

MACK® MP7 DIESEL ENGINE

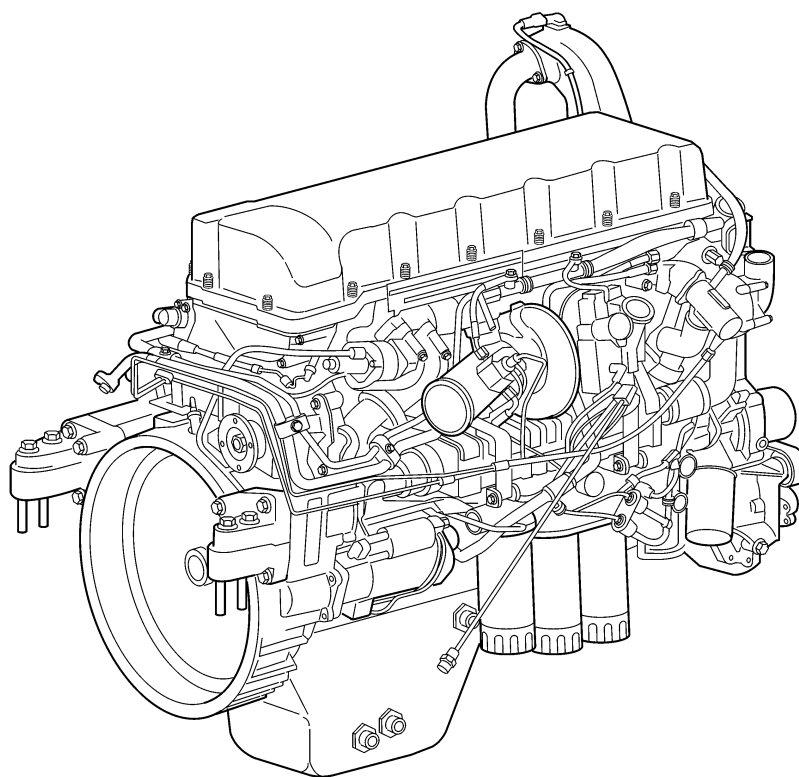
SERVICE MANUAL (’07 EMISSIONS REGULATIONS)



JULY 2009
(REVISED)
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MACK® MP7 DIESEL ENGINE SERVICE MANUAL ('07 EMISSIONS REGULATIONS)



JULY 2009
(REVISED — SUPERSEDES ISSUE DATED JANUARY 2009)

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ENGINE 5-114



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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NOTES



INTRODUCTION

INTRODUCTION



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.



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.

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!**



INTRODUCTION

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

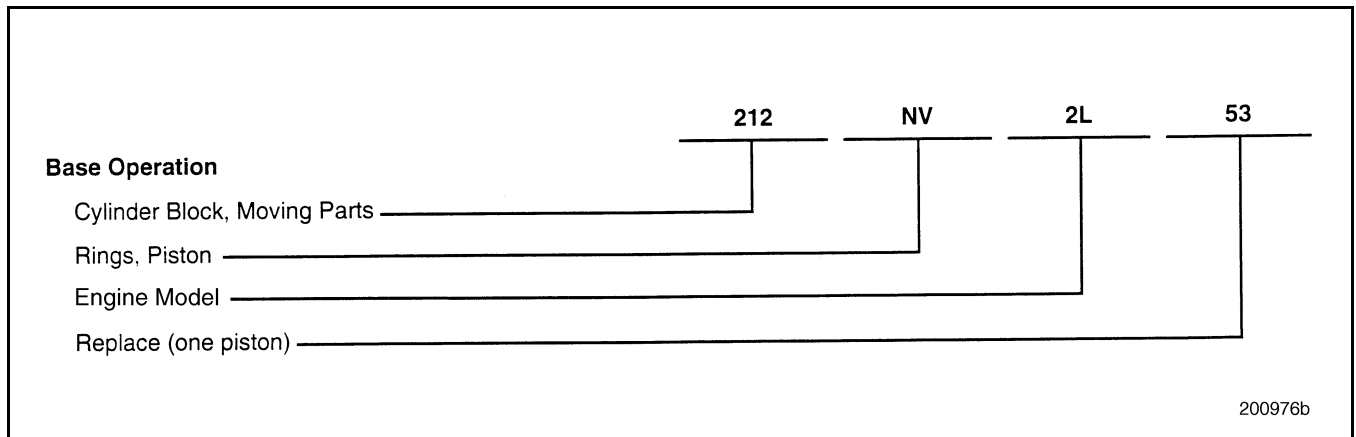
GROUP 600 — CAB, TRUCK BODY

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.

Example:



Numerical Code



INTRODUCTION

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



INTRODUCTION

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)	$(^{\circ}\text{F} - 32) \times 0.556$
Degrees Celsius (°C)	to	Degrees Fahrenheit (°F)	$(1.8 \times ^{\circ}\text{C}) + 32$



INTRODUCTION

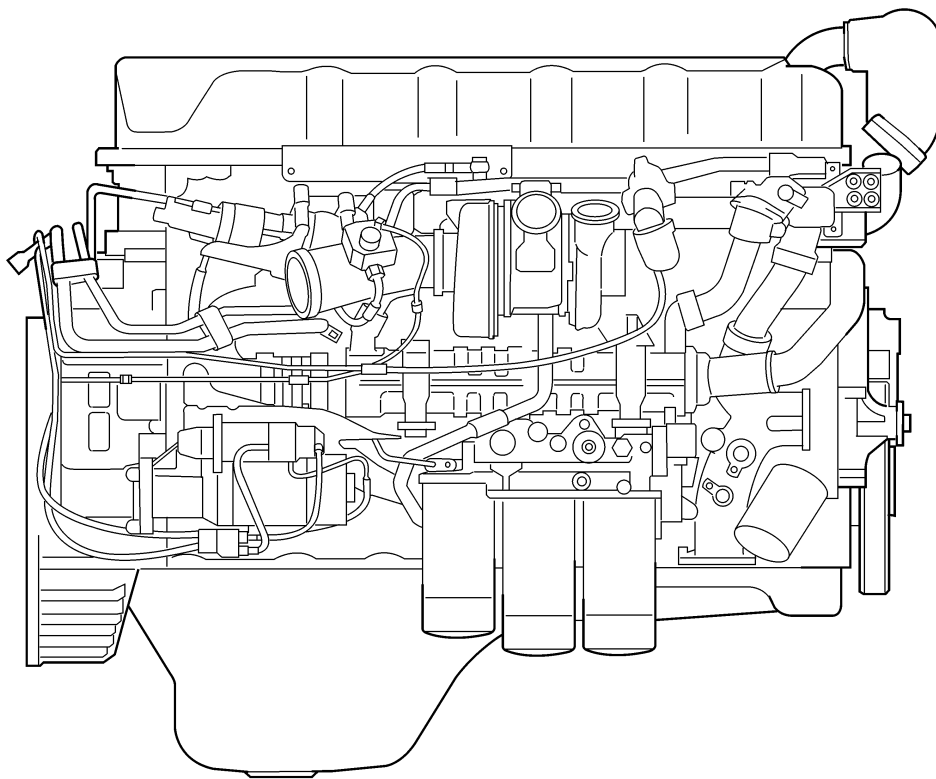
Conversion Units			Multiply By:
Pressure Calculations			
Atmospheres (atm)	to	Bars (bar)	1.01325
Atmospheres (atm)	to	Kilopascals (kPa)	101.325
Bars (bar)	to	Atmospheres (atm)	0.98692
Bars (bar)	to	Kilopascals (kPa)	100
Bar (bar)	to	Pounds per Square Inch (psi)	14.5037
Inches of Mercury (in Hg)	to	Kilopascals (kPa)	3.377
Inches of Water (in H ₂ O)	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 H ₂ O)	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



INTRODUCTION

ABOUT THE MACK MP7 ENGINE [200 EA]

The MACK MP7 is a 700 CID (11 liter) engine with unit injectors, a cooled Exhaust Gas Recirculation (EGR) system and the Holset Variable Geometry Turbocharger (VGT). With the addition of a Diesel Particulate Filter (DPF) system and changes in the EGR system, the design now conforms to year 2007 Environmental Protection Agency (EPA) requirements.

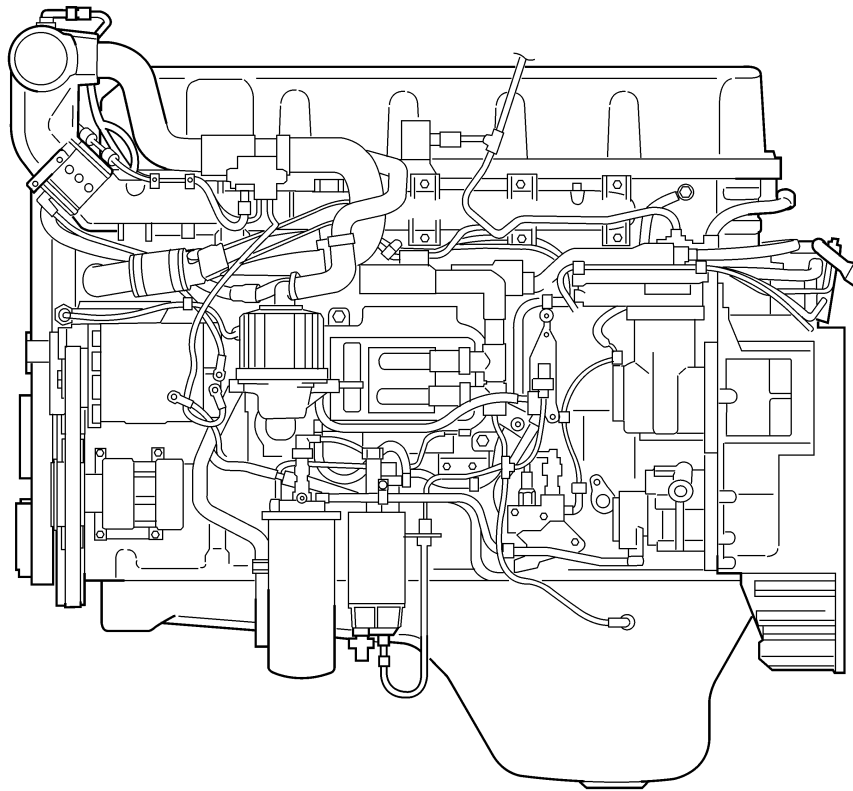


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Figure 1 — MP7 Right Side View — Conventional Chassis



INTRODUCTION

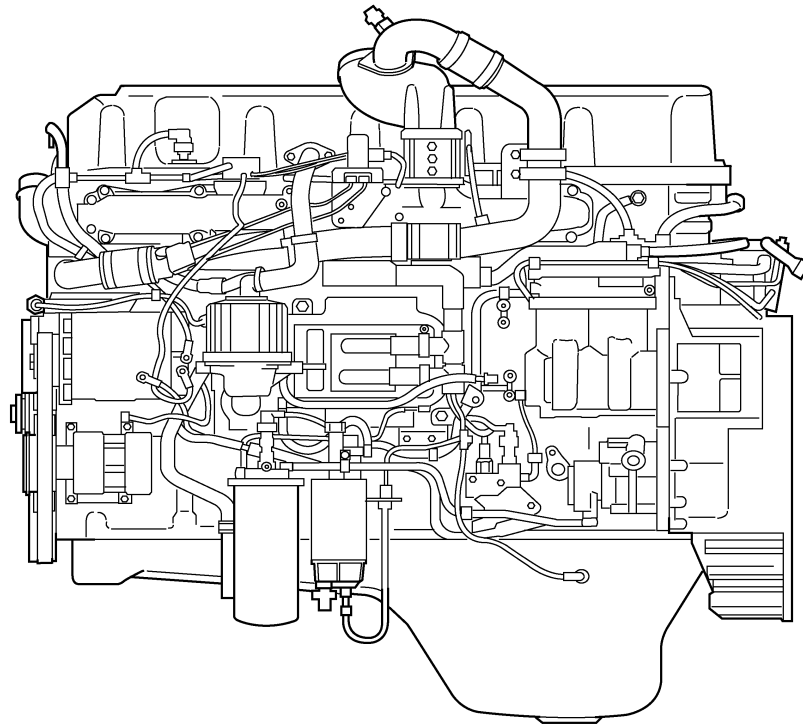


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Figure 2 — MP7 Left Side View — Conventional Chassis



INTRODUCTION



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Figure 3 — MP7 Left Side View — Low Cab Forward (LCF) Chassis

Exhaust Gas Recirculation — 2007

There are two configurations of the new EGR system. For engines installed on conventional chassis, the EGR mixer attaches to the inlet manifold at the top front of the engine. For low cab forward (LCF) chassis, the mixer attaches toward the rear of the inlet manifold. The right side views of the engines are nearly identical. The left side views display the arrangement of components that accommodate the two configurations.

The new MP7 EGR system features a venturi with Delta Pressure sensors. The MASS flow tube has been replaced. The new combination is easy to service.

Variable Geometry Turbocharger

The Holset Variable Geometry Turbocharger (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.



INTRODUCTION

Three Engine Families — Nine Peak Power Options

There are six different power ratings:

- 242 kW (325 hp)
- 257 kW (345 hp)
- 265 kW (355 hp)
- 272 kW (365 hp)
- 295 kW (395 hp)
- 302 kW (405 hp)

Maximum torque ratings fall in the 1700–2115 N•m (1200–1560 lb-ft) range.

The MP7 comes in three families: Econodyne™, MaxiCruise™ and Maxidyne™. Each family has three peak power options. The number after MP7 is the peak power achieved at 1500 rpm. MACK places heavy emphasis on the peak power value. Operators should cruise at approximately 1500 rpm when practical.

Econodyne (Highway Economy)	MaxiCruise (On/Off Road Performance)	Maxidyne (Off Road Performance)
MP7-325E MP7-355E MP7-405E	MP7-345C MP7-365C MP7-395C	MP7-325M MP7-365M MP7-405M

A wide range of the current transmission offerings, especially Allison, can be teamed with the MP7. No new transmissions are required, but the MP7 will readily adapt to the Allison GEN 4 Series transmissions.

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

The engine design includes a one-piece cylinder head, a single overhead camshaft, unit injectors and no pushrods. PowerLeash™ engine braking is standard. 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.

There is a cylinder block (coolant) heater in the cooling duct cover. Two optional fan drives are available: On/Off and electronically actuated. The electronically actuated viscous fan drive is precisely controlled by the Engine Management System (EMS) module, commonly referred to as the Engine Electronic Control Unit (EECU).

Timing gears mount on the rear of the MP7 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.

Another feature of the MP7 is the rear engine power take-off (REPTO-ready) that is gear driven through the timing gear train. An optional PTO shaft with drive gear, bearing and housing can be added at the factory. A front engine power take-off is available for simple attachment.

The engine has one-piece forged steel Monosteel™ pistons and wet cylinder liners. Piston rings are coated using a process called Physical Vapor Deposition (PVD) to provide a thin, well adhered material layer for better cylinder cooling and longer ring and liner life.

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. A heater is available to warm the oil before starting the engine.

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Thank you very much!

Have questions.

Please write to me.

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