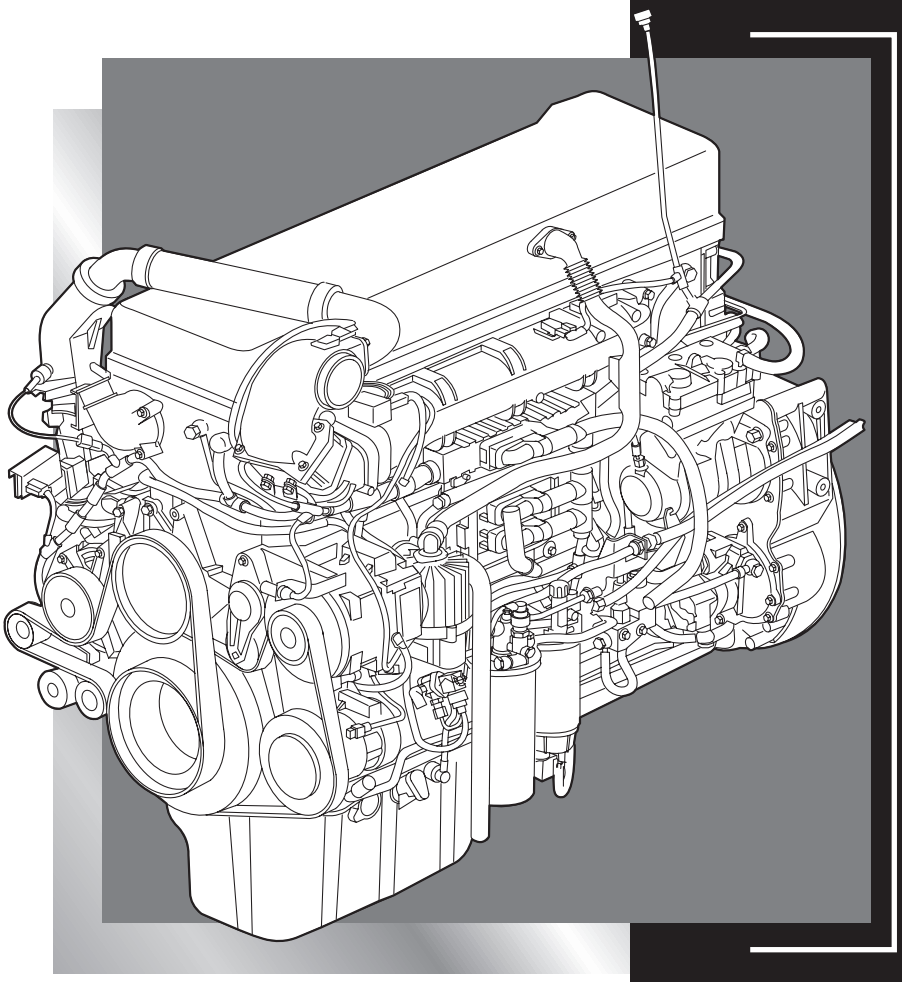
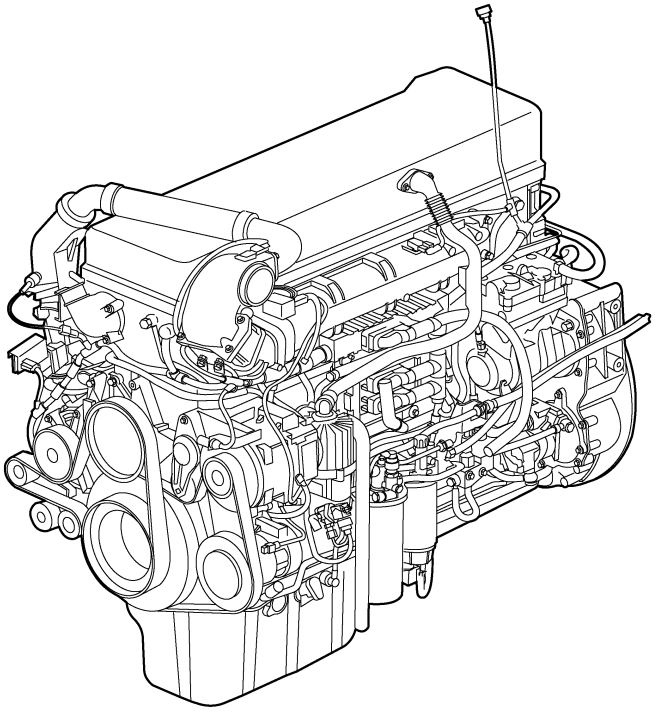


MACK® MP8 DIESEL ENGINE

SERVICE MANUAL
('07 EMISSIONS REGULATIONS)

JULY 2009
(REVISED)
5-113

MACK® MP8 DIESEL ENGINE SERVICE MANUAL ('07 EMISSIONS REGULATIONS)



JULY 2009
(REVISED — SUPERSEDES ISSUE DATED JANUARY 2009)

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. Note that illustrations and instructions are based on information that is subject to change as new engine/chassis development continues.

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INTRODUCTION

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

Danger *indicates an unsafe practice that could result in death or serious personal injury. Serious personal injury is considered to be permanent injury from which full recovery is NOT expected, resulting in a change in life style.*

⚠ WARNING

***Warning* indicates an unsafe practice that could result in personal injury. Personal injury means that the injury is of a temporary nature and that full recovery is expected.**

⚠ CAUTION

***Caution** indicates an unsafe practice that could result in damage to the product.*

NOTE

Note indicates a procedure, practice, or condition that must be followed in order for the vehicle or component to function in the manner intended.

SERVICE HINT

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

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.

⚠ DANGER

1. ***Before starting a vehicle, always be seated in the driver's seat, place the transmission in neutral, apply the parking brakes, and push in the clutch pedal. Failure to follow these instructions could produce unexpected vehicle movement, which can result in serious personal injury or death.***
2. ***Before working on a vehicle, place the transmission in neutral, set the parking brakes, and block the wheels. Failure to follow these instructions could produce unexpected vehicle movement, which can result in serious personal injury or death.***

⚠ 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.

⚠ DANGER

Do not work under a vehicle that is supported only by a hydraulic jack. The hydraulic jack could fail suddenly and unexpectedly, resulting in severe personal injury or death. Always use jackstands of adequate capacity to support the weight of the vehicle.

⚠ CAUTION

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.

REMEMBER,
SAFETY . . . IS NO ACCIDENT!

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.

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 **0**00 — GENERAL DATA

GROUP **1**00 — CHASSIS

GROUP **2**00 — ENGINE

GROUP **3**00 — CLUTCH, TRANSMISSION, TRANSFER CASE AND PTO

GROUP **4**00 — STEERING, AXLES, WHEELS AND TIRES, DRIVELINE

GROUP **5**00 — BRAKES, AUXILIARY SYSTEMS

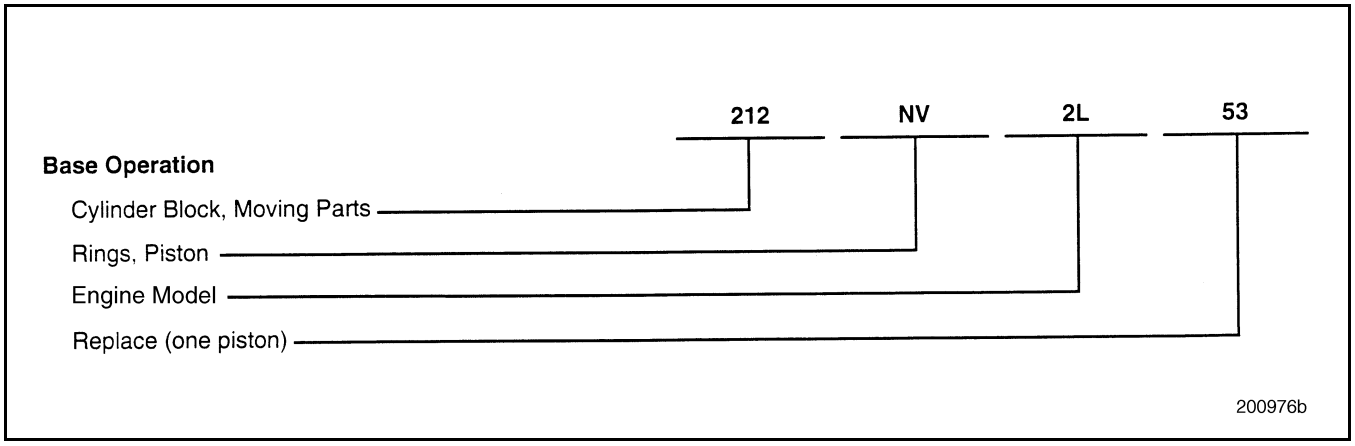
GROUP **6**00 — CAB, TRUCK BODY

GROUP **7**00 — 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.

Example:



Numerical Code

CONVERSION CHART

Conversion Units			Multiply By:
Length Calculations			
Inches (in)	to	Millimeters (mm)	25.40
Inches (in)	to	Centimeters (cm)	2.540
Feet (ft)	to	Centimeters (cm)	30.48
Feet (ft)	to	Meters (m)	0.3048
Yards (yd)	to	Centimeters (cm)	91.44
Yards (yd)	to	Meters (m)	0.9144
Miles	to	Kilometers (km)	1.609
Millimeters (mm)	to	Inches (in)	0.03937
Centimeters (cm)	to	Inches (in)	0.3937
Centimeters (cm)	to	Feet (ft)	0.0328
Centimeters (cm)	to	Yards (yd)	0.0109
Meters (m)	to	Feet (ft)	3.281
Meters (m)	to	Yards (yd)	1.094
Kilometers (km)	to	Miles	0.6214
Area Calculations			
Square Inches (sq-in)	to	Square Millimeters (sq-mm)	645.2
Square Inches (sq-in)	to	Square Centimeters (sq-cm)	6.452
Square Feet (sq-ft)	to	Square Centimeters (sq-cm)	929.0
Square Feet (sq-ft)	to	Square Meters (sq-m)	0.0929
Square Yards (sq-yd)	to	Square Meters (sq-m)	0.8361
Square Miles (sq-miles)	to	Square Kilometers (sq-km)	2.590
Square Millimeters (sq-mm)	to	Square Inches (sq-in)	0.00155
Square Centimeters (sq-cm)	to	Square Inches (sq-in)	0.155
Square Centimeters (sq-cm)	to	Square Feet (sq-ft)	0.001076
Square Meters (sq-m)	to	Square Feet (sq-ft)	10.76
Square Meters (sq-m)	to	Square Yards (sq-yd)	1.196
Square Kilometers (sq-km)	to	Square Miles (sq-miles)	0.3861
Volume Calculations			
Cubic Inches (cu-in)	to	Cubic Centimeters (cu-cm)	16.387
Cubic Inches (cu-in)	to	Liters (L)	0.01639
Quarts (qt)	to	Liters (L)	0.9464
Gallons (gal)	to	Liters (L)	3.7854
Cubic Yards (cu-yd)	to	Cubic Meters (cu-m)	0.7646
Cubic Centimeters (cu-cm)	to	Cubic Inches (cu-in)	0.06102
Liters (L)	to	Cubic Inches (cu-in)	61.024
Liters (L)	to	Quarts (qt)	1.0567
Liters (L)	to	Gallons (gal)	0.2642
Cubic Meters (cu-m)	to	Cubic Yards (cu-yd)	1.308

Conversion Units			Multiply By:
Weight Calculations			
Ounces (oz)	to	Grams (g)	28.5714
Pounds (lb)	to	Kilograms (kg)	0.4536
Pounds (lb)	to	Short Tons (US tons)	0.0005
Pounds (lb)	to	Metric Tons (t)	0.00045
Short Tons (US tons)	to	Pounds (lb)	2000
Short Tons (US tons)	to	Kilograms (kg)	907.18486
Short Tons (US tons)	to	Metric Tons (t)	0.90718
Grams (g)	to	Ounces (oz)	0.035
Kilograms (kg)	to	Pounds (lb)	2.205
Kilograms (kg)	to	Short Tons (US tons)	0.001102
Kilograms (kg)	to	Metric Tons (t)	0.001
Metric Tons (t)	to	Pounds (lb)	2205
Metric Tons (t)	to	Short Tons (US tons)	1.1023
Metric Tons (t)	to	Kilograms (kg)	1000
Force Calculations			
Ounces Force (ozf)	to	Newtons (N)	0.2780
Pounds Force (lbf)	to	Newtons (N)	4.448
Pounds Force (lbf)	to	Kilograms Force (kgf)	0.456
Kilograms Force (kgf)	to	Pounds Force (lbf)	2.2046
Kilograms Force (kgf)	to	Newtons (N)	9.807
Newtons (N)	to	Kilograms Force (kgf)	0.10196
Newtons (N)	to	Ounces Force (ozf)	3.597
Newtons (N)	to	Pounds Force (lbf)	0.2248
Torque Calculations			
Pound Inches (lb-in)	to	Newton Meters (N•m)	0.11298
Pound Feet (lb-ft)	to	Newton Meters (N•m)	1.3558
Pound Feet (lb-ft)	to	Kilograms Force per Meter (kgfm)	0.13825
Newton Meters (N•m)	to	Pound Inches (lb-in)	8.851
Newton Meters (N•m)	to	Pound Feet (lb-ft)	0.7376
Newton Meters (N•m)	to	Kilograms Force per Meter (kgfm)	0.10197
Kilograms Force per Meter (kgfm)	to	Pound Feet (lb-ft)	7.233
Kilograms Force per Meter (kgfm)	to	Newton Meters (N•m)	9.807
Radiator Specific Heat Dissipation Calculations			
British Thermal Unit per Hour (BTU/hr)	to	Kilowatt per Degree Celsius (kW/°C)	0.000293
Kilowatt per Degree Celsius (kW/°C)	to	British Thermal Unit per Hour (BTU/hr)	3414.43
Temperature Calculations			
Degrees Fahrenheit (°F)	to	Degrees Celsius (°C)	(°F – 32) x 0.556
Degrees Celsius (°C)	to	Degrees Fahrenheit (°F)	(1.8 x °C) + 32

Conversion Units			Multiply By:
Pressure Calculations			
Atmospheres (atm)	to	Bars (bar)	1.01325
Atmospheres (atm)	to	Kilopascals (kPa)	101.325
Bars (bar)	to	Atmospheres (atm)	0.98692
Bars (bar)	to	Kilopascals (kPa)	100
Bar (bar)	to	Pounds per Square Inch (psi)	14.5037
Inches of Mercury (in Hg)	to	Kilopascals (kPa)	3.377
Inches of Water (in H2O)	to	Kilopascals (kPa)	0.2491
Pounds per Square Inch (psi)	to	Kilopascals (kPa)	6.895
Pounds per Square Inch (psi)	to	Bar (bar)	0.06895
Kilopascals (kPa)	to	Atmospheres (atm)	0.00987
Kilopascals (kPa)	to	Inches of Mercury (in Hg)	0.29612
Kilopascals (kPa)	to	Inches of Water (in H2O)	4.01445
Kilopascals (kPa)	to	Pounds per Square Inch (psi)	0.145
Power Calculations			
Horsepower (hp)	to	Kilowatts (kW)	0.74627
Kilowatts (kW)	to	Horsepower (hp)	1.34
Fuel Performance Calculations			
Miles per Gallon (mile/gal)	to	Kilometers per Liter (km/L)	0.4251
Kilometers per Liter (km/L)	to	Miles per Gallon (mile/gal)	2.352
Velocity Calculations			
Miles per Hour (mile/hr)	to	Kilometers per Hour (km/hr)	1.609
Kilometers per Hour (km/hr)	to	Miles per Hour (mile/hr)	0.6214
Volume Flow Calculations			
Cubic Feet per Minute (cu-ft/min)	to	Liters per Minute (L/min)	28.32
Liters per Minute (L/min)	to	Cubic Feet per Minute (cu-ft/min)	0.03531

ABOUT THE MACK MP8 ENGINE [200 EA]

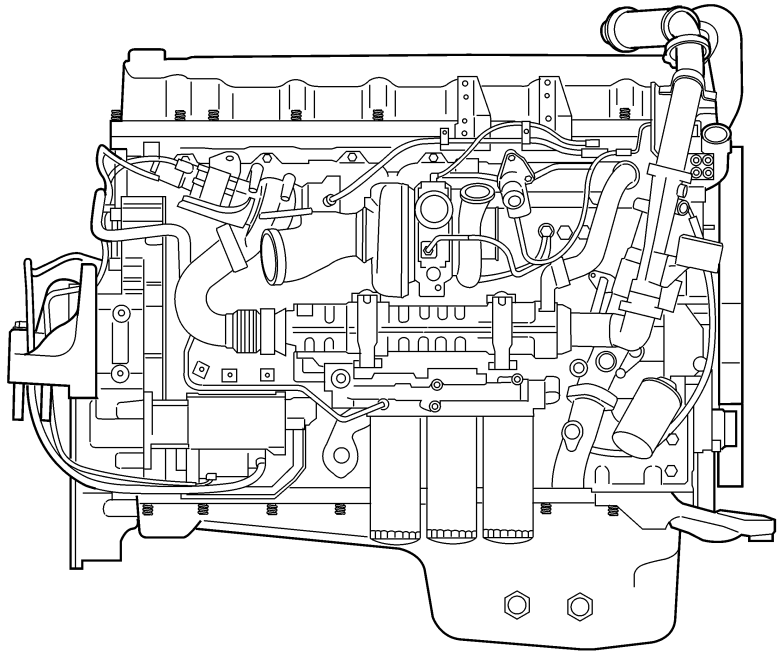


Figure 1 — MACK MP8 Engine — for Conventional Chassis

The MACK MP8 is a 13 liter (800 CID) engine with electronic unit injectors, a cooled Exhaust Gas Recirculation (EGR) system, a Diesel Particulate Filter (DPF) system and the Holset Variable Geometry Turbocharger (VGT). The PowerLeash™ engine brake is optional. The engine conforms to year 2007 Environmental Protection Agency (EPA) requirements.

The MP8 EGR system features reduced restriction plus enhanced efficiency and reliability. Its venturi system is easy to service.

A DPF system requires elevated exhaust temperatures. The system uses a diesel oxidation catalyst, a diesel particulate filter and in-line reheating of the exhaust gases. The DPF system removes Particulate Matter (PM) from the exhaust to conform to the 2007 EPA regulations.

The Holset VGT features fixed vanes with a sliding nozzle ring. The nozzle position is infinitely variable between open and closed. This design reacts quickly to exhaust pressure and controls inlet pressure more precisely. Reliability is enhanced by having fewer moving parts. Its actuator and bearing housing are water cooled and engine oil lubricated for greater durability.

A wide range of the current transmission offerings, including manual, automated manual and automatic, can be teamed with the MP8.

Diagnostic help can be found in the Tech Tool. To obtain the Tech Tool, contact your local MACK dealer.

The engine weighs approximately 1160 kg (2560 lb.) dry (with air compressor, without oil, coolant, starter, fan, alternator and clutch). Its design includes a one-piece cylinder head, a single overhead camshaft, three rocker arms per cylinder, unit injectors and no pushrods. PowerLeash™ engine braking, requiring a fourth rocker arm, is optional. Monosteel™ steel pistons are made in one piece.

⚠ DANGER

Use of ether or similar types of starting aids in MACK® US07 emission compliant engines is strictly prohibited. This applies to engines with or without the electric pre-heater option. An explosion could occur. Failure to heed this danger may result in severe personal injury or death.

Two optional fan drives are available: On/Off and electronically actuated. The electronically actuated viscous fan drive is precisely controlled by the Engine Electronic Control Unit (EECU).

Timing gears mount on the rear of the MP8 improving the flow of cooling air around the front. Special service instructions apply to the camshaft position sensor. The mounting plate, idler and camshaft gears are marked to facilitate proper installation. The air compressor drive gear meshes with the double idler instead of the auxiliary idler as on the MP7 engine.

Another feature of the MP8 is the rear engine power take-off (REPTO-ready) that is gear driven through the timing gear train. An optional PTO with drive gear, bearing and housing can be added at the factory.

The rocker arm shaft is held in place by camshaft bearing capscrews. There are special instructions for installing the camshaft bearing caps and the rocker arm shaft during service.

A stiffener plate fastens to the bottom of the cylinder block to ensure block strength and rigidity. The engine can be used with axle forward or axle back vehicles by virtue of optional oil pans. The engine fan is mounted high or low depending on vehicle configuration.

The MP8 uses unit injectors. The unit injector incorporates the pump, valve and injector. Its internal solenoids permit fast, precise control of fuel delivery into the cylinder. The unit injectors are encased by the valve cover and not exposed to the heat of exhaust system components.

Fuel passes through two filters, one of which separates water from the fuel. High-pressure fuel in the unit injectors is created via the rocker arms with roller followers in constant, direct contact with the cams.

Replacing injectors requires a specific procedure, and installation requires that the EECU be programmed to recognize replacement injectors. Cleaning injector bores requires a special tool.

An engine compression brake option on the MP8 engine assists deceleration and braking. The operation of the brake differs from earlier engine models. Working in conjunction with the exhaust cycle, the brake requires a camshaft with four cams per cylinder, two rocker arms for the exhaust valve, a bridge over the two exhaust valves, an electronic control valve and a wiring harness that includes the control valve. The exhaust valves are adjusted with shims.

Unique colors and the appearance of the valve cover, filters and logo labels distinguish the MP8 from other engines in the MACK line.

Preventive maintenance is important to get the most from the MACK MP8 engine and to ensure many years of reliable, trouble-free operation. Refer to the current TS494 Maintenance and Lubrication manual for schedules and specifications.

Repair instructions in this manual deal with removal, installation, disassembly, assembly, setup and adjustments of MP8 components.

There are restrictions concerning the reuse of certain fasteners. Refer to current specifications bulletins and the **SPECIFICATIONS** section of this manual for detailed information.

Service Precautions Summary

Following is a summary list of the DO and DON'T issues applying to MP8 engine service.

1. DO NOT machine the cylinder head for clean-up since this will change injector depth, thereby affecting emissions. It will also upset the ability to correctly adjust timing gear backlash.
2. DO NOT grind the injector copper sleeves.
3. Install the crankshaft main bearing caps according to marked assembly number.
4. Connecting rod caps MUST BE mated to their respective connecting rods due to the "fractured manufacturing" process used. Also, the rod caps can be installed only one way because of the difference in spacing between screw holes at each side of the cap.
5. DO NOT use the lifting eye on the flywheel housing when tilting the engine/transmission assembly to an angle greater than 15 degrees.
6. Cylinder head installation requires lowering the head onto the gasket using the alignment screws and washers at the sides of the head and block. The head must be pulled back to the mounting plate using screws inserted through the plate. Pressed bosses in the gasket keep the head from making full contact with the gasket surface and prevent damage to the elastomer sealing rings as the head slides into position.

⚠ DANGER

Use of ether or similar types of starting aids in MACK® US07 emission compliant engines is strictly prohibited. This applies to engines with or without the electric pre-heater option. An explosion could occur. Failure to heed this danger may result in severe personal injury or death.

7. The MP8 engine uses a number of O-rings for sealing various fluid joints and tubes. It is essential that **new** O-rings of the correct material be used whenever joints are disassembled and reassembled.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