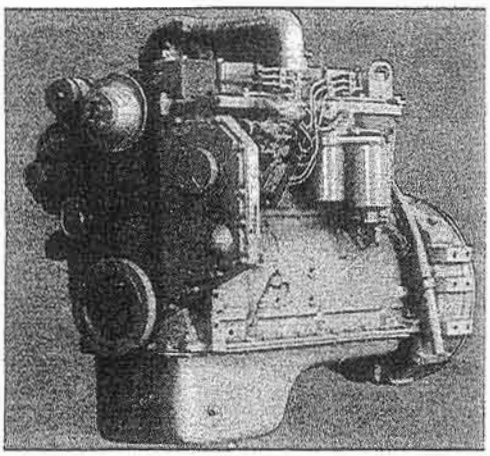
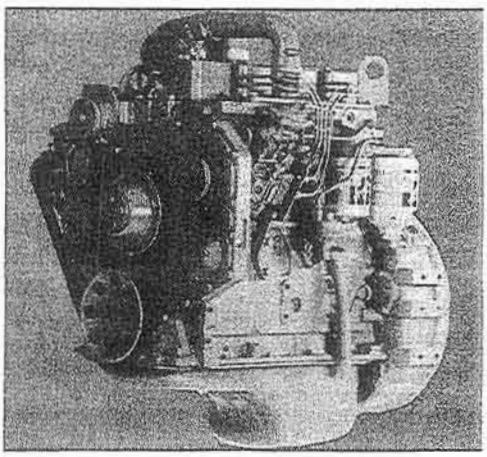
B Series Shop Manual

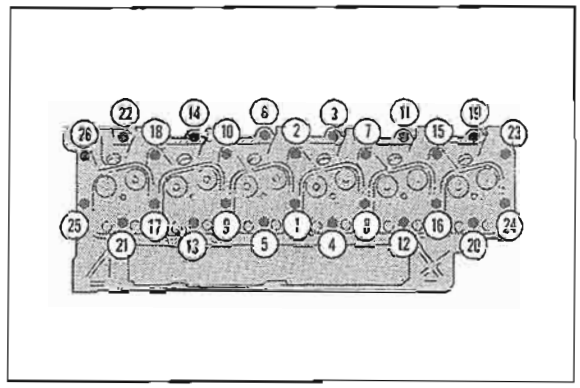
4B3.9, 4BT3.9, 4BTA3.9, 6B5.9, 6BT5.9, 6BTA5.9





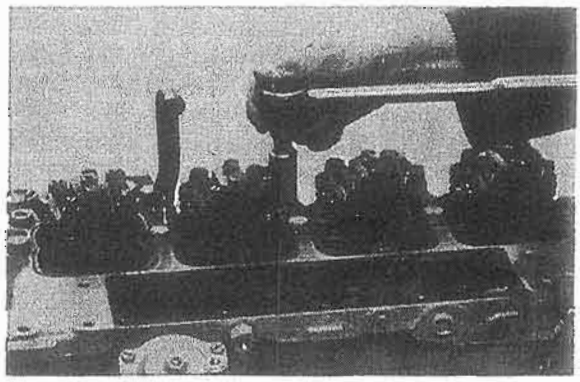
Bulletin 3810206-02
Printed in U.S.A. 12/90 (134)

Use the illustrated sequence to tighten the cylinder head capscrews.



18 mm

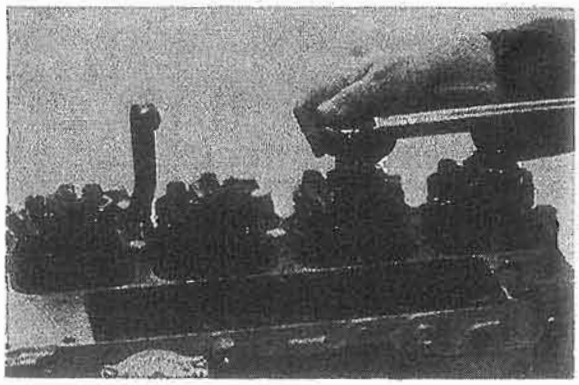
Step	Torque Value
1	40 Nom [29 ft-lb]
2	85 Nom [62 ft-lb]
3	126 Nom [93 ft-lb]



13 mm

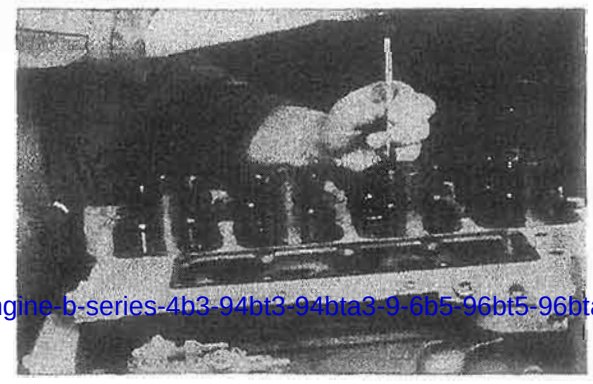
Tighten the 8mm pedestal capscrews.

Torque Value: 24 Nom [18 ft-lb]



Valve Clearance - Adjustment

Turn the valve adjustment screws in until they touch the push rod sockets. Loosen them one full turn.



Foreword

This manual contains complete rebuild specifications and information for the B series engine 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.

The repair procedures in this manual are based on the engine being installed on an approved engine stand.

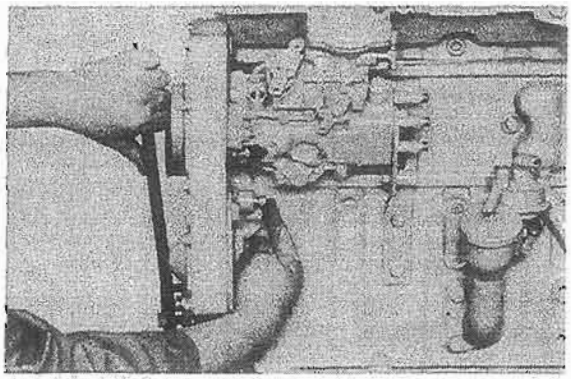
When a specific brand name, number, or special tool is referenced in this manual, an equivalent product can be used in place of the recommended item.

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

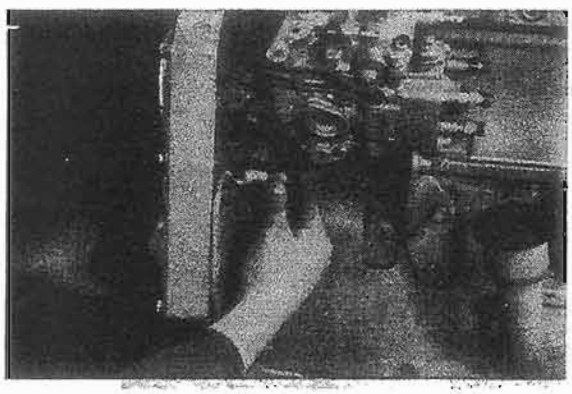
Reporting of errors, omissions, and recommendations for improving this publication by the user is encouraged. Please use the postage paid, self-addressed Literature Survey Form in the back of this manual for communicating your comments.

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.

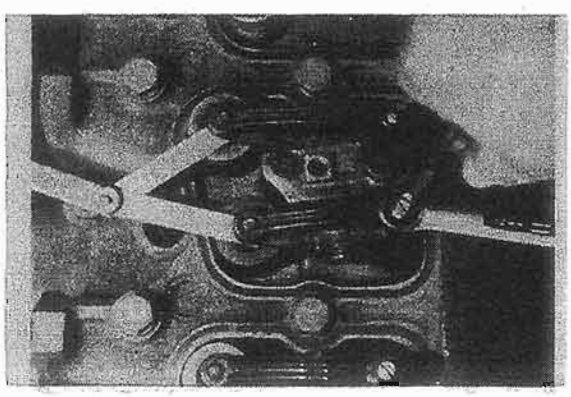
The latest technology and the highest quality components are used to manufacture Cummins engines. When replacement parts are needed, we recommend using only genuine Cummins or ReCon® exchange parts. These parts can be identified by the following trademarks.



Locate TDC for Cylinder Number 1.

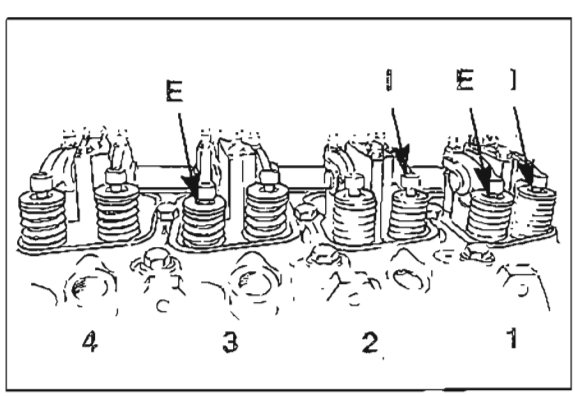


Disengage the timing pin.



Valve Stem to Rocker Lever Clearances

Intake	Exhaust
0.25mm [0.010 inch]	0.51mm [0.020 inch]



Caution: Perform step A of the valve set procedure with Cylinder Number 1 at TDC compression stroke (timing pin will engage).

Step A - Four Cylinder

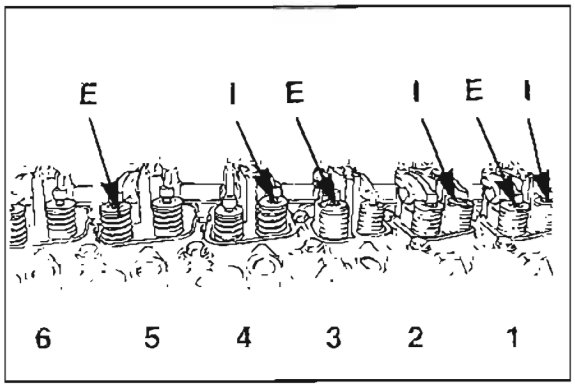
Cylinder	Valve I = Intake	E = Exhaust
1	*	*
2	*	-
3	-	*
4	-	-

(* = Set)
(- = Do not Set)

Step A - Six Cylinder

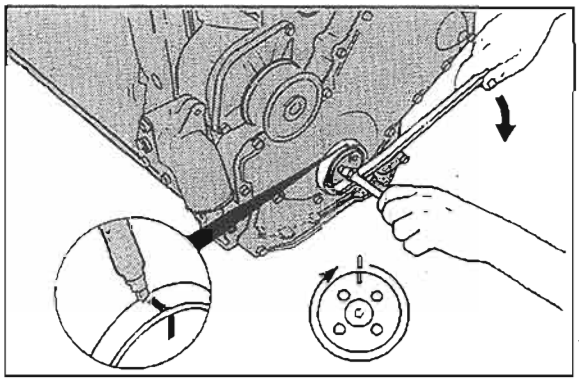
Cylinder	Valve I = Intake	E = Exhaust
1	*	*
2	*	-
3	-	*
4	*	-
5	-	*
6	-	-

(* = Set)
(- = Do not Set)



Perform Step B of the valve set procedure with Cylinder Number 1 at TDC plus 360 degrees (timing pin will not engage).

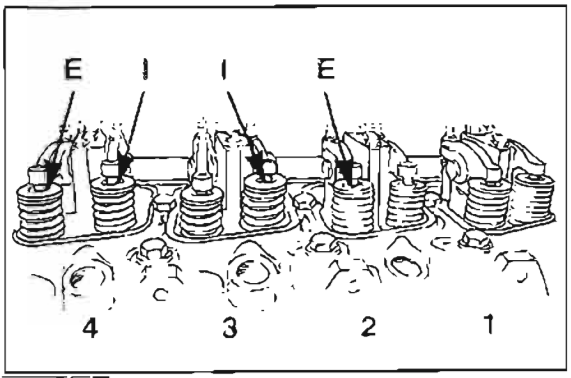
Mark the crankshaft and front cover. Rotate the crankshaft one full turn.



Step B - Four Cylinder

Cylinder	Valve I = Intake	E = Exhaust
1	-	-
2	-	*
3	*	-
4	*	*

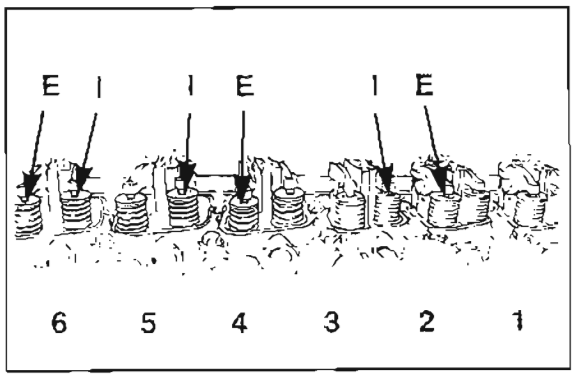
(* = Set)
(- = Do not Set)



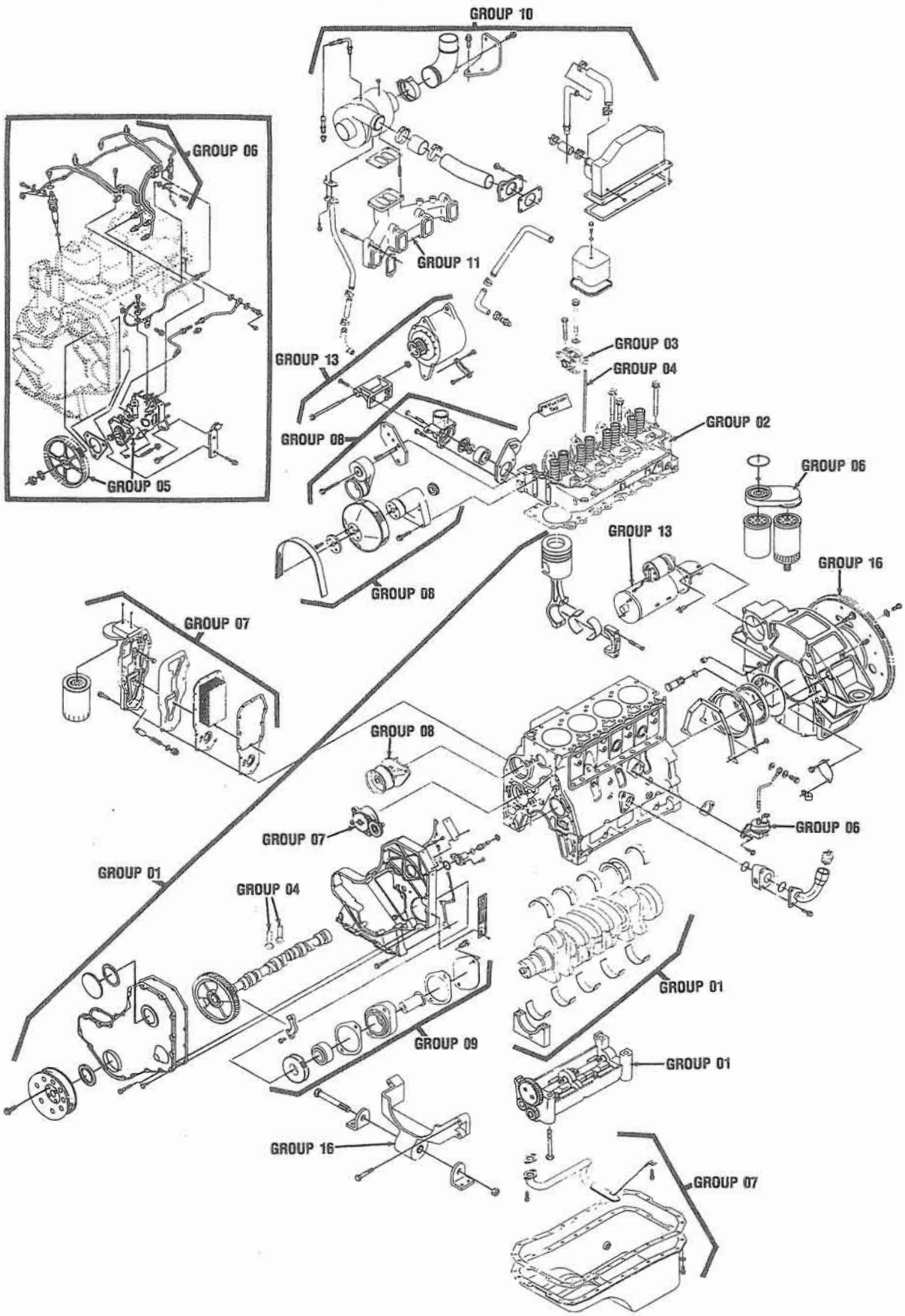
Step B - Six Cylinder

Cylinder	Valve I = Intake	E = Exhaust
1	-	-
2	-	*
3	*	-
4	-	*
5	*	-
6	*	*

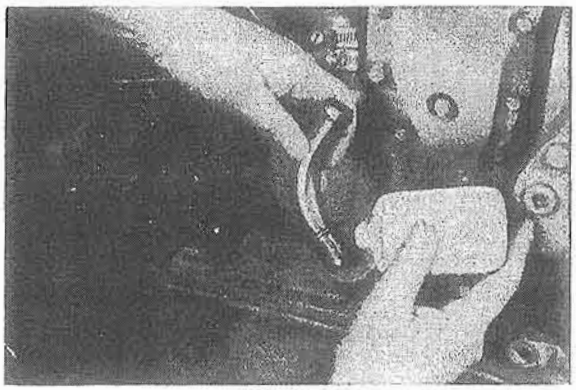
(* = Set)
(- = Do not Set)



Cummins 22-Group System Exploded Diagram

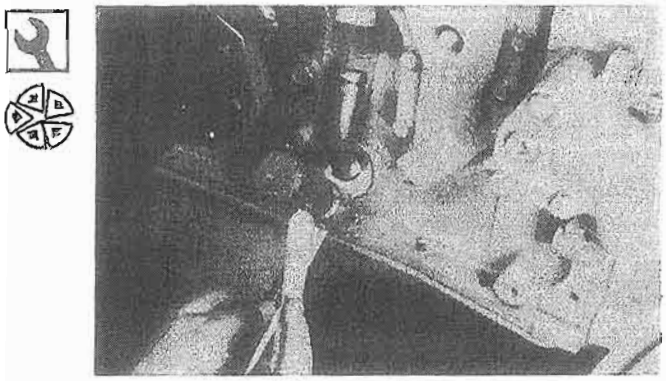


If the drain tube in the block was removed, apply sealant Part Number 3375068 to the sealing surfaces.



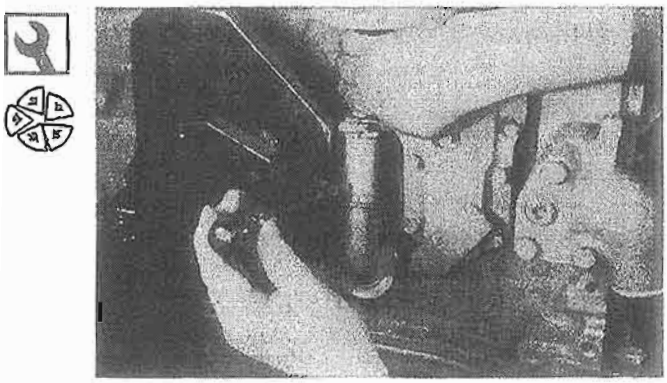
22 mm Open End Wrench, Hammer

Install the tube in the block so it is aligned with the turbocharger drain tube.



Screwdriver

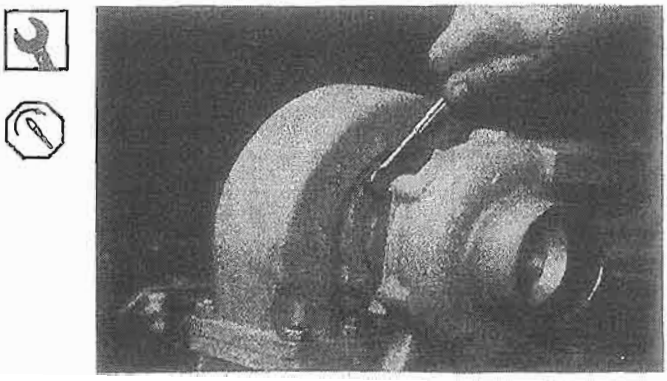
Position the turbocharger drain hose to connect the drain tubes; tighten the clamps.



13 mm

If loosened, tighten the turbocharger turbine housing cap-screws.

Torque Value: 11.3 Nom [100 in-lb]



Section i - Introduction

Section Contents

About the Manual

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 i-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.

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 i-5 through i-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.

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.

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.

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.

sécurité p

Indique une opération de DEPOSE.

Indique une operation 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.

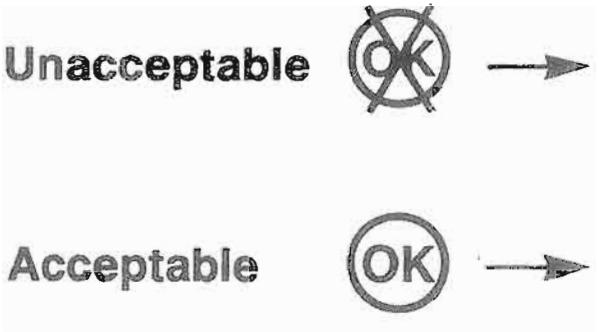
SERRER à un couple spécifique.

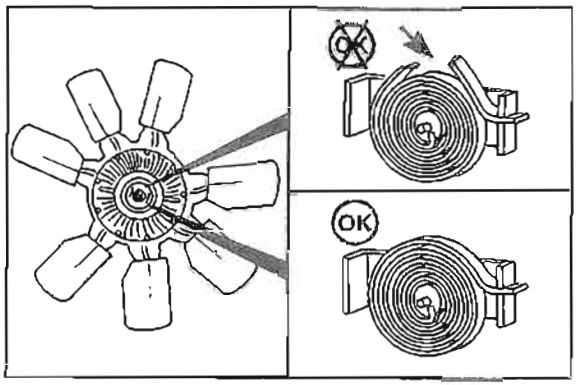
EFFECTUER une MESURE électrique.

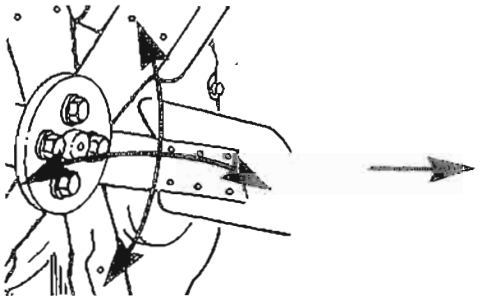
Se reporter à un autre endroit dans ce manuel ou à une autre publication pour obtenir des informations plus complètes.

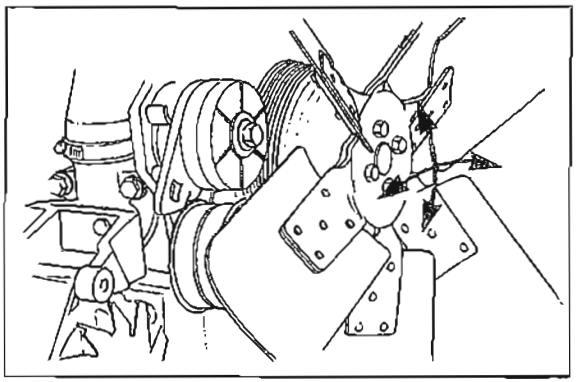
Illustrations

The illustrations used in this manual are intended to give an example of a problem, show what to look for and where to look for the problem. Most of the illustrations are generic and might not look exactly like the engine or parts used in your application. Some illustrations contain symbols to indicate an action required and an acceptable or unacceptable condition.









General Safety Instructions

Important Safety Notice

WARNING

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 safe. Be aware of hazardous conditions that can exist.
- Always wear protective glasses and protective shoes when working.
- Do not wear loose-fitting or torn clothing. Remove all jewelry when working.
- Disconnect the battery 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 engine 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 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.

General Rebuild Instructions

The B Series engine incorporates the latest diesel technology, yet it is designed to be rebuilt using existing repair practices performed to quality standards.

Observe all of the safety precautions noted in the procedures.

Provide a clean environment and follow the cleaning instructions specified in the procedures.

Cleanliness is an important consideration during repair of a diesel engine. Built-in contamination can reduce the life of an engine.

Perform the inspections specified in the procedures.

Replacement of worn and damaged parts is also necessary for a successful rebuild - the engine cannot be better than its components.

The dimensions given for a part such as a cylinder bore include the minimum dimension of a new part and the maximum dimension of a part that can be reused. The dimensions of a part such as a crankshaft include the maximum dimension of a new part and the minimum dimension of a part that can be reused. Replace or recondition the parts worn beyond the limits given.

Use genuine Cummins new or ReCon® service parts and assemblies.

The assembly instructions have been written for reusing as many parts and assemblies as is practical. When it is necessary to replace a part or assembly, the procedure is based on the use of new or ReCon® parts. However, some of the major components such as the cylinder block and head can be restored to usable condition by machining. Refer to the Alternative Repair Manual or contact your nearest Cummins Distributor for the correct procedures. All of the rebuild service described in this manual is available from all Cummins Distributors and many Dealer locations.

Follow the specified disassembly and assembly procedures to avoid damaging the parts and to ensure the components are properly assembled and tightened.

In-chassis repair instructions are available in the Troubleshooting and Repair Manual, Bulletin No. 3810207, which can be ordered or purchased from a local Cummins Distributor.

The contents of this manual are based on information in effect at the time of publications approval and are subject to change without notice.

Comply with the manufacturer's recommendations for cleaning solvents and other substances used in connection with the rebuild of the engine. Also, observe good safety practices regarding the use of tools and machines.

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.

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 Electric 1470.
D.C.:	Direct Current
Dye Penetrant Methid:	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, had bond with good characteristics. 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 clacium soap (2 percent to 6 percent), and zinc oxide (2 percent to 4 percent) additives.

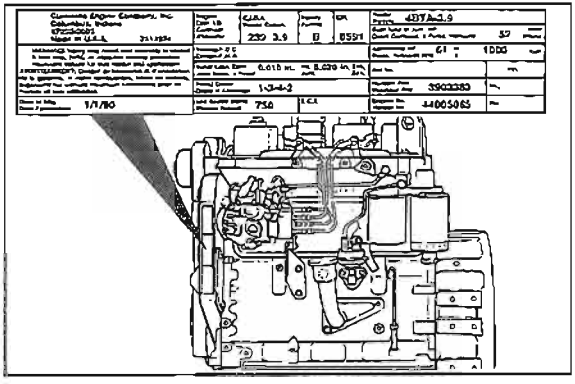
	Definition
Magnetic Particle Inspection:	A method of checking for cracks in either steel or iron parts. This method requires a Magnaflux machine, or an equivalent machine that imprats a magnetic field on the part being checked.
Mallet:	A hand tool consisting of a soft head, either wood, plastic, lead, 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 indicjator, from the most negative reading to the most positive reading.
Water Pump Grease:	A premium high temperature geast 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.

Item	Part Name	Qty.	Remarks
45	Screw, Hex Hd Cap	2	M8-1.25x20
46	Housing, Balancer	1	
47	Bearing, Needle	2	
48	Bearing,Needle	2	
49	Bearing, Needle	2	
50	Shaft, Balancer	1	
51	Shaft, Balancer	1	
52	Race, Inner Bearing	6	
53	Pin	8	
54	Key	2	
55	Gear, Balancer Shaft	1	
56	Gear, Balancer Shaft	1	
57	Weight, Balancer Counter	3	
58	Screw, Hex Head	10	
59	Collar, Thrust	2	
60	Plate, Thrust Bearing	1	
61	Plate, Thrust Bearing	1	
62	Screw, Hex Head	2	
63	Gear, Idler	1	
64	Bearing, Needle	1	
65	Retainer, Gear	1	
66	Screw, Socket Head	2	
67	Gasket, Gear Cover	1	
68	Housing, Gear	1	
69	Gasket, Gear Housing Cover	1	
70	Gear Cover	1	
71	Screw, Hex Head (Flange)	4	M8-1.25x50
72	Screw, Hex Head (Flange)	16	M8-1.25x16
73	Screw, Hex Head (Flange)	7	M8-1.25x50
74	Seal, Rectangular Ring	1	
75	Cover, Access Hole	1	
76	Plate, Data	1	
77	Screw, Drive	2	
78	Plate, Data	1	
79	Screw, Drive	2	
80	Seal, Rectangular Ring	1	
81	Housing, Timing Pin	1	
82	O-Ring	1	
83	Pin, Timing	1	
84	Ring, Retaining	1	
85	Screw, Round Hex (Torx)	2	M5-0.8x17
86	Seal, Front Crank	1	
87	Pulley, Crankshaft	1	
88	Screw, Hex Head (Flange)	4	M12-1.25x36

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 service needs.

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

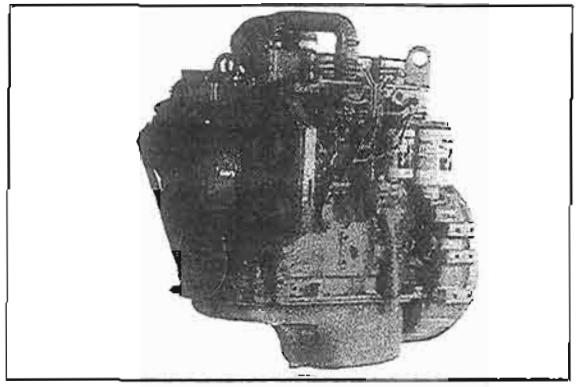
Cummins Engine Company, Inc. Columbus, Indiana 47202-3005 Made in U.S.A. 3918974	Engine Cert. I.D. Certificat d'identite	C.I.D./L. Pouce Cube/L. 239 3.9	Family Famille B	CPL 0591	Model Modele 4BTA-3.9	
					Fuel Rate at Adv. HP. Debit Combust. a Pulse. indiquee 52	mm³ stroke
WARNING: Injury may result and warranty is voided if fuel rate, RPM, or altitudes exceed published maximum values for this model and application. AVERTISSEMENT: Danger de blessures et d'annulation de la garantie, si debit combustible, trimn ou altitude, depassent les valeurs maximum annoncees pour ce modele et son utilisation.	Timing-T.D.C. Calage-P.M.H.				Advertised HP Puiss. indiquee (ch) 61 at	1800 rpm
	Valve Lash Cold Jeux Soup. a Froid 0.010 in.		Int. 0.020 in. Exh. Adm. Ech.		Ref No.	FEL
	Firing Order Ordre d'Allumage 1-3-4-2				Injector P/N Injecteur P/N 3903388	No_x
Date of Mfg. Date Fabrication 1/1/90	Idle Speed (rpm) Vitesse Ralenti 750		E.C.S.		Engine No. Moteur No. 44005065	Pm

Cummins Engine Nomenclature

The model name provides the following engine data:

4 B T A 3.9

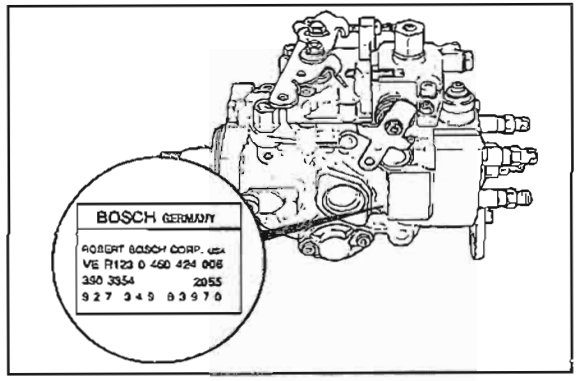
- 4 — Number of Cylinders
- B — Engine Series
- T — Turbocharged
- A — Aftercooled
- 3.9 — Displacement in Litres



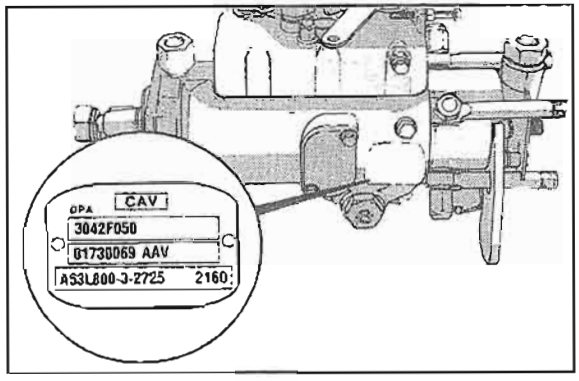
Injection Pump Dataplate

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.



General Specifications

GENERAL ENGINE DATA	4B3.9	4BT3.9	4BTA3.9	6B5.9	6BT5.9	6BTA5.9
Bore - mm [in.]	102 [4.02]					
Stroke - mm [in.]	120 [4.72]					
Displacement - litre [in.^{3}]	3.9 [239]			5.88 [359]		
Engine Weight (Dry) Less Flywheel and Electrics - kg [lbs.]	308 [680]	320 [705]	329 [725]	388 [855]	399 [880]	411 [905]
Firing Order	1.3.4.2			1.5.3.6.2.4		
Valve Clearances						
- Intake - mm [in.]	.25 [.010]					
- Exhaust - mm [in.]	.51 [.020]					
Compression Ratio	18.5:1	17.5:1	16.5:1	18.5:1	17.5:1	16.5:1
Rotation, viewed from the Front of the Engine	Clockwise					
Aspiration						
- Naturally Aspirated	X			X		
- Turbocharged		X	X		X	X
- Aftercooled			X			X

LUBRICATION SYSTEM	4B3.9	4BT3.9	4BTA3.9	6B5.9	6BT5.9	6BTA5.9
Oil Pressure at Idle - (Minimum Allowable) kPa [PSI]	69 [10]					
Oil Pressure at Rated - (Minimum Allowable) kPa [PSI]	207 [30]					
Regulating Valve Opening Pressure kPa [PSI]	414 [60]					
Differential Pressure to Open the Filter Bypass Valve - kPa [PSI]	138 [20]					
Oil Capacity of Pan (High-Low)	9.5 [10]				14.2 [15]	
- Litre [U.S. Qts.]	8.6 [9]				12.4 [13]	

COOLING SYSTEM						
Coolant Capacity (Engine Only) - litre [U.S. Qts.]	7 [7.4]		7.9 [8.4]	9 [9.5]		9.9 [10.5]
Standard Modulating Thermostat - Range - °C [°F]	Start 83 [181]			Fully Open 95 [203]		
Pressure Cap - kPa [PSI]						
104° C [220° F] Systems	103 [15]					
99° C [210° F] Systems	48 [7]					

INTAKE AIR, EXHAUST AND FUEL SYSTEM	4B3.9	4BT3.9	4BTA3.9	6B5.9	6BT5.9	6BTA5.9
Maximum Allowable Intake Restriction at Rated Speed and Load with Dirty Air Filter Element-mm H_2O (in. H_2O)	508 [20]	635 [25]	635 [25]	508 [20]	635 [25]	635 [25]
Maximum Allowable Exhaust Restriction at Rated Speed and Load - mm Hg [in. Hg]	76.2mm [3 in.]					
Maximum Allowable Restriction to Pump - With Dirty Filter - mm Hg [in. Hg]	95mm [3.75 in.]					
Maximum Allowable Return Line Restriction - mm Hg [in. Hg]	518mm [20.4 in]					

ELECTRICAL SYSTEM	4B3.9	4BT3.9	4BTA3.9	6B5.9	6BT5.9	6BTA5.9
Minimum Recommended Battery Capacity - With Light Accessories*						
- 12 V Starter	625CCA	625CCA	625CCA	800CCA	800CCA	800CCA
- 24 V Starter	312CCA	400CCA	400CCA	400CCA	400CCA	400CCA
With Heavy Accessories**						
- 12 V Starter	800CCA	800CCA	800CCA	950CCA	950CCA	950CCA
- 24 V Starter	400CCA	400CCA	400CCA	475CCA	475CCA	475CCA
Maximum Allowable Resistance of Starting Circuit						
- With 12 V Starter - Ohms	.0012					
- With 24 V Starter - Ohms	.0020					

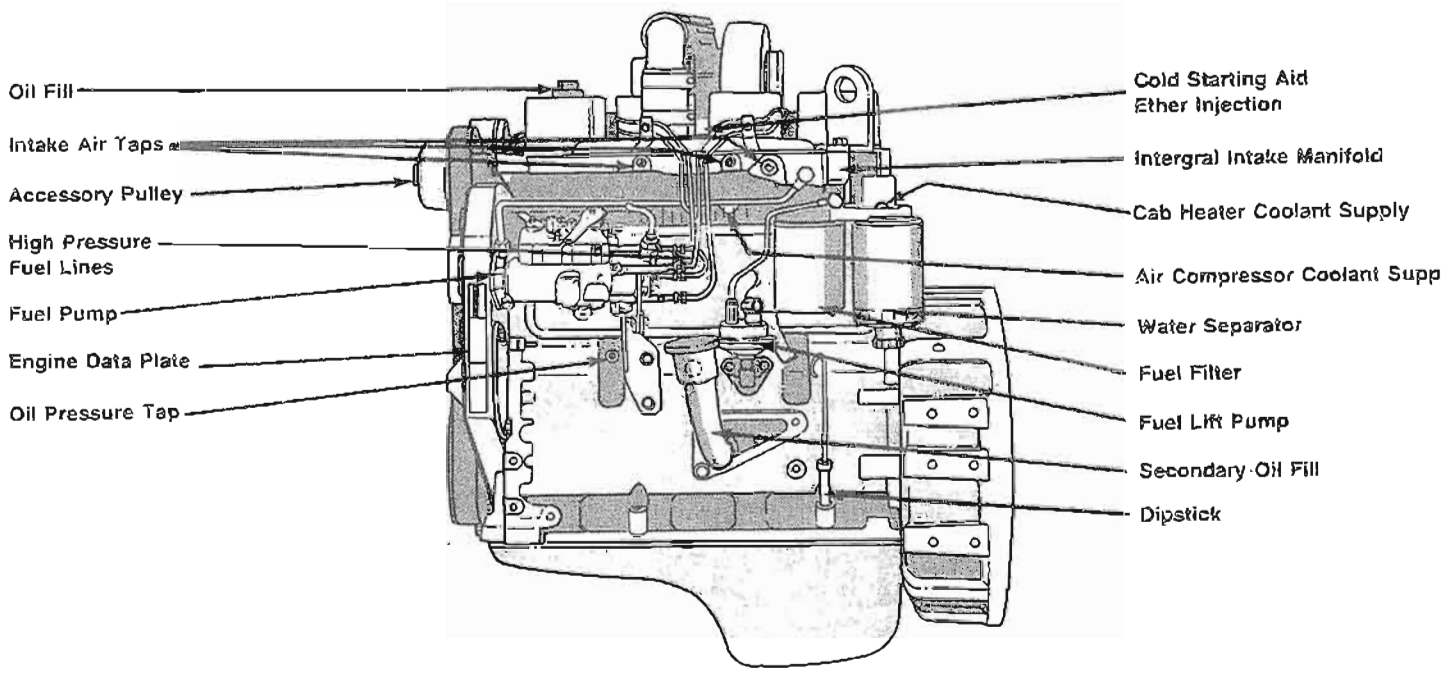
*Typical light accessories include alternator, small steering pump, and disengaged clutch.
**Typical heavy accessories include hydraulic pump and torque converter.

Batteries (Specific Gravity)

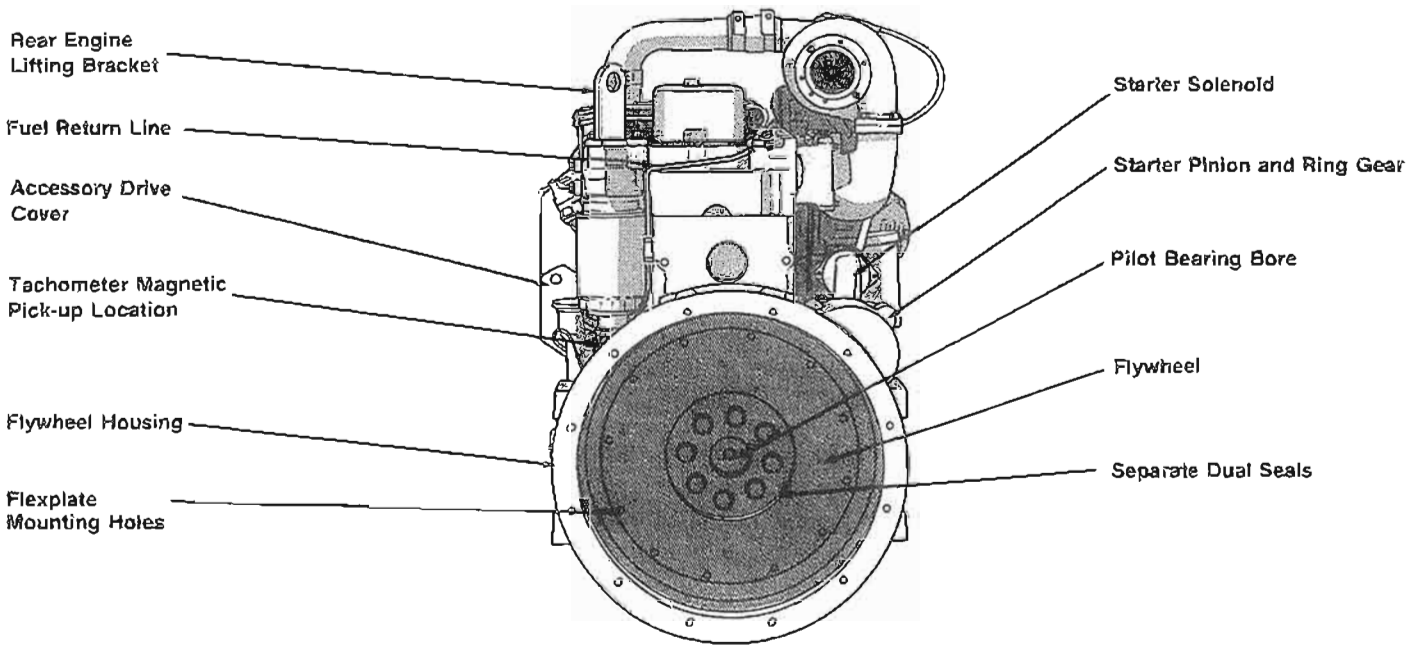
Specific Gravity at 27° C [80° F]	State of Charge
1.260 - 1.280	100%
1.230 - 1.250	75%
1.200 - 1.220	50%
1.170 - 1.190	25%
1.110 - 1.130	Discharged

External Engine Components

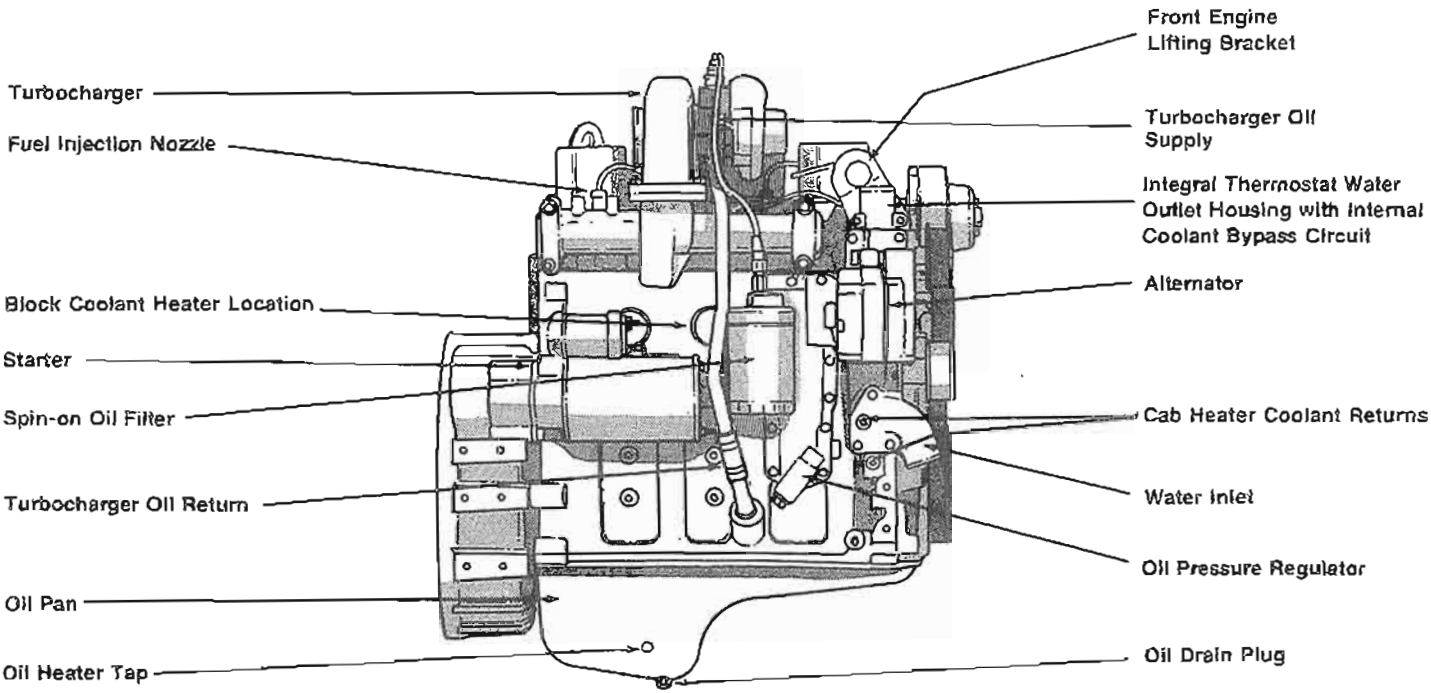
The illustrations which follow show the locations of the major external engine components, the filters, and other service and maintenance points. Some external components will be at different locations for different engine models.



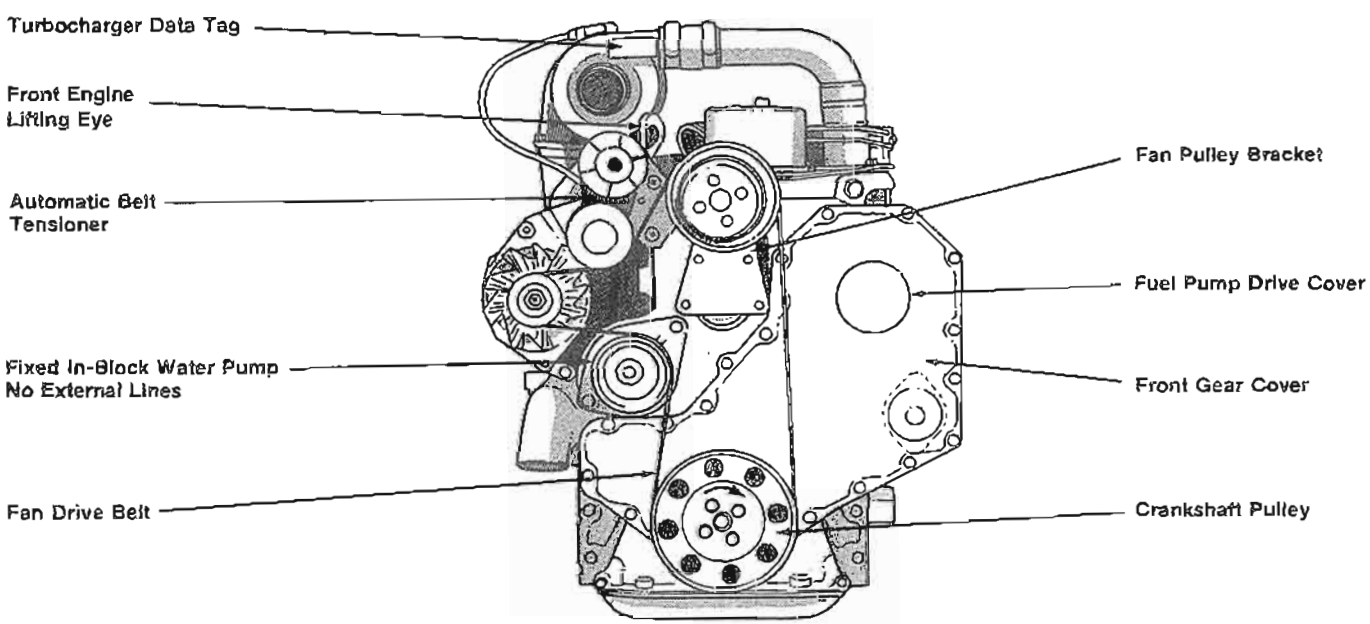
Intake Side



Rear View



Turbocharger Side View



Front View

Cylinder Block - General Information

The B-Series engine is available in a 4 cylinder version or a 6 cylinder version.

Most of the parts are common between the 4 and 6 cylinder version (e.g. pistons, rings, connecting rods, water pump).

In general, the only parts that differ between the 4 and 6 cylinder versions are those that must change due to the difference in number of cylinders (e.g. crankshaft, camshaft, block casting cylinder head etc).

Camshaft

The profile of the cam lobes is the same for all B Series engines.

The camshaft end clearance is determined by the clearance between the camshaft and the thrust plate.

Camshafts that are damaged or worn on the lift pump or the valve lobes must be replaced. **Cummins Engine Company, Inc. does not recommend the grinding of camshaft lobes.**

Crankshaft

The 6 cylinder crankshaft is a balanced, forged steel, full fillet hardened unit with seven main bearing journals. The lower bearing shells are all the same. All of the upper bearing shells are the same except for the Number 4 journal which uses a flanged upper bearing shell. The flanges on the bearing shell control the end thrust of the crankshaft.

Oversize main bearings and thrust bearings are available for service. **Cummins Engine Company, Inc. recommends regrinding ALL of the main or the connecting rod journals when ONE requires regrinding.**

Cylinder Block

The cylinder block has provisions for the oil cooler housing, thermostat seats, coolant bypass line, water pump volute, oil pump housing, water pump inlet and bored piston cylinders with spacing between cylinders to provide room for dry liners, if needed for service.

Oil Seals

All crankshaft seals on the B Series are the Teflon™ lay-down lip (scroll) type. The Teflon™ lay-down lip type seal does **not** contain a spring on the back of the sealing lip. The sealing lip is a thin, stiff piece of Teflon™.

Teflon™ seals must be dry before installation. Do not lubricate the seal lip or the shaft. After the first few turns of the shaft, a thin film of Teflon™ is transferred from the seal lip to the shaft. If the shaft is **not** clean and dry, this transfer will not occur and the seal will leak.

Pistons

The pistons have a cast aluminum body, high swirl combustion bowl and three ring grooves. The top ring groove has a ni-resist insert with a Keystone profile. The pistons for the different engine configurations are similar in appearance, but are not interchangeable. Always check the part number to be sure the correct piston is used during piston replacement.

Vibration Damper

The vibration damper controls the twisting or torsional vibration of the crankshaft. A vibration damper is engineered for use on a specific engine model.

It is not economical to repair a vibration damper in the field. Install a **new** or a **rebuilt** vibration damper if the inspection indicates that a damper is defective.