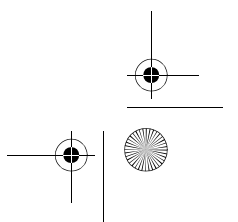
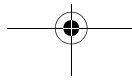
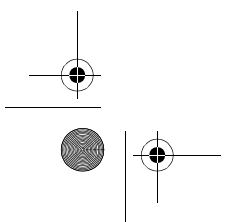
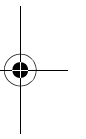
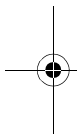
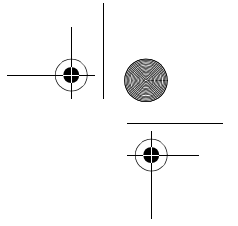
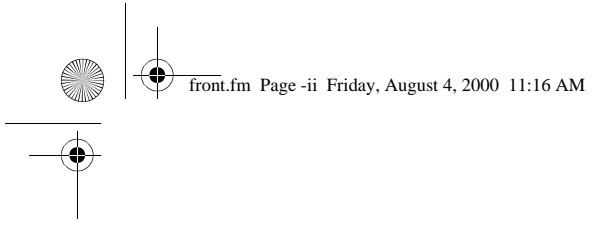


**E-TECH™ ENGINE**  
**SERVICE MANUAL**  
**(Includes Left-Side Redesign)**



OCTOBER 2000  
(REVISED)  
5-106





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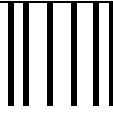
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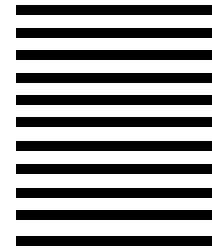
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## ERRATA SHEET — ENGINE

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### Crankshaft Center Main Bearing Specification Update

Effective January 2006, Mack Powertrain Engineering has widened the crankshaft center main bearing runout specification. The maximum allowable crankshaft runout specification was changed from 0.005 in. (0.127 mm) to 0.007 in. (0.178 mm). The manuals listed below are affected by this change.

Reference: **Engine Manuals**

5-101 E7

5-106 E-Tech™

5-107 E7G

5-110 ASET™ AI/AMI

5-111 ASET™ AC

JANUARY 2006  
(NEW ISSUE)

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MACK ENGINE SERIES

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NUMBER: SB-210-034  
 DATE: 5/14/02  
 MODEL: E-Tech™

(Also applies to Mack Trucks Australia)

### MISCELLANEOUS FASTENER CHANGES — E-TECH™ ENGINES

The following fastener changes were made on E-Tech™ engines:

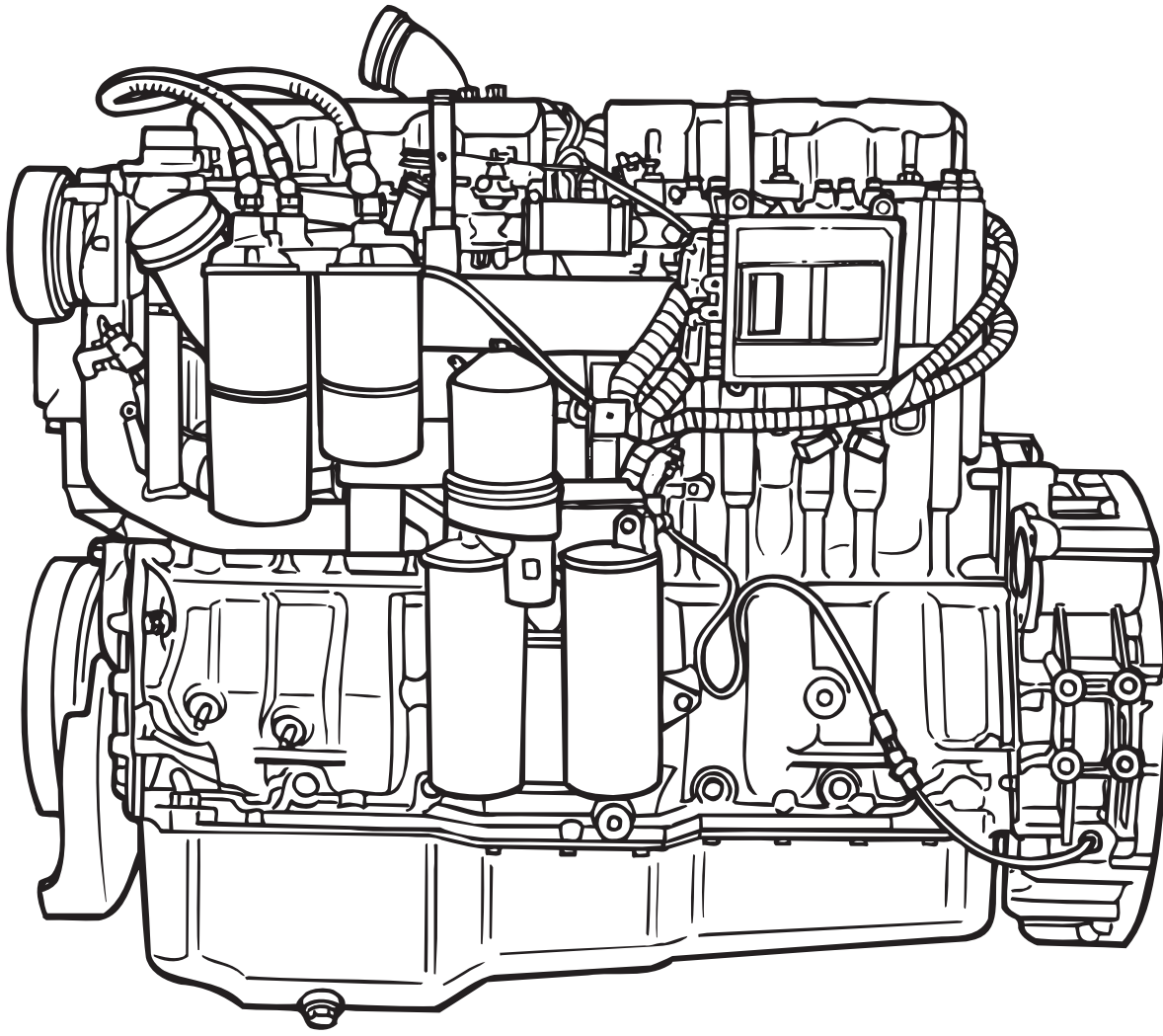
- **Injection Nozzle Hold-Down Screws** — Beginning 3/00, the injection nozzle hold-down screws having the 15 mm external hex head have been changed to a new screw (part No. 421GC2116M) that has a 16 mm internal hex head.
- **Rocker Shaft Mounting Bracket Bolts** — Beginning 4/00, the bolts and washers used to secure the rocker shaft mounting brackets to the cylinder head have been changed to a flange-head bolt (part No. 65AM5010). Tightening torque value for this new fastener remains the same at 40 lb-ft (50 N•m).
- **Air Compressor Mounting Screw** — Beginning 8/00, the original hex-head screw has been changed to a flange-head screw (part No. 27AM16). This change was made so that the mounting screw clamp load is distributed over a wider area of the flat washer.
- **Camshaft Thrust Washer** — Beginning 10/00, the two screws and washers used to secure the camshaft thrust washer to the block were changed to a flange-head screw (part No. 66AM44). Tightening torque value for this fastener remains the same at 15 lb-ft (20 N•m).
- **Cylinder Head Capscrews** — Beginning 6/01, the cylinder head capscrews and the separate hardened flat washer were replaced in production with capscrews having captured washers (part number series 400GC317M). This change was implemented to prevent the possibility of omitting or installing more than one washer during assembly. Additionally, the outside diameter of the captured washer was reduced slightly (approximately 0.030") to accommodate the redesigned cylinder head cover that was phased into production 7/01. Cylinder head capscrew torque remains the same at 205 lb-ft (278 N•m).
- **Flywheel-to-crankshaft mounting bolts** — Beginning 9/01, bolts having captured washers (part Nos. 419GC31M and 419GC31M2) were released into production to replace the previously used bolts and separate hardened flat washer used to secure the flywheel to the crankshaft. Flywheel-to-crankshaft mounting bolt torque remains the same at 185 lb-ft (250 N•m).
- **Electronic Unit Pump (EUP) hold-down screws** — Beginning 11/01, new hold-down screws (part No. 421GC2123M) were released into production for the electronic unit pumps. These screws are dimensionally the same as the previously used screws, but conform to a more stringent specification that controls minor surface forming defects to a greater degree than for common fasteners. Torque of the EUP hold-down bolts has been changed from 42 lb-ft (57 N•m) to 60 lb-ft (81 N•m).
- **Turbocharger Mounting Nuts** — Beginning 5/02, new turbocharger mounting nuts were released into production. These nuts (part No. 142GC247M) are composed of silver-plated stainless steel to provide greater resistance to heat than the previous nuts. Additionally, these nuts have the Spiralock™ self-locking thread feature to prevent loosening in service.



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# E-TECH™ ENGINE SERVICE MANUAL

(Includes Left-Side Redesign)



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OCTOBER 2000  
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## ATTENTION

The information in this manual is not all inclusive and cannot take into account all unique situations. Note that some illustrations are typical and may not reflect the exact arrangement of every component installed on a specific chassis.

The information, specifications, and illustrations in this publication are based on information that was current at the time of publication.

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# NOTES

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# INTRODUCTION

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# INTRODUCTION



## INTRODUCTION

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### SAFETY INFORMATION

#### Advisory Labels

Cautionary *signal words* (Danger-Warning-Caution) may appear in various locations throughout this manual. Information accented by one of these signal words must be observed to minimize the risk of personal injury to service personnel, or the possibility of improper service methods which may damage the vehicle or cause it to be unsafe. Additional Notes and Service Hints are used to emphasize areas of procedural importance and provide suggestions for ease of repair. The following definitions indicate the use of these advisory labels as they appear throughout the manual:

#### **DANGER**

*Activities associated with Danger indicate that death or serious personal injury may result from failing to heed the advisory. Serious personal injury may be equated to career-ending injury.*

---

#### **WARNING**

*Activities associated with Warning indicate that personal injury may result from failing to heed the advisory. In this case, personal injury is not equated to career-ending injury, but results in possible change in quality of life.*

---

#### **CAUTION**

*Activities associated with Caution indicate that product damage may result from failing to heed the advisory. Caution is not used for personal injury.*

---

#### **NOTE**

A procedure, practice, or condition that is essential to emphasize.

---

#### **SERVICE HINT**

A helpful suggestion that will make it quicker and/or easier to perform a procedure, while possibly reducing service cost.

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## INTRODUCTION

### Service Procedures and Tool Usage

Anyone using a service procedure or tool not recommended in this manual must first satisfy himself thoroughly that neither his safety nor vehicle safety will be jeopardized by the service method he selects. Individuals deviating in any manner from the instructions provided assume all risks of consequential personal injury or damage to equipment involved.

Also note that particular service procedures may require the use of a special tool(s) designed for a specific purpose. These special tools must be used in the manner described, whenever specified in the instructions.

#### **WARNING**

1. Before starting a vehicle, always be seated in the driver's seat, place the transmission in neutral, be sure that parking brakes are set, and disengage the clutch.
2. Before working on a vehicle, place the transmission in neutral, set the parking brakes, and block the wheels.
3. Before towing the vehicle, place the transmission in neutral and lift the rear wheels off the ground, or disconnect the driveline to avoid damage to the transmission during towing.

#### **DANGER**

*Engine-driven components such as Power Take-Off (PTO) units, fans and fan belts, driveshafts and other related rotating assemblies, can be very dangerous. Do not work on or service engine-driven components unless the engine is shut down. Always keep body parts and loose clothing out of range of these powerful components to prevent serious personal injury. Be aware of PTO engagement or nonengagement status. Always disengage the PTO when not in use.*

**REMEMBER,  
SAFETY . . . IS NO ACCIDENT!**



## INTRODUCTION

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Mack Trucks, Inc. cannot anticipate every possible occurrence that may involve a potential hazard. Accidents can be avoided by recognizing potentially hazardous situations and taking necessary precautions. Performing service procedures correctly is critical to technician safety and safe, reliable vehicle operation.

The following list of general shop safety practices can help technicians avoid potentially hazardous situations and reduce the risk of personal injury. **DO NOT** perform any services, maintenance procedures or lubrications until this manual has been read and understood.

- Perform all service work on a flat, level surface. Block wheels to prevent vehicle from rolling.
- **DO NOT** wear loose-fitting or torn clothing. Remove any jewelry before servicing vehicle.
- **ALWAYS** wear safety glasses and protective shoes. Avoid injury by being aware of sharp corners and jagged edges.
- Use hoists or jacks to lift or move heavy objects.
- **NEVER** run engine indoors unless exhaust fumes are adequately vented to the outside.
- Be aware of hot surfaces. Allow engine to cool sufficiently before performing any service or tests in the vicinity of the engine.
- Keep work area clean and orderly. Clean up any spilled oil, grease, fuel, hydraulic fluid, etc.
- Only use tools that are in good condition, and always use accurately calibrated torque wrenches to tighten all fasteners to specified torques. In instances where procedures require the use of special tools which are designed for a specific purpose, use only in the manner described in the instructions.
- Do not store natural gas powered vehicles indoors for an extended period of time (overnight) without first removing the fuel.
- Never smoke around a natural gas powered vehicle.



# INTRODUCTION

## EXPLANATION OF NUMERICAL CODE

The organization of MACK service manuals has been upgraded to standardize manual content according to a reference system based on component identification. The new reference system will help link the information contained in this publication with related information included in other MACK service/warranty publications, such as associated service bulletins, warranty manuals, and MACK Service Labor Time Standards.

The system is based on a numerical code, the first **digit** of which identifies the general component grouping as listed here:

- GROUP 000 — GENERAL DATA
- GROUP 100 — CHASSIS
- GROUP 200 — ENGINE
- GROUP 300 — CLUTCH, TRANSMISSION, TRANSFER CASE AND PTO

GROUP 400 — STEERING, AXLES, WHEELS AND TIRES, DRIVELINE

GROUP 500 — BRAKES, AUXILIARY SYSTEMS

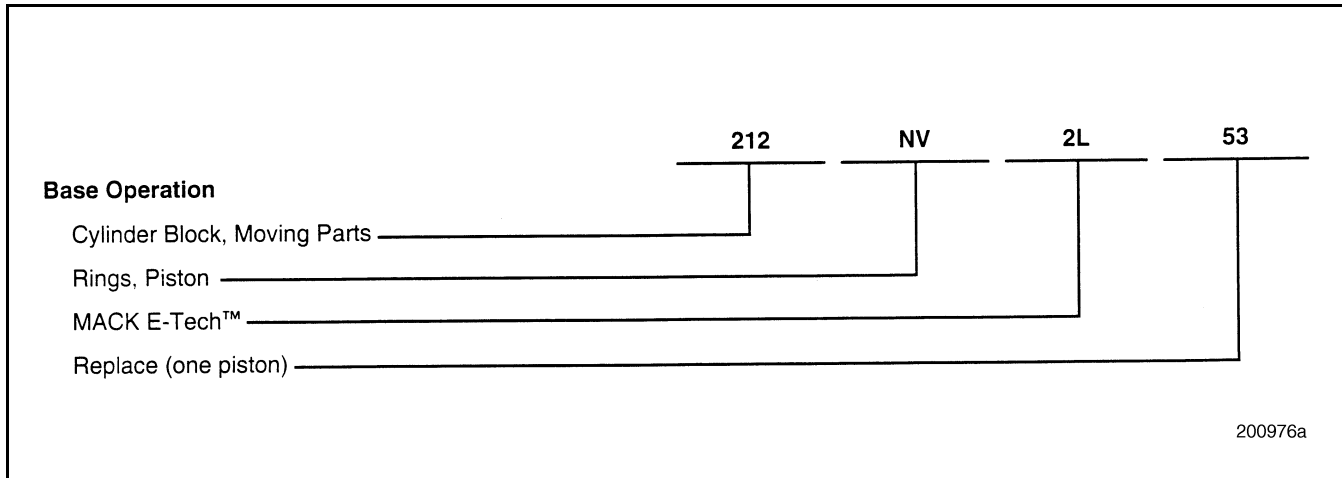
GROUP 600 — CAB, TRUCK BODY

GROUP 700 — ELECTRICAL

The second two digits of the three-digit code are used to identify the **system, assembly or subassembly**, as appropriate, within each of the groupings. The codes applicable to this publication are shown at the beginning of each procedure, as necessary, to guide you to specific component information.

Additionally, a two-character alpha code (i.e., [NV] RINGS, PISTON) may be referenced with each procedure. This alpha code, in combination with the three-digit Group number, identifies the specific assembly, sub-assembly or part, and directly relates to the first five positions of the operation code listed in MACK Service Labor Time Standards.

### Examples:



Numerical Code



## INTRODUCTION

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### ABOUT THIS MANUAL

#### Changes from the Existing E-Tech™ Service Procedures Manual

Mack Trucks, Inc. has made many major improvements to this E-Tech™ Service Procedures Manual, with changes to both content and organization. This is a complete manual, describing engine features and the operation of major systems as well as providing comprehensive overhaul procedures, specifications and adjustments.

All specifications and torque values are given in English and metric measurements. Critical torque values are also included in the text, eliminating the need to refer to SPECIFICATIONS section each time a specified torque value is required. The Special Tools list has been revised to include all special tools required for a complete overhaul. Warnings, cautions, notes and service hints help the technician service the engine safely and efficiently.

The engine disassembly procedures show how to remove components in an order that requires the least amount of handling. Where appropriate, it includes general information needed to properly service that component.

Various component bench procedures guide the technician in disassembly, cleaning, inspection and assembly of each component. Each bench procedure helps in determining if the part is serviceable or should be replaced.

The engine reassembly procedure includes step-by-step instructions for reassembling the engine. This helps to ensure proper installation and longer service life.

Under Engine Setup and Adjustments, the latest setup information is provided for adjusting all E-Tech™ engine models. Engines perform best and conserve fuel most efficiently when adjusted properly.

Two additional procedures are included as guides for removing and reinstalling the engine. Both sections are generic in nature since E-Tech™ engine installation procedures vary from one vehicle style to another. As such, the procedures are intended as a checklist to remind the technician of all necessary tasks.

While troubleshooting procedures are similar for most diesel engines, this manual includes only those that pertain to the E-Tech™ engine. The TROUBLESHOOTING section contains symptom-related questions as well as tests to help the technician consider all possible problem sources.

This service manual also includes applicable information from active service bulletins and service letters since publication of the E-Tech™ Service Procedures Manual dated July 1999.



## INTRODUCTION

### ABOUT THE E-TECH™ ENGINE AND ITS SERVICE

This publication is intended to provide technicians with a working knowledge of the E-Tech™ engine, including both early-production and current-production versions.

The E-Tech™ engine has undergone a left-side redesign. Changes include a new plate-type oil cooler and a new oil filter mounting arrangement. This new oil filter arrangement includes a new centrifugal oil filter assembly, where the centrifugal filter assembly is now mounted upside down, and the external oil drain is eliminated. This new centrifugal oil filter is called Centri-Max® PLUS.

The engine electronic control unit (EECU) has been relocated to the left side of the engine and is mounted on a new one-piece inlet manifold. Relocating the EECU has eliminated the need for the EECU cooling plate, and has also brought about a design change to the unit pump front outboard heat shield. Additionally, with the change to the one-piece inlet manifold, the fuel filter mounting adapter is new and is located slightly forward of the previous location.

Descriptions of these design changes and the other features are provided in the DESCRIPTION & OPERATION section. Additionally, the service effects of these changes on removal, installation, disassembly, assembly, setup and adjustment procedures, etc., are included in the respective sections of this publication.

Development of the E-Tech™ engine has been driven by three basic requirements. It was designed to:

- Meet projected exhaust and noise emissions regulations.
- Meet customer demands for improved fuel economy, driveability and engine braking.
- Compete in a world market.

Although the drive to reduce emissions and noise levels is primarily the result of government mandates, the E-Tech™ engine is designed to provide customers with an improved engine over the existing E7 engine it replaces. Specific improvements include:

- Improved fuel economy.
- Increased throttle response (time to 90 percent torque is faster with the E-Tech™).
- More retarding horsepower through a newly designed J-Tech™ Engine Brake from Jacobs.

Mack Trucks, Inc. is looking beyond the borders of North America to increase its market and bring the quality, toughness and technology associated with the MACK name to a worldwide audience. The current environment of global regulations concerning exhaust emissions, noise and other factors has leveled the playing field on an international basis. This means that the improvements made to meet the North American environmental regulations can now be applied worldwide.

The E-Tech™ engine is used in MACK trucks and European Renault VI trucks.



# NOTES

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# IDENTIFICATION

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# IDENTIFICATION



## IDENTIFICATION

### ENGINE MODEL IDENTIFICATION

#### Engine Information Plate

The E-Tech™ engine information plate is located on the top of the front cylinder head cover (back cover for LE and MR chassis). This plate includes information concerning:

- Engine model, serial number and 11GBA part number.
- Advertised horsepower at rated speed rpm.
- Emissions regulations to which the engine conforms and other pertinent information required by emissions regulations.
- Inlet and exhaust valve lash settings and engine brake slave piston lash setting.

The following explanations are provided to aid in interpreting some of the key information found on the engine information plate.

#### Block 1 — U.S. EPA Regulations

- An "X" in block one means the engine meets United States EPA regulations for the year stamped in block four.
- Two dashes in block one indicate the engine does not meet United States EPA regulations for the year stamped in block four. This is only permissible with certain export engines. All domestic engines will have an "X" in block one.

#### Block 2 — California Regulations

- An "X" in block two indicates the engine meets California emissions regulations for the year stamped in block four. This engine is referred to as a "50-state" engine and can be sold in any state throughout the U.S.
- Two dashes stamped in block two mean the engine does not meet California emissions regulations. If an engine has an "X" in block one and two dashes in block two, it is referred to as a "49-state" engine, meaning it is not certified for sale in California.

#### Block 3 — ADR Regulations

- An "X" in block three means the engine has been certified to meet Australian emissions regulations.
- Two dashes in block three mean the engine does not meet Australian emissions regulations.

#### Block 4 — Model Year

- The four-digit number stamped in block four represents the year in which the engine was certified.

#### Block 5 — Federal Family

- A 12-digit number stamped in block five denotes the Federal Family to which the engine belongs for emissions certification purposes.
- All domestic engines will have a 12-digit Federal Family number in block five.

#### Block 6 — California Family

- If the engine meets California emissions regulations, the same 12-digit number stamped in the Federal Family block is stamped in block six.
- If the engine does not meet California emissions regulations, there will be two dashes in block six.

#### Block 7 — Initial Injection Timing

- E-Tech™ engines do not have an initial injection timing, as this is controlled electronically.
- E-Tech™ engines will have "NA" stamped in block seven.

#### Block 8 — Engine Brake

- This block is only used when the engine is equipped with an engine brake. The stamping in this block indicates the engine brake slave-piston lash setting.

Figure 1 illustrates the location of the information plate and Figure 2 illustrates its content.



# IDENTIFICATION

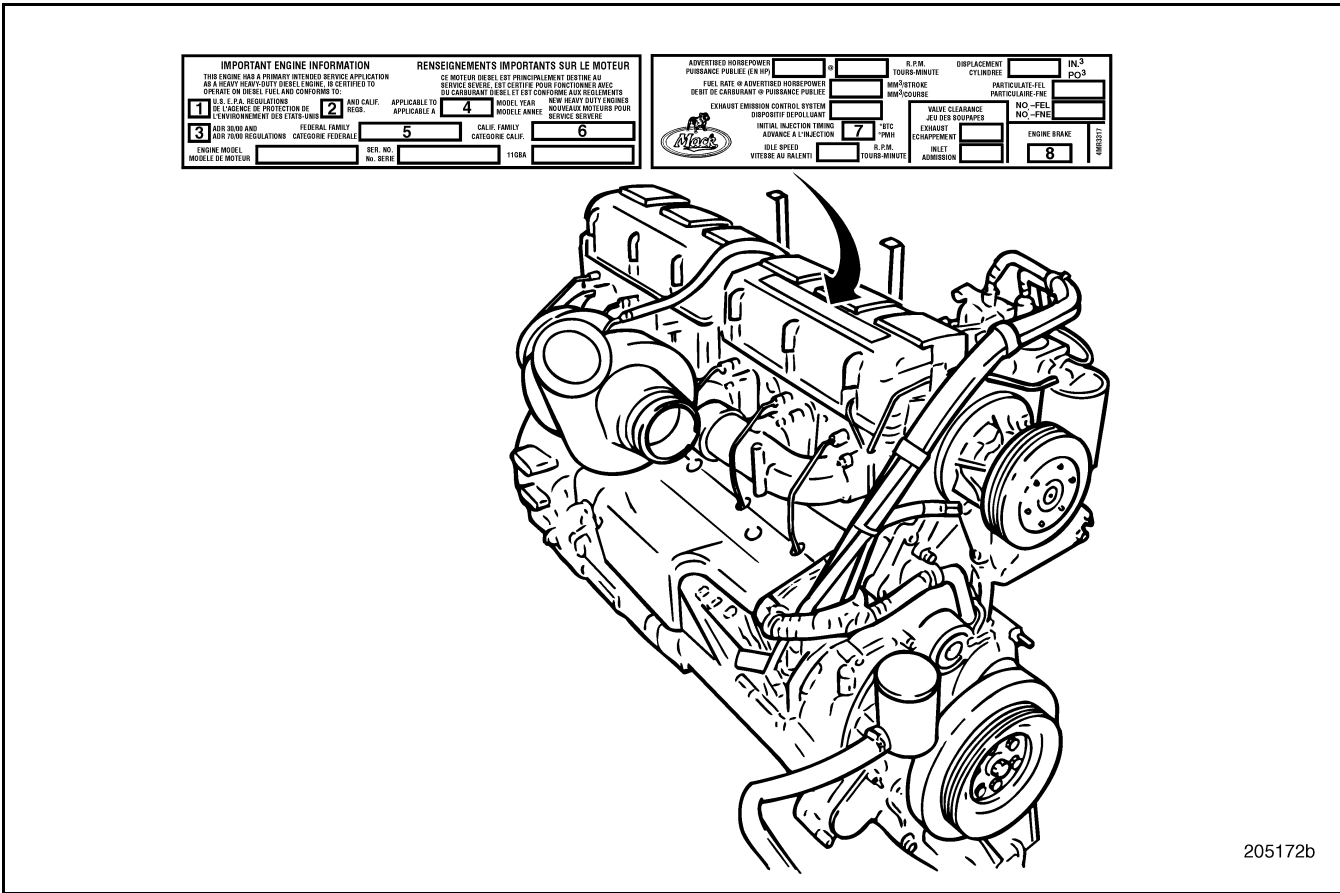


Figure 1 — Engine Information Plate Location

205172b



# IDENTIFICATION

IMPORTANT ENGINE INFORMATION		RENSEIGNEMENTS IMPORTANTS SUR LE MOTEUR	
THIS ENGINE HAS A PRIMARY INTENDED SERVICE APPLICATION AS A HEAVY HEAVY-DUTY DIESEL ENGINE, IS CERTIFIED TO OPERATE ON DIESEL FUEL AND CONFORMS TO:		CE MOTEUR DIESEL EST PRINCIPALEMENT DESTINE AU SERVICE SEVERE, EST CERTIFIE POUR FONCTIONNER AVEC DU CARBURANT DIESEL ET EST CONFORME AUX REGLEMENTS	
<b>1</b> U.S. E.P.A. REGULATIONS DE L'AGENCE DE PROTECTION DE L'ENVIRONNEMENT DES ETATS-UNIS	<b>2</b> AND CALIF. REGS.	APPLICABLE TO APPLICABLE A	<b>4</b> MODEL YEAR MODELE ANNEE
<b>3</b> ADR 30/00 AND ADR 70/00 REGULATIONS	FEDERAL FAMILY CATEGORIE FEDERALE	<b>5</b>	CALIF. FAMILY CATEGORIE CALIF. <b>6</b>
ENGINE MODEL MODELE DE MOTEUR	SER. NO. No. SERIE	11GBA	

ADVERTISED HORSEPOWER PUISSANCE PUBLIEE (EN HP)	@	R.P.M. TOURS-MINUTE	DISPLACEMENT CYLINDREE	IN. <sup>3</sup> PO <sup>3</sup>
FUEL RATE @ ADVERTISED HORSEPOWER DEBIT DE CARBURANT @ PUISSANCE PUBLIEE		MM <sup>3</sup> /STROKE MM <sup>3</sup> /COURSE	PARTICULATE-FEL PARTICULAIRE-FNE	
EXHAUST EMISSION CONTROL SYSTEM DISPOSITIF DEPOLLUANT		VALVE CLEARANCE JEU DES SOUPAPES	NO.-FEL NO.-FNE	
INITIAL INJECTION TIMING ADVANCE A L'INJECTION	<b>7</b> °BTC °PMH	EXHAUST ECHAPPEMENT	ENGINE BRAKE	<b>8</b>
IDLE SPEED VITESSE AU RALENTI	R.P.M. TOURS-MINUTE	INLET ADMISSION		4MR3317

201388b

Figure 2 — Engine Information Plate

## Engine Serial Number Identification

In addition to the engine information plate on the front cylinder head cover, the engine is also identified by the engine serial number stamped into the cylinder block. This serial number is located on the block right side just below the turbo oil drain tube flange as shown in Figure 3.

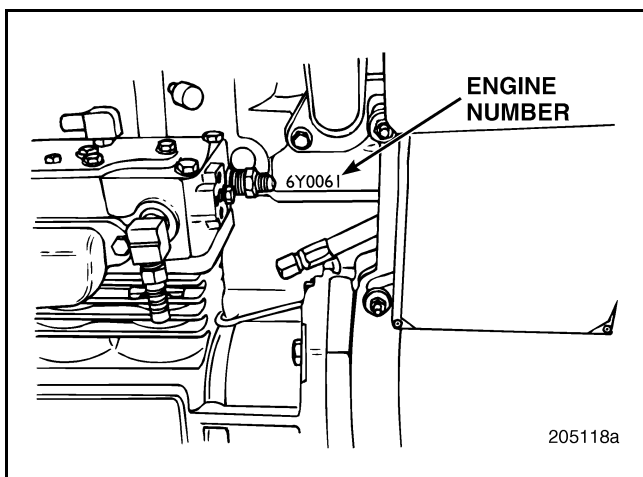


Figure 3 — Engine Serial Number



## DESCRIPTION & OPERATION

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## DESCRIPTION & OPERATION



## DESCRIPTION & OPERATION

### E-TECH™ ENGINE DESIGN FEATURES

The E-Tech™ engine evolved from the E7 PLN (commonly referred to as the E7). The four primary design features that differentiate the E-Tech™ engine from the E7 engine are as follows:

- Electronic Unit Pump (EUP) fuel injection system
- V-MAC® III electronic control system
- Poly-v belt drive system
- J-Tech™ engine brake system from Jacobs

These major changes resulted in subsequent improvements and redesign of related components within the engine.

### Electronic Unit Pumps

Electronic Unit Pump (EUP) technology, which has been utilized in the heavy-duty industry for many years, has been adapted for the E-Tech™ engine to achieve:

- Optimum performance
- Lower emissions
- Simplified service
- More effective pump/engine diagnostics (individual cylinders can be isolated)

An EUP is a single-plunger fuel-injection pump, one per cylinder, driven by a third lobe on the engine camshaft. The pump roller follower (tappet) is in contact with the engine cam lobe.

The EUP is very similar to a unit injector. The primary difference is that the EUP delivers fuel through a fuel injection line to a conventional-style nozzle-holder assembly, whereas a unit injector has a nozzle mounted directly on it.

The EUP is capable of providing very high fuel-injection pressures. The pump is controlled by a high-speed solenoid valve (see Figure 4) responding to electronic signals from the V-MAC III engine control module. This electronic control provides a greater timing range. The combination of higher pressures and greater timing control improves the combustion process and optimizes engine performance. This enables the E-Tech™ engine to conform to more stringent emissions regulations while providing performance and fuel economy improvements.

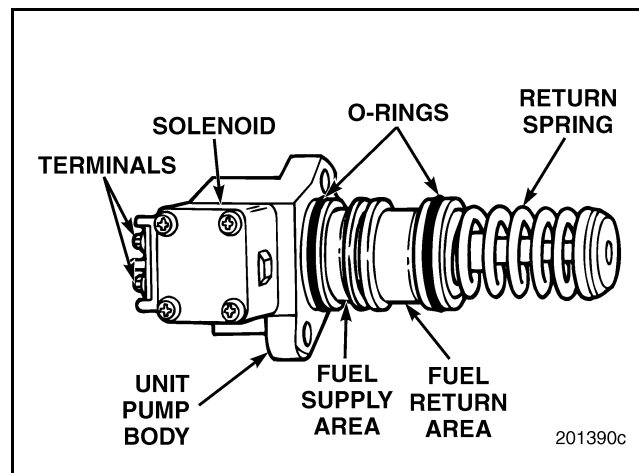


Figure 4 — EUP Components

### NOTE

Electronic unit pumps for engines produced through approximately late 3rd quarter 2000 were fitted with three O-rings on the pump housings. Pumps on engines produced later than 3rd quarter 2000 are fitted with two O-rings in the top and bottom grooves. The O-ring in the center groove has been eliminated.

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