.

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, 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 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 capture 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 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 lessor 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.

General Repair Instructions

This engine incorporates the latest diesel 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, injestion 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, Literature, 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: Acid is extremely dangerous, 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.

Glossary of Terms

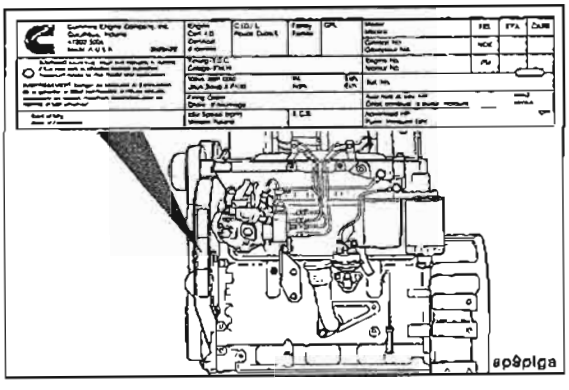
	Definition
A.C..	Alternating Current
AFC:	Air Fuel Control; a device in the fuel pump that limits the fuel delivery until there is sufficent intake manifold pressure to allow for complete combustion.
ATDC:	After Top Dead Center· refers to the position of the piston or the crankshaft rod journal. The piston is moving downward on the power stroke or intake stroke.
BDC:	Bottom Dead Center· refers to the position of the piston or the crankshaft rod journal. The piston is at its lowest position in the cylinder.
BTDC:	Before Top Dead Center· refers to the position of the piston or the crankshaft rod journal. The piston is moving upward on the compression stroke or exhaust stroke.
Circumferential Direction:	In the direction of a circle in respect to the centerline of a round part or a bore.
Concentricity·	A measurement of the **difference** between the centers of **either** two or more parts **or the bores in one part.**
CPL.	Control Parts List; this listing identifies the specific parts that **must** be installed on the engine to meet agency certification.
Cummins Sealant:	This is a one part Room Temperature Vulcanizing (RTV) silicone rubber, adhesive and sealant material having **high** heat and oil resistance, and **low** compression set. Some of the equivalent products are Marston Lubricants, Hylosil, Dow Corning, Silastic 732, Loctite Superflex, General Electric 1473, and General Elec tric 1470.
D.C..	Direct Current
Dye Penetrant Method:	A method used to check for cracks in a part by using a dye penetrant and a developer. Use crack detection kit, Part No. 3375432, or its equivalent.
End Clearance:	The clearance in an assembly determined by pushing the shaft in an axial direction **one way** and then pushing the shaft the **other way**
E.S.N.	Engine Serial Number
Hammer·	A hand tool consisting of a hard steel head on a handle.
I.D..	Inside Diameter
Loctite 290:	A single component, anaerobic, polyester resin, liquid sealant compound that hardens between closely fitted metal surfaces producing a tough, hard bond. An equivalent product is Perma-Lok HL 126.
Loctite 609:	A single component anaerobic, liquid adhesive that meets or exceeds the requirements of MIL-R-46082A (MR) TYPE1 Some of the equivalent products are Loctite 601 and Permabond HL 138.
Lubriplate 105:	A mineral oil base grease with calcium soap (2 percent to 6 percent), and zinc oxide (2 percent to 4 percent) additives.

	Definition
Magnetic Particle Inspection:	A method of checking for cracks in **either** steel **or** iron parts. This method requires a Magnaflux or equivalent machine that imparts a magnetic field on the part being checked.
Mallet:	A hand tool consisting of a soft head, **either** wood, plastic, lead, brass, **or** rawhide, on a handle.
MAX.	Maximum allowed
MIN:	Minimum allowed
No..	Number
O.D..	Outside Diameter
OS:	Oversize
Protrusion:	The **difference** in the height between two parts in the assembled state.
STD:	Standard
TC:	Torque Converter· used when referring to the torque converter cooler.
TDC:	Top Dead Center· refers to the position of the piston or the crankshaft rod journal. The piston is at its highest position in the cylinder. The rod journal is pointing straight up toward the piston.
T.I.R..	Total Indicator Runout; used when measuring the concentricity or the runout. The T.I.R. refers to the total movement of the needle on a dial indicator, from the most **negative** reading to the most **positive** reading.
Water Pump Grease:	A premium high temperature grease that will lubricate antifriction bearings continually from **minus** 40°C [**minus** 40°F] to **plus** 150°C [Plus 350°F]. Some of the greases meeting this requirement are Aeroshell No. 5, Chevron SRI, Amoco Rykon Premijm No. 2, Texaco Premium RB, and Shell Dolium R. Aeroshell No. 5 is **not** compatible with the other greases and **must not** be mixed. Cummins Engine Company, Inc., uses Aeroshell No. 5 on new engines and components.

Section E - Engine and Component Identification

Section Contents

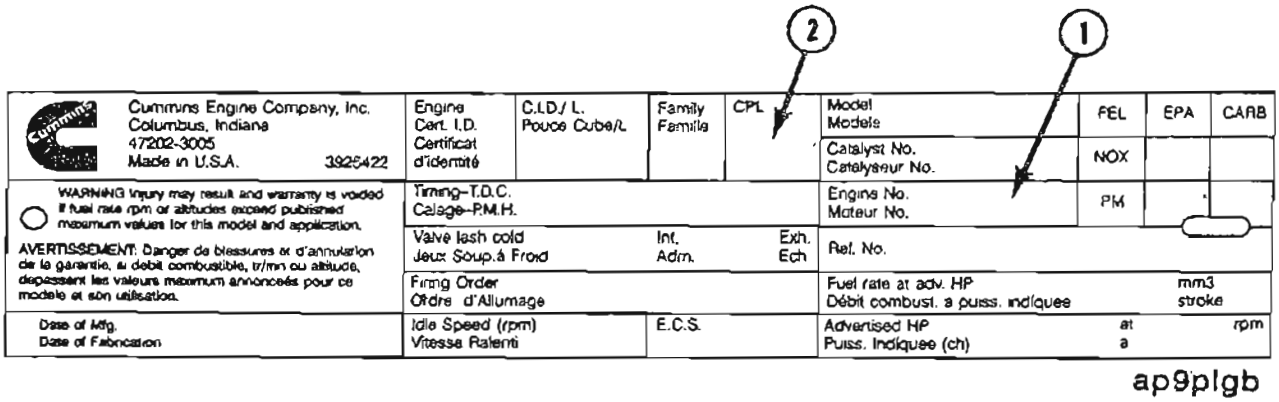
Engine Identification



Engine Dataplate

The engine dataplates show specific information about your engine. The engine serial number (1) and Control Parts List (CPL) (2) provide information for ordering parts and servicing the engine.

NOTE: The engine dataplate **must not** be changed unless approved by Cummins Engine Company, Inc.



ap9plgb

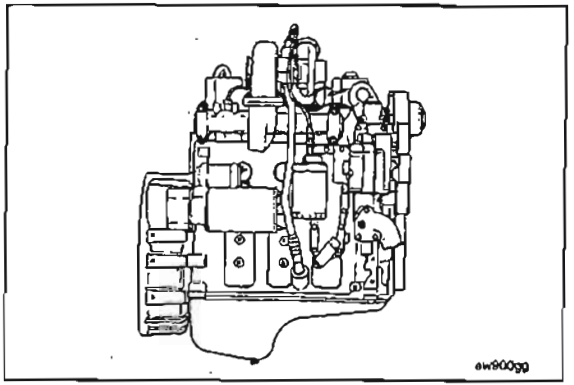
Automotive Engine Dataplate

Industrial Engine Nomenclature

The model name for Industrial engines provides the following engine data:

4 B T A 3.9

- 3.9 — Displacement in Liters
- A — Aftercooled
- T — Turbocharged
- B — Engine Series
- 4 — Number of Cylinders

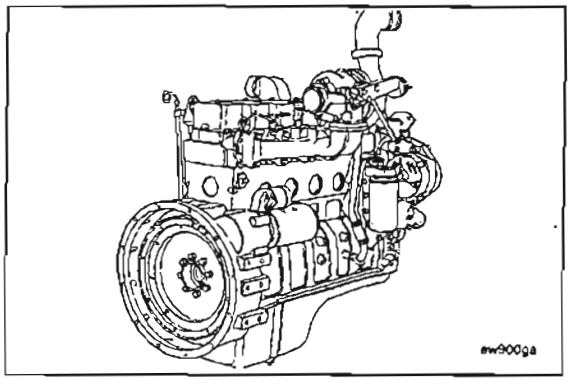


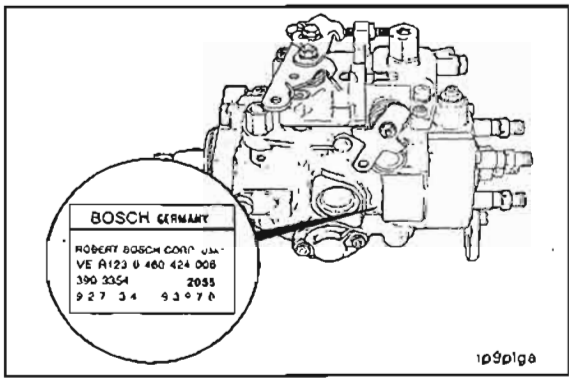
Automotive Engine Nomenclature

The model name for Automotive engines provides the following engine data:

B 5.9 190

- 190 — Horsepower Rating
- 5.9 — Displacement in Liters
- B — Engine Series

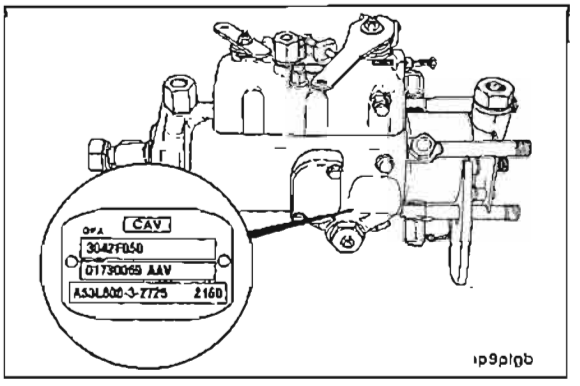




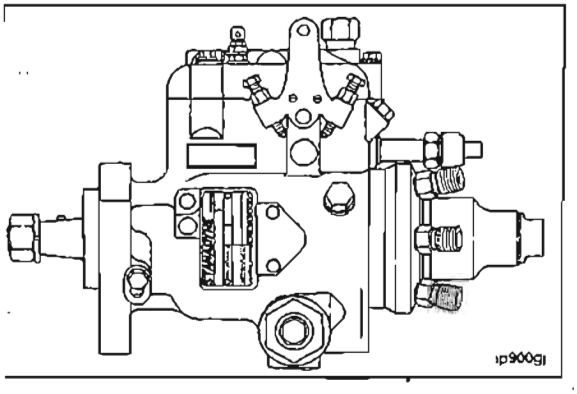
Injection Pump Dataplate

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

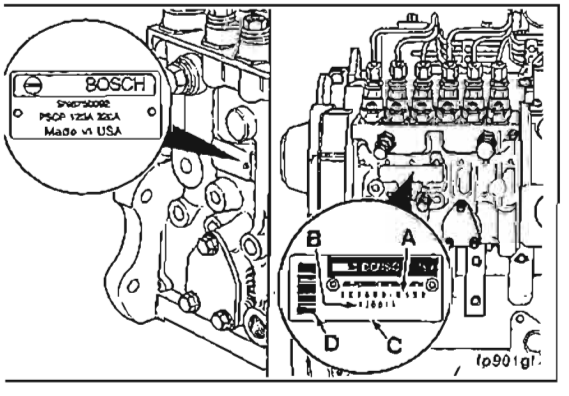
Robert Bosch VE dataplate location.



Lucas CAV DPA dataplate location.



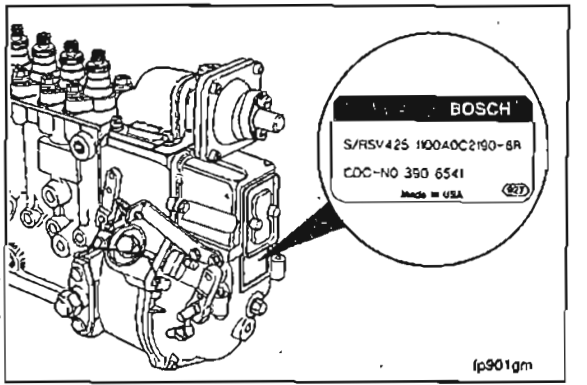
Stanadyne DB4 Dataplate Location



In-Line Injection Pump Dataplate Location

This illustration shows the dataplate location for the Bosch and Nippondenso in-line injection pump.

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



General Engine Specifications

General Engine Data

Bore ..... 102 mm [4.02 in]

Stroke ..... 120 mm [4.72 in]

Displacement

- 4B ..... 3.92 liters [239 in^3]
- 6B ..... 5.88 liters [359 in^3]

Compression ratio

- 4B3.9/6B5.9 Industrial, naturally aspirated 18.5:1
- 4BT3.9/6BT5.9 Industrial, turbocharged 17.5:1
- 4BTA3.9/6BTA5.9 Industrial, turbocharged and aftercooled 16.5:1
- B3.9/B5.9* Automotive, charge air cooled 17.6:1

Firing order

- 6 cylinder 1-5-3-6-2-4
- 4 cylinder 1-3-4-2

Valve Settings

- Intake Valve Adjustment ..... 0.25 mm [0.010 in]
- Exhaust Valve Adjustment ..... 0.51 mm [0.020 in]

Engine rotation (viewed from front of engine) ..... Clockwise

Engine weight (with standard accessories)

- 4 cylinder engines ..... 325 to 350 kg [715 to 770 lb]
- 6 cylinder engines ..... 410 to 440 kg [910 to 970 lb]

Lubrication System

Oil pressure

- At Idle (minimum allowable) ..... 69 kPa [10 psi]
- At rated speed (minimum allowable) ..... 207 kPa [30 psi]

Regulating valve opening pressure ..... (1991) 449 kPa [65 psi]
(1994) 517 kPa [75 psi]

Differential pressure to open oil filter bypass valve ..... (1991) 138 kPa [20 psi]
(1994) 172 kPa [25 psi]

Oil capacity of standard engine

- 4 cylinder engines ..... 9.5 liters [10 U.S. Qts.]
- 6 cylinder engines ..... 14.2 liters [15 U.S. Qts.]

Total system capacity

- 4 cylinder engines ..... 11.0 liters [11.6 U.S. Qts.]
- 6 cylinder engines ..... 16.4 liters [17.3 U.S. Qts.]

Cooling System

Thermostat

- Begins to open ..... 81°C [181°F]
- Fully open ..... 95°C [203°F]

Pressure cap for 99°C [210°F] system ..... 50 kPa [7 psi]

Pressure cap for 104°C [220°F] system ..... 103 kPa [15 psi]

Coolant capacity (engine only)

- 4 cylinder (non-aftercooled, charge air cooled)* ..... 7.0 liters [7.4 U.S. Qts.]
- 4 cylinder (jacket water aftercooled) ..... 7.9 liters [8.4 U.S. Qts.]
- 6 cylinder (non-aftercooled, charge air cooled)* ..... 9.0 liters [9.5 U.S. Qts.]
- 6 cylinder (jacket water aftercooled) ..... 9.9 liters [10.5 U.S. Qts.]

Intake Air and Exhaust System

Maximum allowable intake restriction at rated speed and load (with dirty air filter element)

- Naturally Aspirated ..... 50.8 cm H_2O [20 in H_2O]
- Turbocharged ..... 63.5 cm H_2O [25 in H_2O]

Maximum turbocharger outlet restriction at rated speed and load ..... 76.2 mm Hg [3 in Hg]

Maximum exhaust restriction at rated speed and load

- Automotive with oxidation catalyst ..... 152.4 mm Hg [6 in Hg]
- Automotive ..... 114.3 mm Hg [4.5 in Hg]
- Industrial ..... 76.2 mm Hg [3 in Hg]

Fuel System

Fuel transfer pump maximum inlet restriction ..... 100 mm Hg [4 in Hg]

Fuel transfer pump output pressure at rated speed

- Distributor fuel injection pumps (maximum) ..... 70 kPa [10 psi]
- Inline fuel injection pumps (minimum) ..... 172 kPa [25 psi]

Fuel filter restriction (maximum pressure drop across filters) ..... 35 kPa [5 psi]

Fuel return restriction (maximum) ..... 518 mm Hg [20.4 in Hg]

* All 1991 and 1994 automotive engines with charge air cooling are designated as B3.9 or B5.9.

Electrical System

Minimum Recommended Battery Capacity

Light accessories including alternator, power steering pump, and disengaged clutch

12 Volt System

4 cylinder engine ..... 625 CCA

6 cylinder engine ..... 800 CCA

24 Volt System*

4 cylinder engine ..... 400 CCA

6 cylinder engine ..... 400 CCA

Heavy accessories including hydraulic pump and torque converter

12 Volt System

4 cylinder engine ..... 800 CCA

6 cylinder engine ..... 950 CCA

24 Volt System*

4 cylinder engine ..... 400 CCA

6 cylinder engine ..... 475 CCA

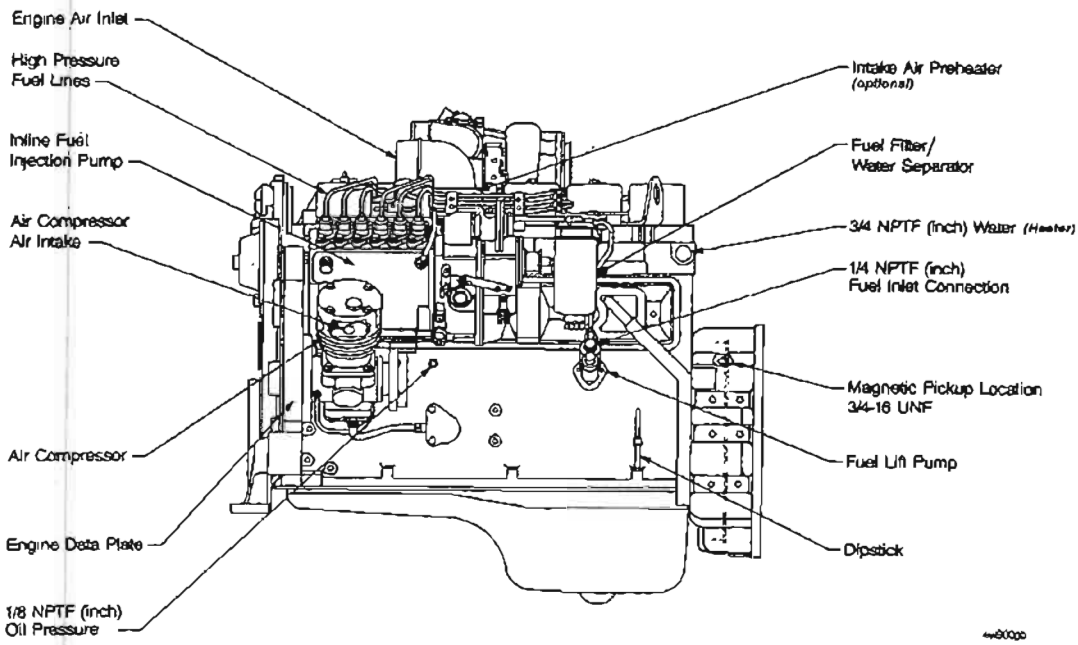
* Per battery (two 12 volt batteries in series) CCA Ratings are based on 18°C [0°F].

Batteries (Specific Gravity)

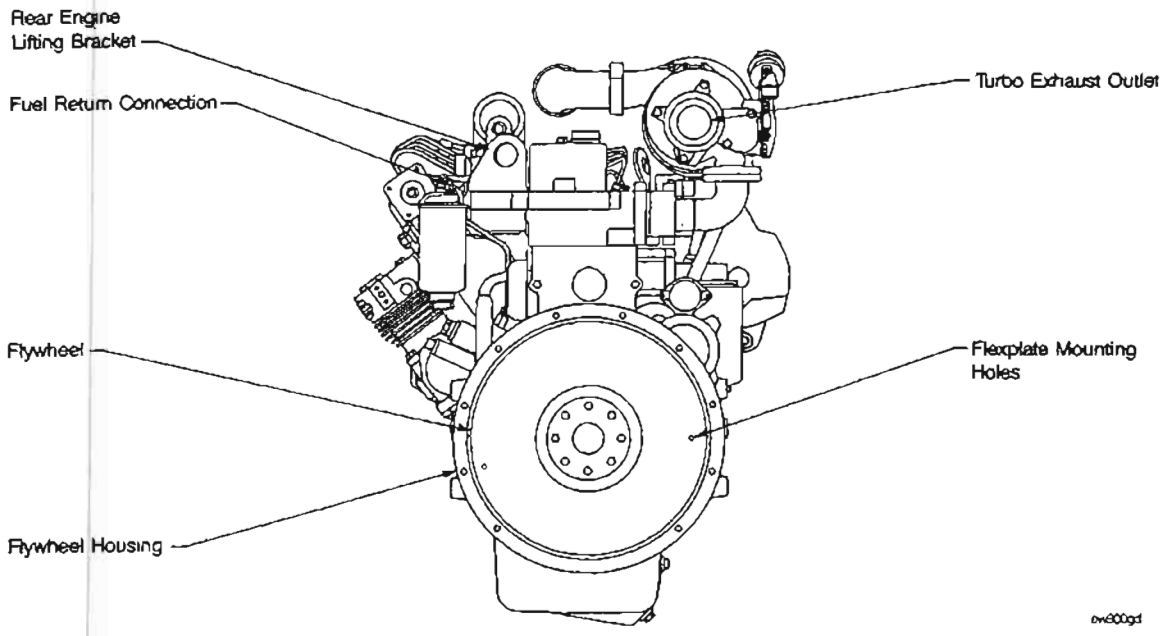
Specific Gravity at 27°C [80°F]	State of Charge
1.260 1.280	100%
1.230 1.250	75%
1.200 1.220	50%
1 170 1 190	25%
1 110 1 130	Discharged

Engine Diagram - Automotive Engine

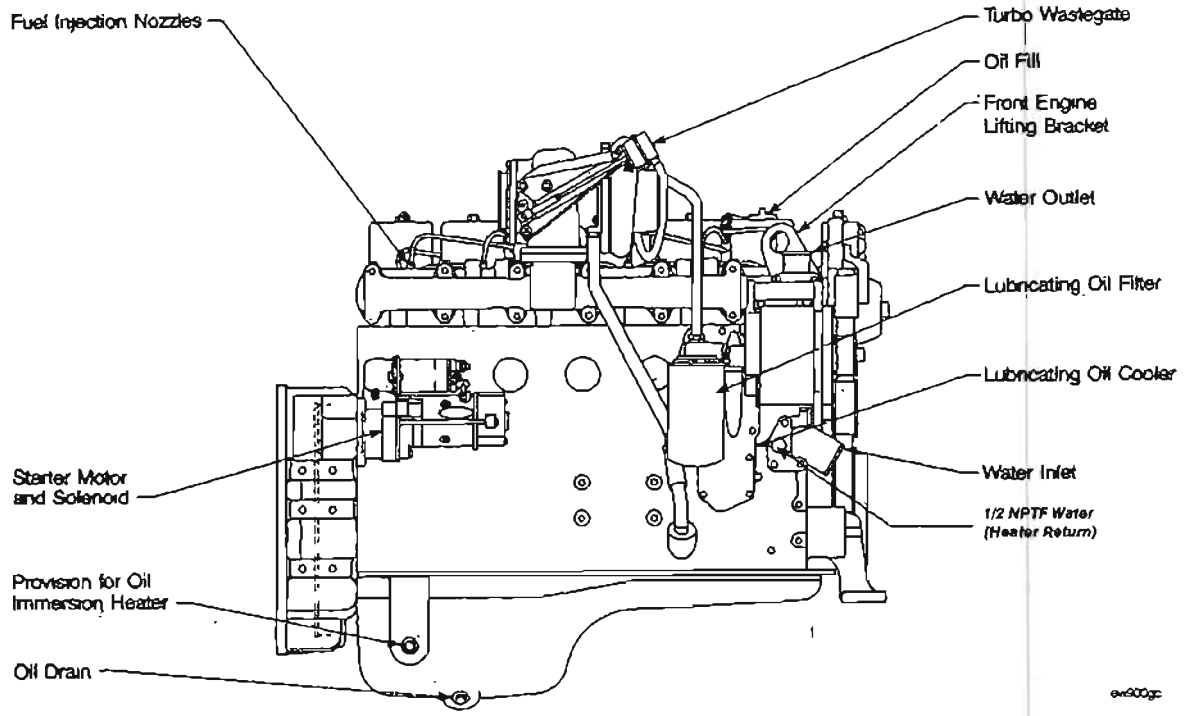
The illustrations which follow show the locations of the major external engine components, the filters, and other service and maintenance points. Some external components will be at different locations for different engine models.



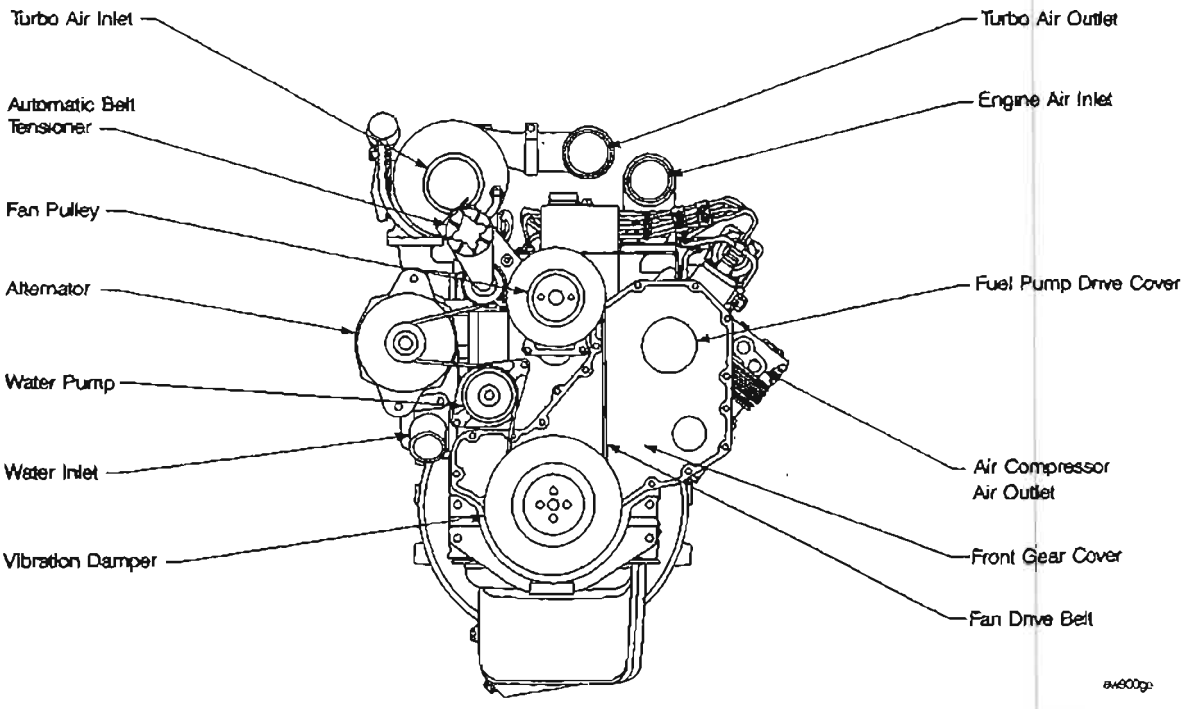
Inlet Side



Rear View



Turbocharger Side View



Front View

Section 0 - Engine Disassembly and Assembly - Group 00

Section Contents

Engine Disassembly and Assembly

General Information

These procedures apply to all B Series engines. The differences between engine models due to the application, the optional equipment on an engine, and the year an engine was built are included in the instructions. Omit the steps that do **not** apply to the engine being rebuilt.

Warning: A Warning statement is included for any component or assembly that weighs more than 23 kg [50 lb]. To avoid personal injury, use a hoist or get assistance when **removing** or **installing** these parts.

Caution: All fasteners are specified in metric units. All fasteners have right-hand threads unless a **Caution** states that a fastener has **left-hand** threads.

Disassembly

The instructions in this procedure are organized in a logical sequence to **disassemble** an engine. This is **not** the **only** sequence to **disassemble** an engine. Certain parts **must** be removed in the sequence indicated. Use this sequence until you become familiar with the engine.

Discard all gaskets, seals, hoses, filters, and o-rings. **Keep** these parts if they are needed for a failure analysis.

Label, tag, or mark the parts for location as the parts are removed. This will help identify the parts that can be involved in a failure and will simplify the **assembly** procedure.

Label, tag, mark, or photograph all special equipment prior to the removal from an engine. This engine **assembly** procedure does **not** include the installation of special optional equipment.

Use a mallet when force is required to remove certain parts. Make sure all of the fasteners are removed before using force.

Avoid as much dirt as possible during **disassembly** The accumulation of additional dirt will make it more difficult to clean the components.

Assembly

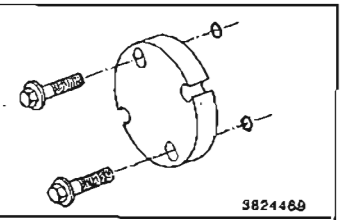
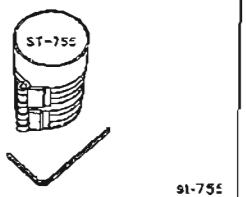
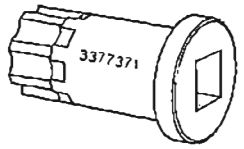
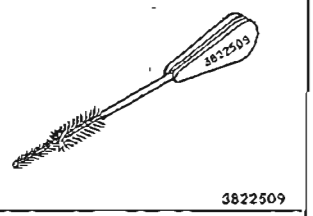
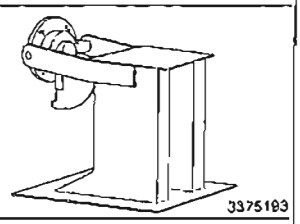
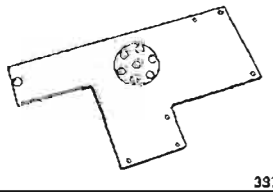
This procedure assumes that all of the components and assemblies have been cleaned, replaced, or rebuilt and are ready to be installed on the engine.

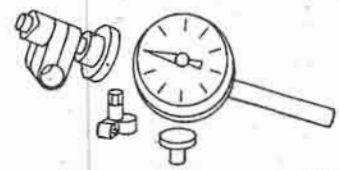
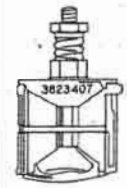
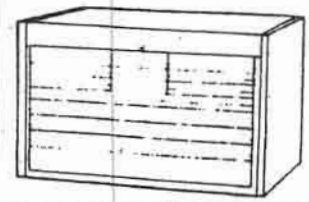
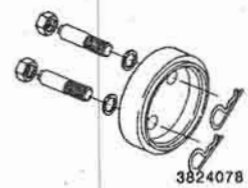
Torque values are listed in each step. If a torque value is **not** specified, use the chart listed in the Specifications, Group 18, to determine the correct torque value.

Many of the gaskets and o-rings are manufactured from a material designed to absorb oil. These gaskets will enlarge and provide a tight seal after coming in contact with oil. Use ONLY a recommended contact adhesive or a vegetable-based oil to install these parts.

Engine Disassembly and Assembly - Service Tools

The following special tools are recommended to perform procedures in Group 00. The use of these tools is shown in the appropriate procedure. These tools can be purchased from your local Cummins Authorized Repair Location.

Tool No.	Tool Description	Tool Illustration
3824469	Fuel Pump Drive Gear Puller	
ST-755	Piston Ring Compressor	
3377371	Engine Barring Tool	
3822509	Injector Bore Brush	
3375193 3375194	Engine Rebuild Stand	
3376975	Engine Rebuild Stand Adapter	

Tool No.	Tool Description	Tool Illustration
3823276	**Flexible Injector Puller**	
3376050	**Dial Indicator & Sleeve Assembly** Use with Part No. ST 1325 Dial Gauge Attachment to measure flywheel and flywheel housing runout.	
3823407	**Ridge Reamer**	
3376593	**Mechanic's Tool Kit**	
3824078	**Wear Sleeve Installation Tool** Used to install the rear crankshaft lubricating oil seal wear sleeve.	
3824498	**Oil Seal Installation Tool** Used to install the front crankshaft lubricating oil seal in the front cover to a specified depth.