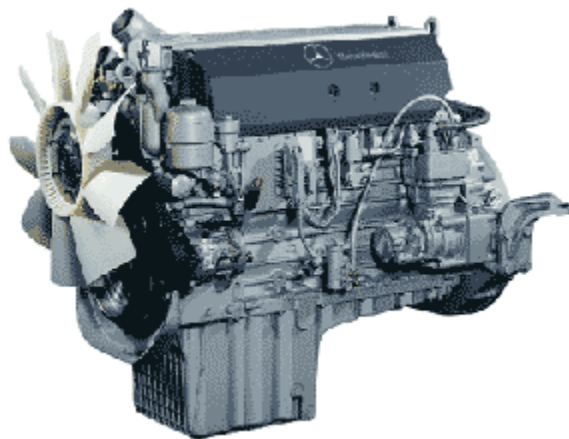


MBE 900 SERVICE MANUAL - 6SE414



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GENERAL INFORMATION

SCOPE AND USE OF THIS MANUAL

This manual contains complete instructions on operation, adjustments (including valve lash), preventive maintenance, and repair (including complete overhaul) for the MBE 900 engine. This manual was written primarily for persons servicing and overhauling the engine. In addition, this manual contains all of the instructions essential to the operators and users. Basic maintenance and overhaul procedures are common to all MBE 900 engines, and apply to all engine models.

This manual is divided into numbered sections. Section one covers the engine (less major assemblies). The remaining sections cover a complete system such as the fuel system, lubrication system, or air system. Each section is divided into subsections which contain complete maintenance and operating instructions for a specific engine subassembly. Each section begins with a table of contents. Pages and illustrations are numbered consecutively within each section.

Information can be located by using the table of contents at the front of the manual or the table of contents at the beginning of each section. Information on specific subassemblies or accessories within the major section is listed immediately following the section title.

GENERAL DESCRIPTION

The MBE 900 engine described in this manual is a water-cooled, four-stroke, direct-injection diesel engine. The cylinders are arranged inline on both the 6-cylinder and 4-cylinder models. Each has a separate fuel injection pump (unit pump) with a short injection line to the injection nozzle, which is located in the center of the combustion chamber. The unit pumps are attached to the crankcase and are driven from the camshaft. Each cylinder has two intake valves and one exhaust valve.

Charge-air cooling and an exhaust gas turbocharger are standard equipment on all MBE 900 engines (wastegate turbochargers are optional).

The engine has a fully electronic control system, which regulates the fuel injection quantity and timing using solenoid valves, providing extremely low-emission operation. The control system consists of an engine-resident pump and nozzle control unit (DDEC-ECU) and a vehicle control unit (DDEC-VCU). The two are connected by a proprietary datalink.

Engine braking is controlled by a pneumatically-operated exhaust brake on the turbocharger and by a constant-throttle system (optional).

The cylinder block has integrated oil and water channels. The upper section of the cylinder bore is induction-hardened. The single-piece cylinder head is made of cast iron. The cylinder head gasket is a three-layer, adjustment-free seal with Viton sealing elements.

The pistons are made of aluminum alloy with a shallow combustion chamber recess. The pistons are cooled by oil spray nozzles.

The crankshaft is precision-forged with seven main bearings (five on the 4-cylinder engine), six of which have custom-forged counterweights (four on the 4-cylinder engine), and a vibration damper at the front end.

The camshaft is made of induction-hardened steel and has seven main bearings (five on the 4-cylinder engine). Each cylinder has cams for intake and exhaust valves and a unit pump. The valves are controlled by mushroom tappets, pushrods, and rocker arms. The intake valves are opened and closed by a valve-guided bridge.

There is a force-feed lubricating oil circuit supplied by a rotary oil pump. This pump is positioned at the front of the crankcase and driven by gears from the crankshaft. The oil cooler is located near the front of the crankcase on the right-hand side near the turbocharger.

The gear-type fuel pump is bolted to the front of the crankcase. The pump is driven from the forward end of the camshaft.

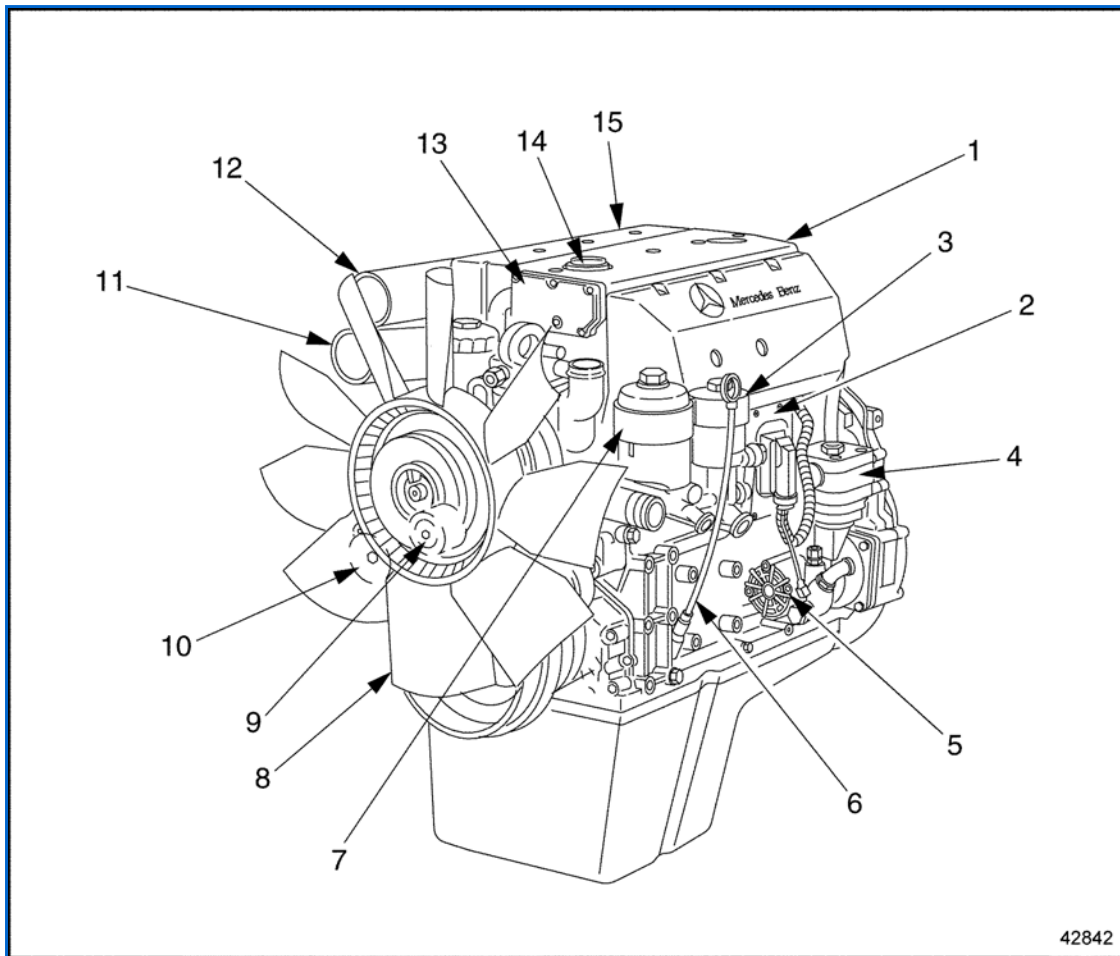
The air compressor, with a power-steering pump attached, is driven by a gear on the camshaft (optional).

The vehicle is cooled by a closed system using recirculated coolant; temperature is regulated automatically by a thermostat (two thermostats on the 6-cylinder engine).

The alternator and coolant pump (and other accessories) are driven by a belt with automatic belt tensioner. Electrical equipment includes a starter and an alternator.

GENERAL SPECIFICATIONS AND ENGINE VIEWS

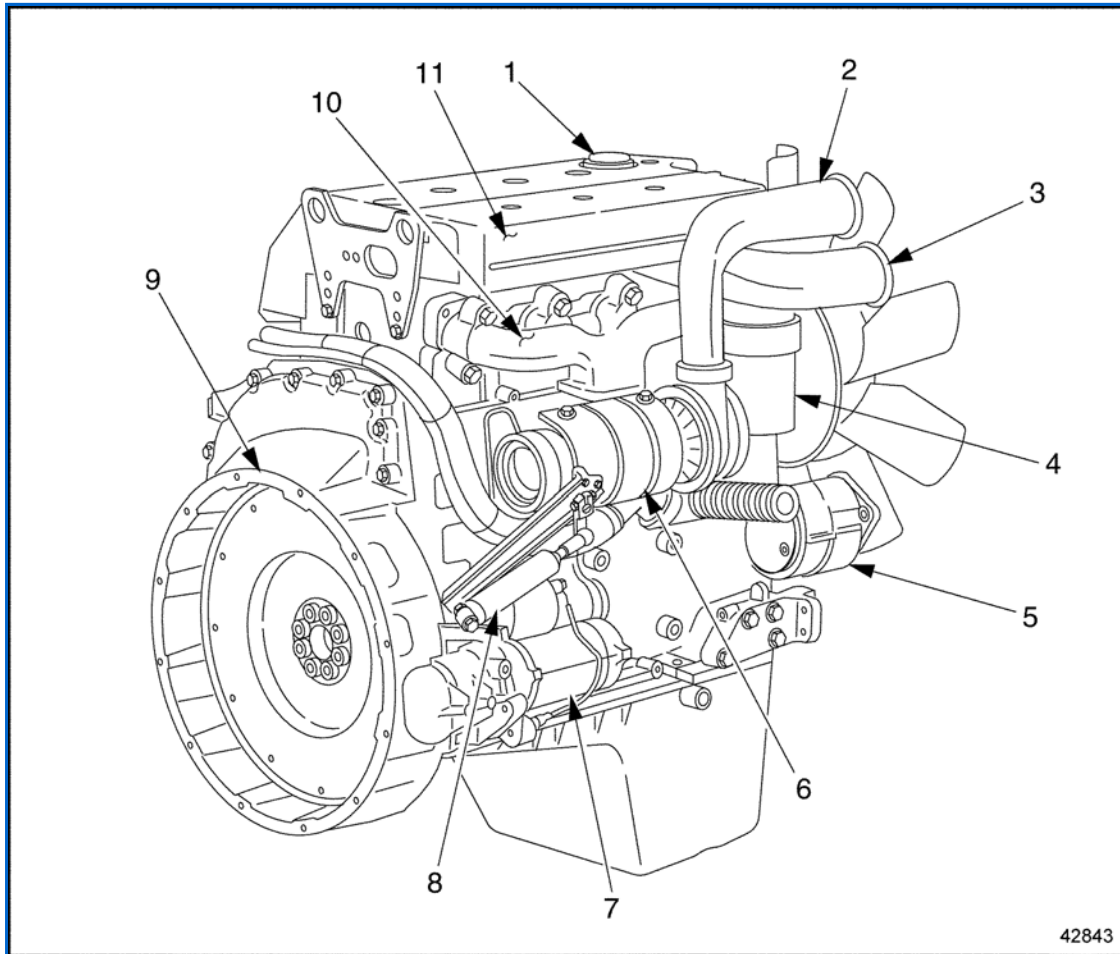
For a general view of the MBE 900 4-cylinder engine, showing major components, [see Figure 42842](#) for the left-hand side, and [see Figure 42843](#) for the right-hand side.



1. Cylinder Head Cover	9. Belt Tensioner (behind fan)
2. DDEC-ECU Control Unit	10. Alternator Pulley (behind fan)
3. Fuel Pre-Filter	11. Intake Manifold Inlet

4. Air Compressor (optional)	12. Turbo Compressor Outlet
5. Power Steering Pump	13. Crankcase Breather (oil separator)
6. Oil Dipstick	14. Oil Fill Cap
7. Fuel Filter	15. Intake Manifold
8. Fan	

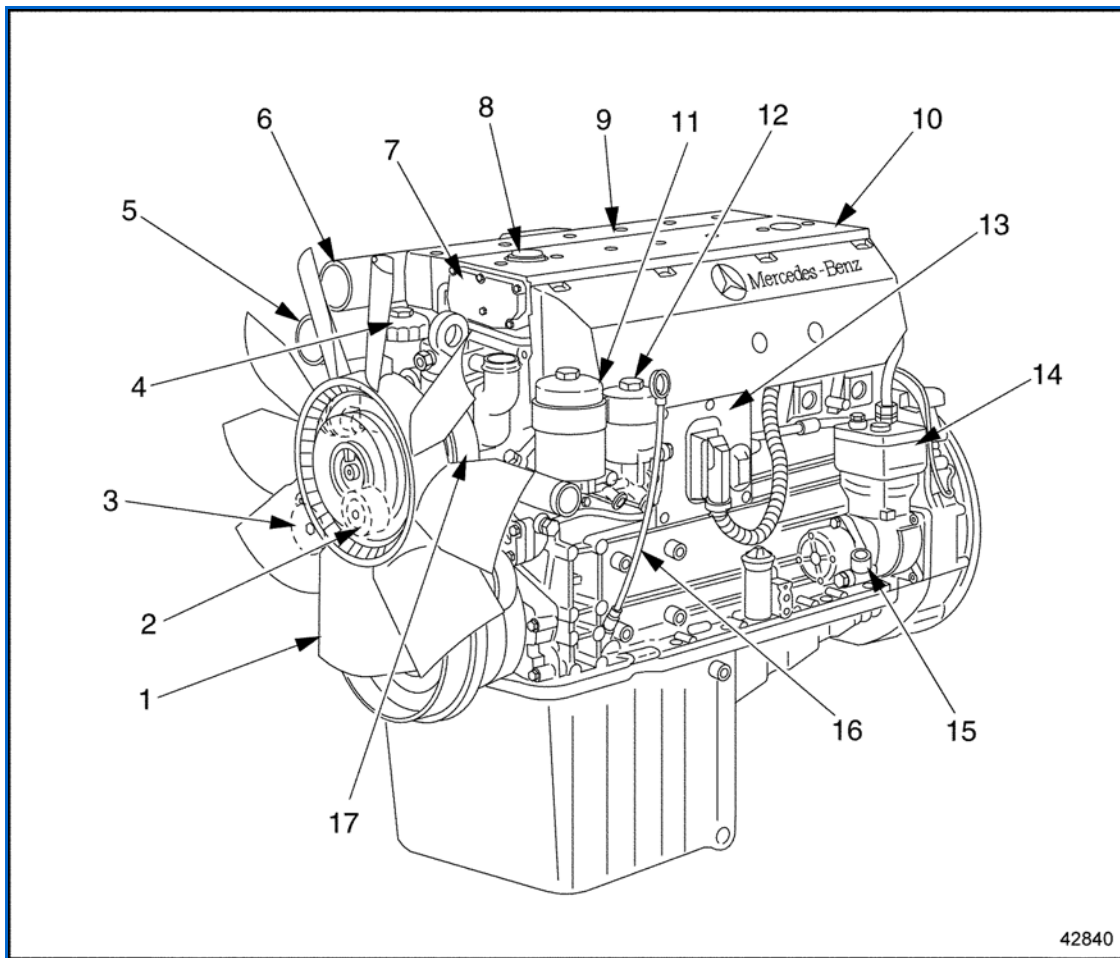
Left Side, 4-Cylinder Engine



1. Oil Fill Cap	7. Starter Motor
2. Turbo Compressor Outlet	8. Exhaust Brake (optional)
3. Intake Manifold Inlet	9. Flywheel Housing
4. Oil Filter	10. Exhaust Manifold
5. Alternator	11. Intake Manifold
6. Turbocharger	

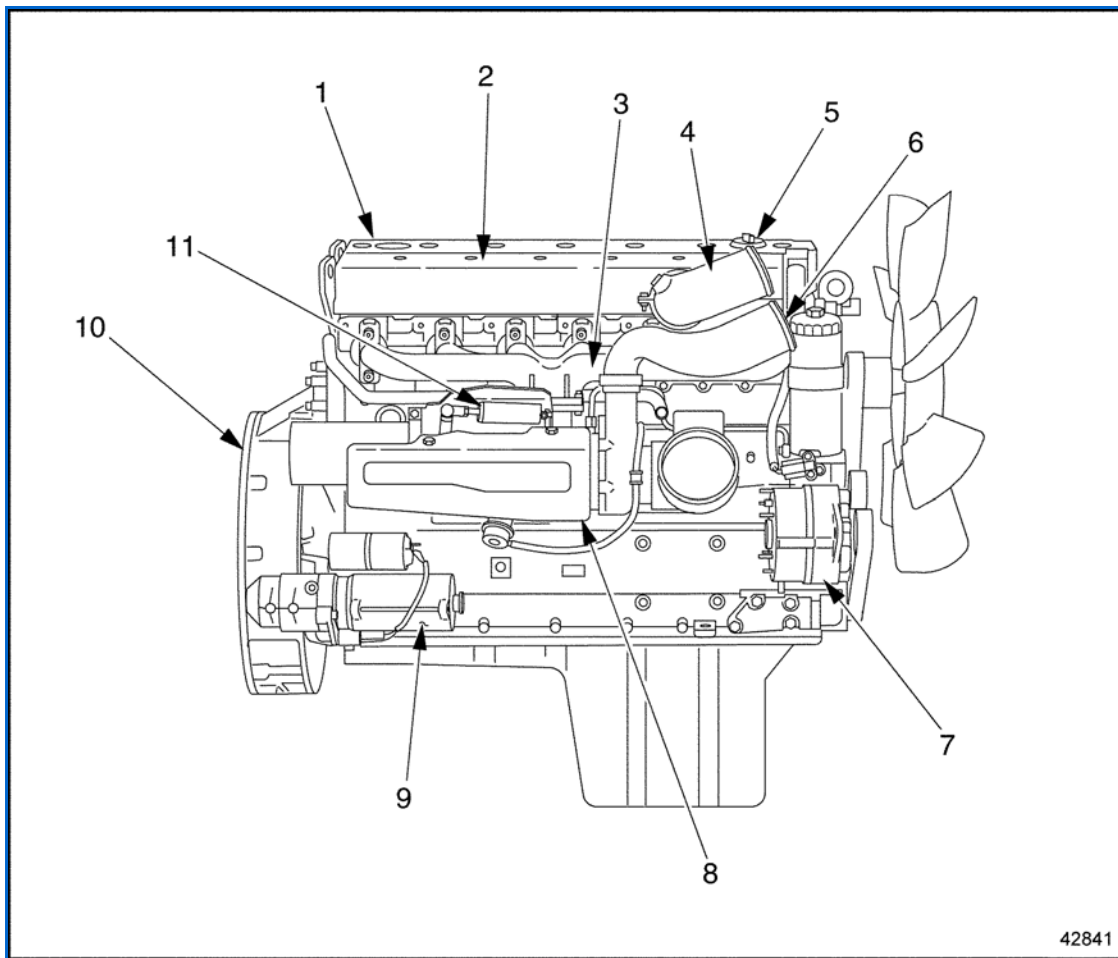
Right Side, 4-Cylinder Engine

For a general view of the MBE 900 6-cylinder engine, showing major components, [see Figure 42840](#) for the left-hand side, and [see Figure 42841](#) for the right-hand side.



1. Fan	10. Cylinder Head Cover
2. Belt Tensioner (behind fan)	11. Fuel Filter
3. Alternator Pulley (behind fan)	12. Fuel Pre-Filter
4. Oil Filter	13. DDEC-ECU Control Unit
5. Turbo Compressor Outlet	14. Air Compressor (optional)
6. Intake Manifold Inlet	15. Power Steering Pump
7. Crankcase Breather (oil separator)	16. Oil Dipstick
8. Oil Fill Cap	17. Coolant Pump Pulley
9. Intake Manifold	

Left Side, 6-Cylinder Engine



1. Cylinder Head Cover	7. Alternator
2. Intake Manifold	8. Turbocharger
3. Exhaust Manifold	9. Starter Motor
4. Intake Manifold Inlet	10. Flywheel Housing
5. Oil Fill Cap	11. Exhaust Brake (optional)
6. Turbo Compressor Outlet	

Right Side, 6-Cylinder Engine

The general specifications for the MBE 900 NON-EGR engines are [listed in Table .](#)

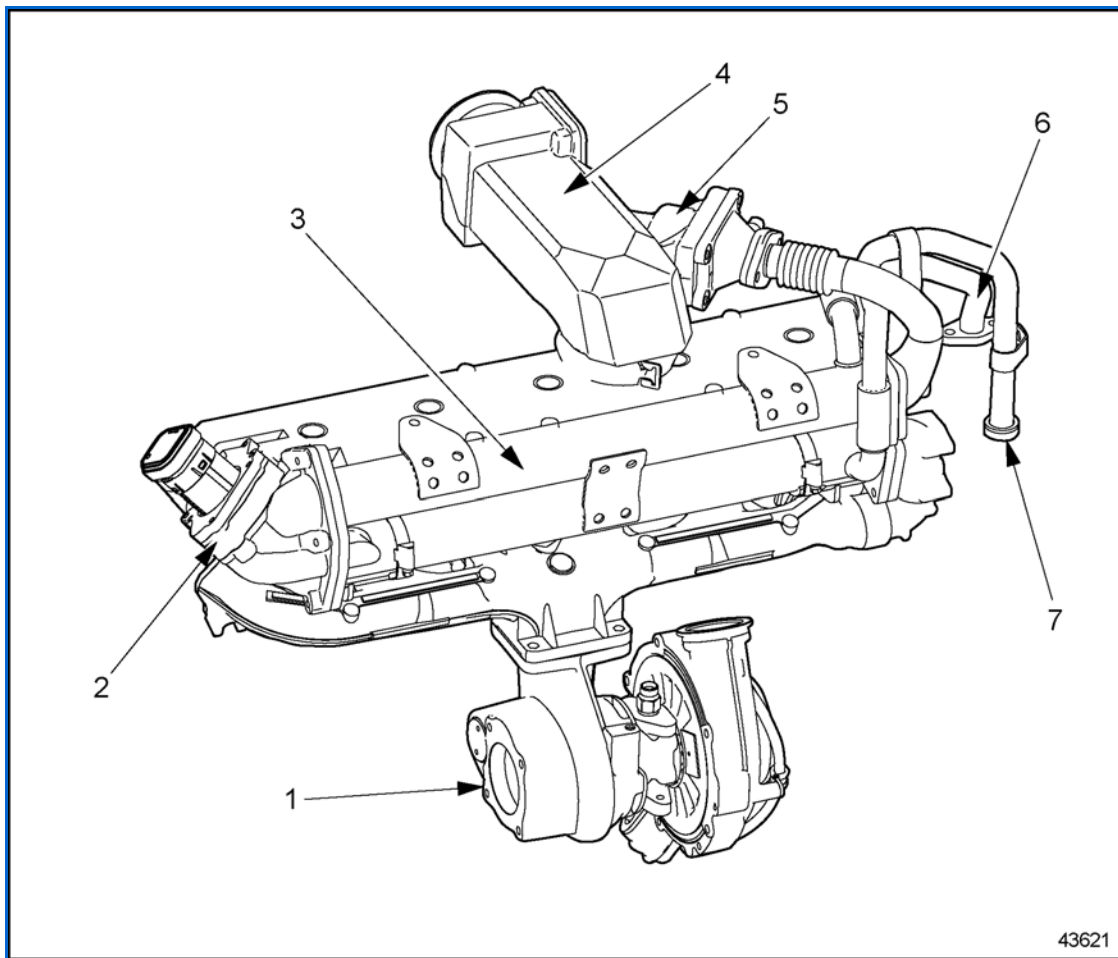
Description	4-Cylinder Engines	6-Cylinder Engines
Engine Type	Vertical, inline cylinder block with turbocharger and charge-air cooler	
Cooling System	Liquid Circuit	
Combustion Principle	4-Stroke direct-injection diesel	
Number of Cylinders	4	6
Bore	102 mm (4.02 in)	
Stroke	130 mm (5.11 in)	

Displacement (total)	4.25 liters (259 in ³)	6.37 liters (389 in ³)
Compression Ratio	17.4:1	
Starting Speed	Approximately 100 rpm	
Direction of Engine Rotation (viewed from flywheel)	Counterclockwise	
Starter	Electric Motor	
Coolant Capacity of Engine (Does not include capacity of cooling system.)	Max. 8.5 liters (9.0 qt.)	Max. 12.5 liters (13.2 qt.)
Lubricating Oil (In standard pan, including oil filter.)	Max. 15.8 liters (17.0 qt.)	Max. 25.0 liters (26.4 qt.)
Cold-Start Temperature Limit (Without starting aids and with battery 75 percent charged)	Down to - 20 ° C (- 4 ° F)	
Engine "Dry" Weight	395 kg (871 lb)	530 kg (1169 lb)
Valve Lash (with engine cool)	Intake = 0.40 mm (0.016 in)	
	Exhaust = 0.60 mm (0.024 in)	
Valve Lift (at maximum valve clearance)	Intake = 9.7 mm (0.38 in)	
	Exhaust = 10.7 mm (0.42 in)	
Engine Oil Pressure	At idle rpm = 50 kPa (7 psi)	
	At maximum rpm = 250 kPa (36 psi)	
Fuel Injectors	Minimum opening pressure = 24 500 kPa (3553 psi)	
	Maximum opening pressure = 25 700 kPa (3727 psi)	
Coolant Thermostat	Opening temperature = 81 ° to 85 ° C (178 ° to 185 ° F)	
	Normal operating temperature = 95 ° C (203 ° F)	

General Technical Information

GENERAL DESCRIPTION OF MBE 900 EGR SYSTEM AND ENGINE VIEWS

The purpose of the Exhaust Gas Recirculation (EGR) System is to reduce engine exhaust gas emissions in accordance with EPA regulations. [See Figure 43621 , , , , and](#) for EGR component locations.



1. Turbocharger	5. Reed Valves (Models 904, 924 and 926)
2. EGR Rotary Valve	6. Water Return Line
3. EGR Cooler	7. Water Inlet Line.
4. EGR Cool Air Mixer	

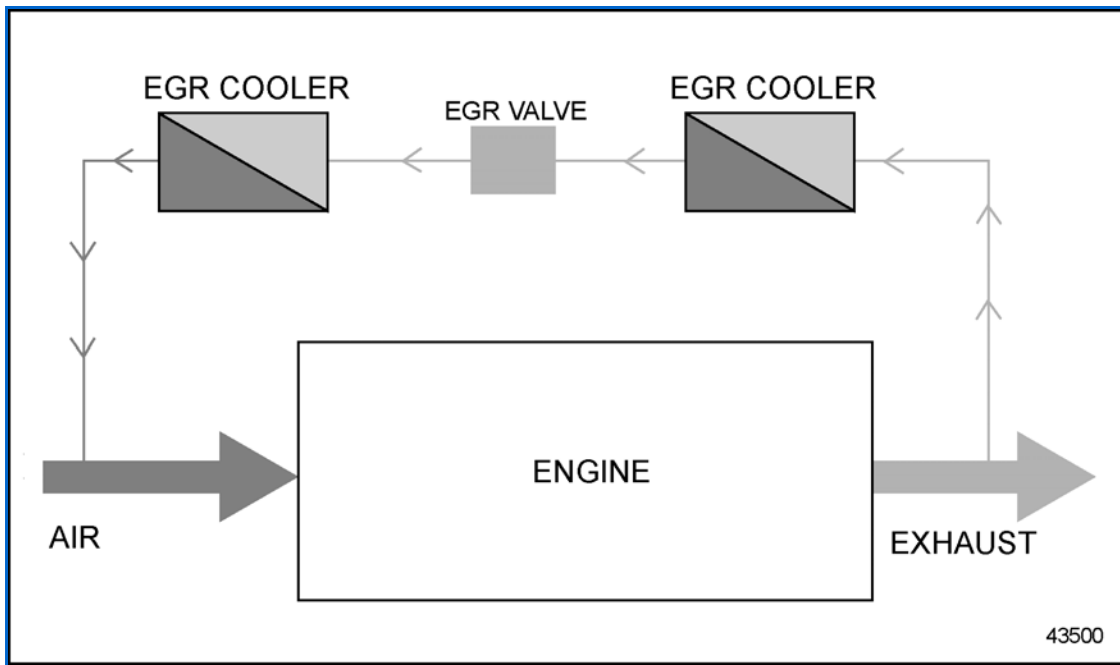
MBE 900 EGR System Components

The EGR system consists of:

- Turbocharger
- EGR Cooler
- EGR Rotary Valve
- Reed Valves
- EGR Mixer

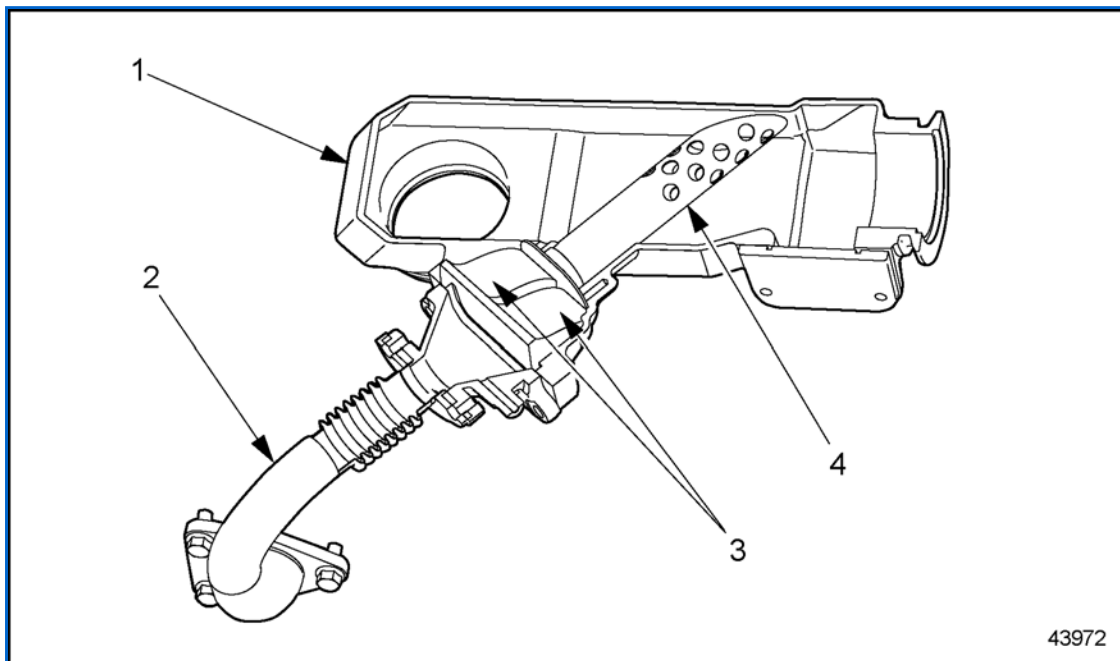
The MBE 900 engines for on-highway EPA 2004 regulation applications use a water cooled EGR system. Exhaust gases from the front three cylinders on six cylinder engines (all four cylinders on four cylinder engines) are routed from the exhaust manifold through the EGR cooler, past control and reed valves (not on MBE 906), and mixed with the intake manifold charge air. The addition of cooled exhaust gases back into the combustion airflow reduces the peak in cylinder combustion temperature. Less oxides of nitrogen (NOx) are produced at lower combustion temperatures.

The recycled exhaust gases are cooled before engine consumption in a twin tube-and-shell engine water cooler. [See Figure 43500](#) .



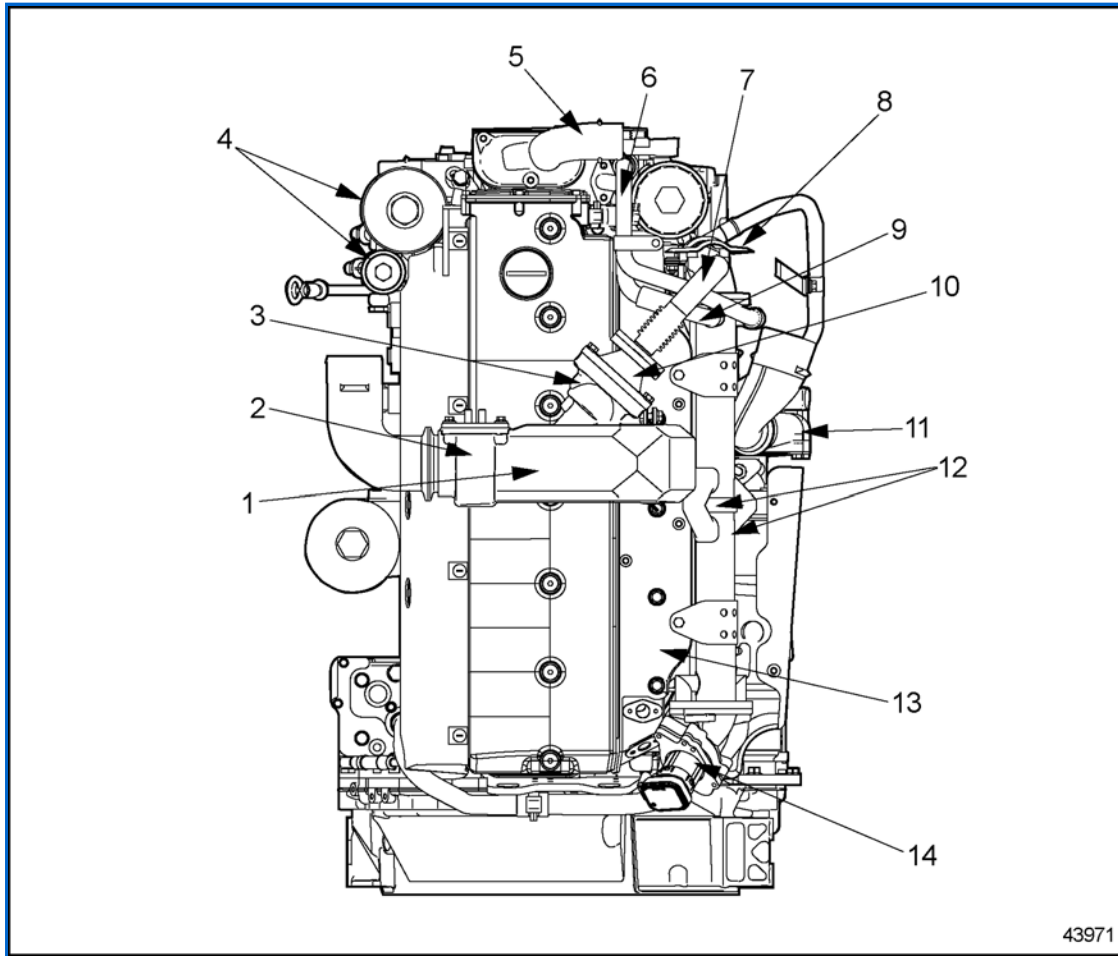
Air Flow Diagram Through Engine with EGR System

The MBE 904, MBE 924 and MBE 926 engines have reed valves to assist in the transport of exhaust gasses. In order to drive exhaust gas transport to the engine, the pressure in the exhaust manifold must be greater than the charge air pressure. The pressure of gasses in the exhaust manifold changes over time, peaking when the exhaust valves open. Exhaust gasses pass through the reed valves during these pressure peaks. The reed valves permit transport of exhaust gasses only during the time when the exhaust gasses pressure is greater than the charge air pressure. [See Figure 43972](#) for the location of the reed valves. [See Figure 43971](#) for a top view of the MBE 906 EGR engine, indicating major EGR parts.



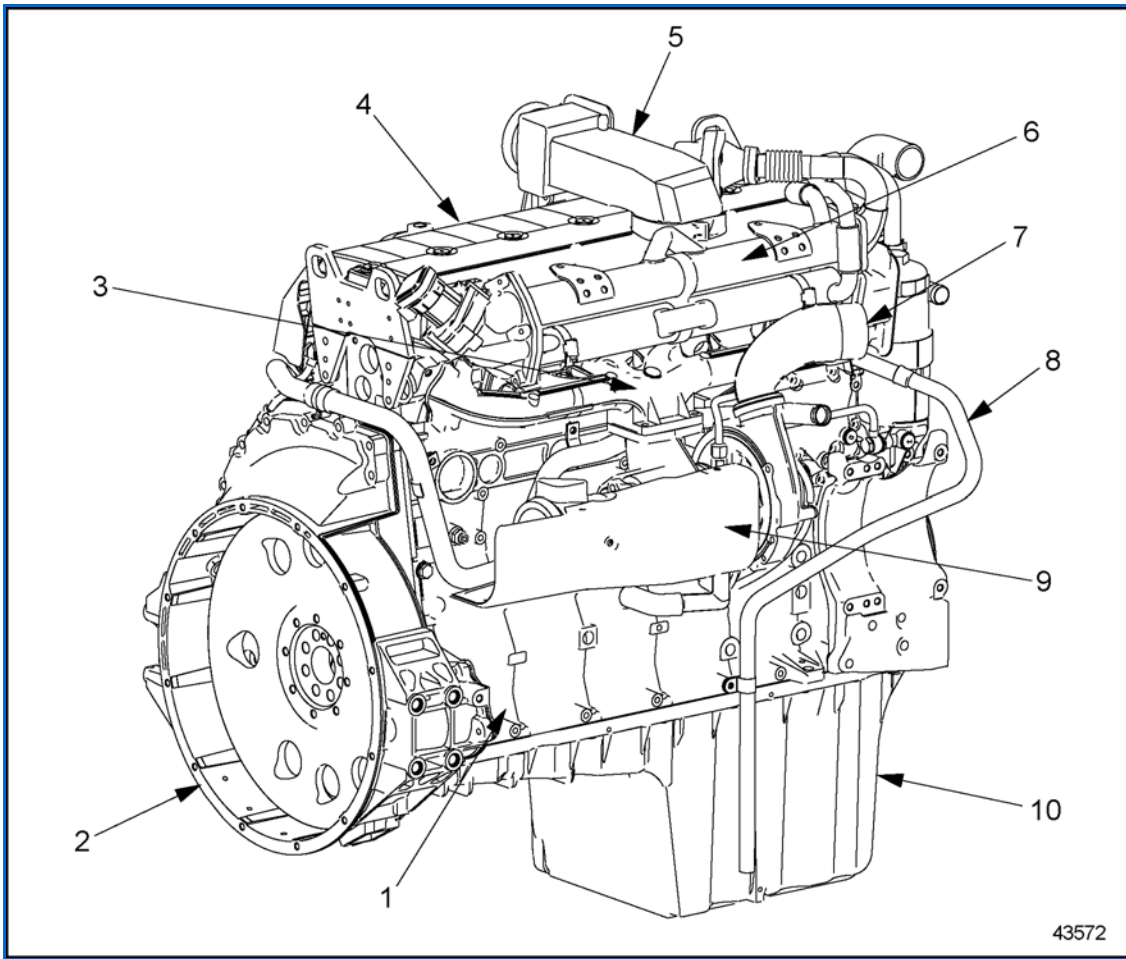
1. Charge Air Tube Manifold	3. Reed Valves (Models 904, 924 and 926)
2. EGR Delivery Pipe	4. EGR/CA Mixer Tube (Model 906)

Reed Valve Location (MBE 904, MBE 924 and 926 engines only)



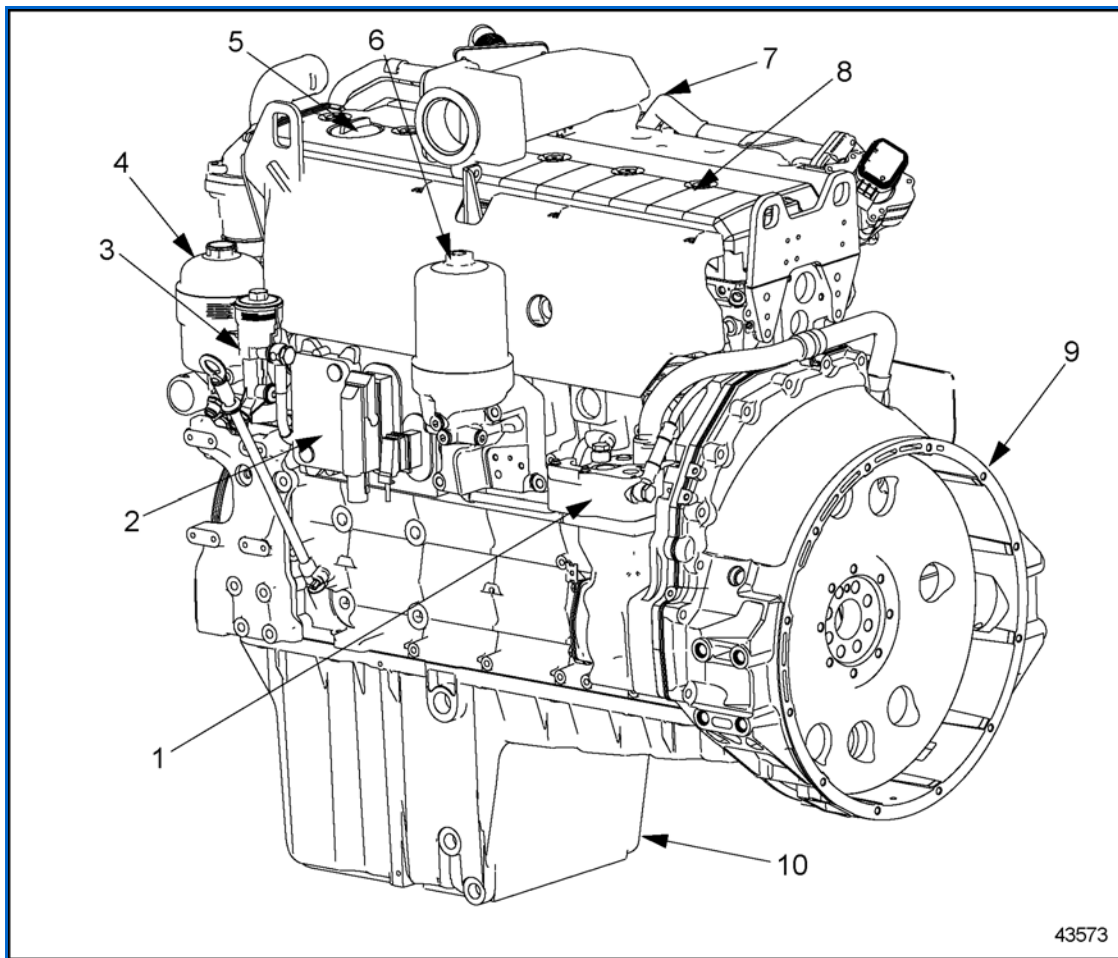
1. Charge Air Tube	8. EGR Cooler Flange Heat Shield
2. Grid Heater	9. Coolant Return Tube
3. Reed Valve (904, 924 and 926 models only)	10. EGR/CA Mixer
4. Fuel Filter Pre and Main	11. Turbocharger
5. Thermostat Cover and Housing	12. EGR Cooler (upper and lower)
6. Coolant Inlet Tube	13. Charge Air Housing
7. EGR Delivery Pipe	14. EGR Rotary Valve

Top View of EGR Components



1. Starter Motor	6. EGR Cooler
2. Flywheel Housing	7. Turbocharger Compressor Out
3. Exhaust Manifold	8. Breather Tube
4. Cylinder Head Cover	9. Turbocharger Heat Shield
5. Air Intake Manifold	10. Oil Pan

Right Rear View of MBE 900 2004 EGR Engine and Components



1. Air Compressor	6. Oil Centrifuge
2. DDEC-ECU	7. Air Intake Manifold
3. Pre Fuel Filter	8. Cylinder Head Cover
4. Main Fuel Filter	9. Flywheel Housing
5. Oil Fill Cap	10. Oil Pan

Left Rear View of MBE 900 2004 EGR Engine and Components

The general specifications for the MBE 900 EGR engines are [listed in Table](#)

Description	4-Cylinder EGR Engines		6-Cylinder EGR Engines	
Engine Type	Vertical, inline cylinder block with turbocharger and charge-air cooler			
Cooling System	Liquid Circuit			
Combustion Principle	4-Stroke direct-injection diesel			
Number of Cylinders	4		6	
Bore	102 mm (4.02 in)	106 mm (4.17 in)	102 mm (4.02)	106 mm (4.17 in.)
Stroke	130 mm (5.11 in.)	136 mm (5.35 in.)	130 mm (5.11 in.)	136 mm (5.35 in.)
	4.3 liters (259)	4.8 liters (292)	6.4 liters (389)	7.2 liters (439)

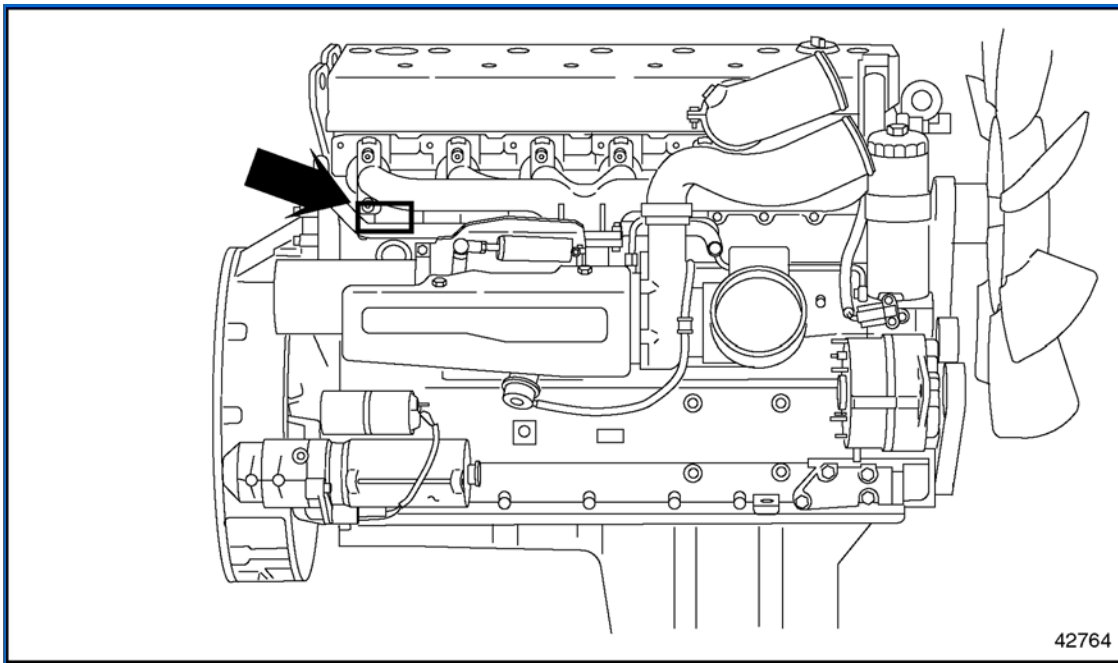
Displacement (total)	in ³)	in ³)	in ³)	in ³)
Compression Ratio	18:1		18:1	17.5:1
Starting Speed	Approximately 100 rpm			
Direction of Engine Rotation (viewed from flywheel)	Counterclockwise			
Starter	Electric Motor			
Coolant Capacity of Engine (Does not include capacity of cooling system.)	Max. 8.5 liters (9.0 qt.)		Max. 12.5 liters (13.2 qt.)	
Lubricating Oil (In standard pan, including oil filter.)	Max. 16.1 liters (17.0 qt.)		Max. 25.0 liters (26.4 qt.)	
Cold-Start Temperature Limit (Without starting aids and with battery 75 percent charged)	Down to - 15 ° C (+5 ° F)			
Engine "Dry" Weight	420 kg (926 lb)		560 kg (1235 lb)	
Valve Lash (with engine cool)	Intake = 0.40 mm (0.016 in)			
	Exhaust = 0.60 mm (0.024 in)			
Valve Lift (at maximum valve clearance)	Intake = 9.7 mm (0.38 in)			
	Exhaust = 10.7 mm (0.42 in)			
Engine Oil Pressure	At idle rpm = 50 kPa (7 psi)			
	At maximum rpm = 250 kPa (36 psi)			
Fuel Injectors	Minimum opening pressure = 24,500 kPa (3553 psi)			
	Maximum opening pressure = 25,700 kPa (3727 psi)			
Coolant Thermostat	Opening temperature = 81 ° to 85 ° C (178 ° to 185 ° F)			
	Normal operating temperature = 95 ° C (203 ° F)			

General Technical Information for MBE 900 EGR Engines

IDENTIFICATION

Engine Identification Number

The engine identification number is lasered in large font onto an enlarged labeling surface on the rear right block. [See Figure 42764](#). The etched identification number contains the type reference followed by a sequential manufacturing number. [See Figure 42763](#).



42764

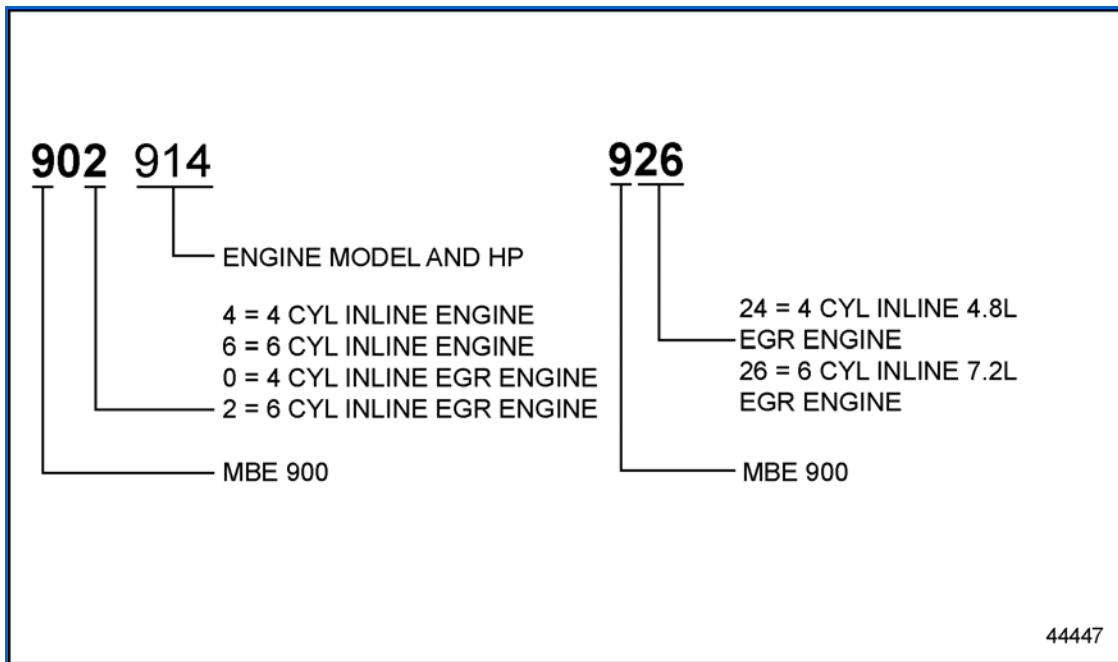
Location of Engine Identification Numbers



42763

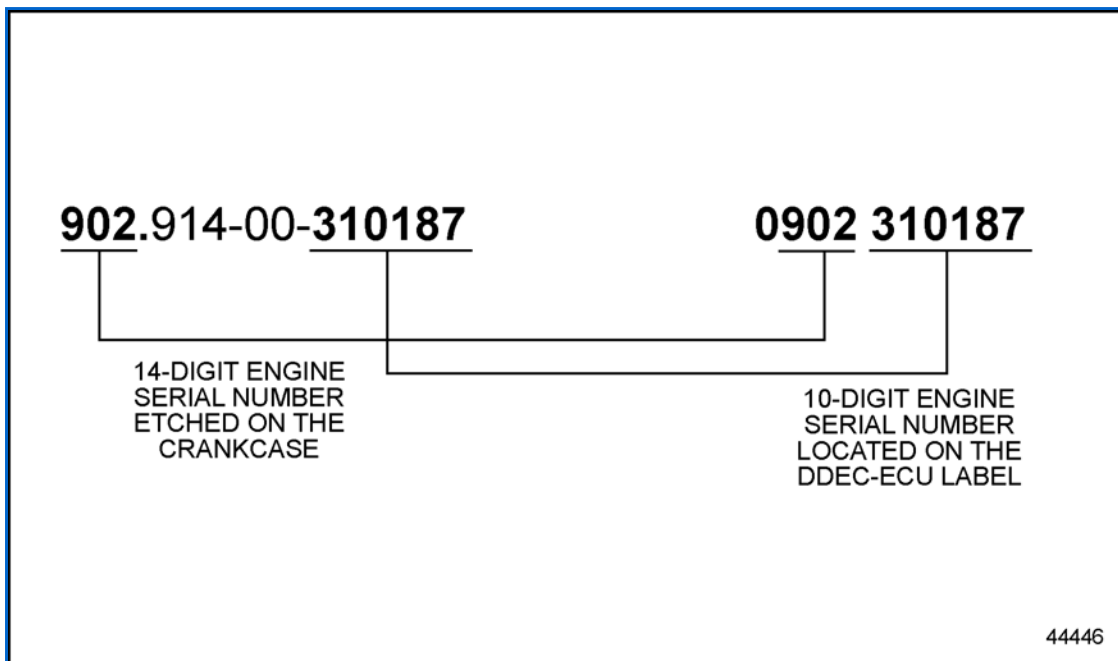
Engine Identification Number

The last six numbers are the serial numbers of the engine (263172 in [see Figure 42763](#)). [See Figure 44447](#) for an explanation of the first six numbers found in the engine identification number.



Engine Identification

Note: In addition to the fourteen digit number etched on the crankcase, there is a ten digit number used for warranty and service that is found on the DDEC-ECU label. The ten digit number is derived from the fourteen digit number (see [Figure 44446](#)).



Engine Serial Number and DDEC-ECU Label

Emission Label

The MBE 900 engine is built in accordance with sound technological principles and based on state-of-the-art technology. It complies with all United States Environmental Protection Agency (USEPA) and California Air Resources Board (CARB) emission standards. An emission label is attached to the cylinder head cover, as required

by law. [See Figure 42960](#) for the emission label for the 6-cylinder non-EGR model and [see Figure 42961](#) for the 4-cylinder non-EGR model label. See figure 17 for the emission label for the 6-cylinder EGR model and see figure 18 for the 4-cylinder EGR model label.

Important Engine Information 

DaimlerBenz AG, Stuttgart, Germany


MercedesBenz Engine, Model	OM 906 LA	CID 388
Engine Family / Engine code	XMBXH6.37DJA / Code 1	
Exhaust Emission Control System	TC, EMC, CAC	
Date of engine manufacture	1998	
Advertised Output (SAE gr.)	209 kW (280 HP) / 2300 rpm	
Fuel rate at adv. output	128 136 mm $\bar{?}$ stroke	
Valve lash cold (ins.)	0.016 int. 0.024 exh.	
Basic injection timing	18+1 degrees BTDC	
Idle speed	600 + 50 rpm	

This engine conforms to U.S. EPA, California and Canada regulations, applicable to 1999 Model Year new heavy duty engines. This engine has a primary intended service application as a medium HD diesel engine. This engine is not certified for use in an urban bus as defined at 40 CFR 86.093.2. Sales of this engine for use in an urban bus is a violation of Federal Law under the Clean Air Act.

This engine is certified to be operated on diesel fuel.

42960

Emission Label for 6-Cylinder Non-EGR Engine

Important Engine Information 

DaimlerBenz AG, Stuttgart, Germany

MercedesBenz Engine, Model	OM 904 LA	CID 259
Engine Family / Engine code	YMBXH4.25DJA / Code 1	
Exhaust Emission Control System	TC;EMC;CAC;	
Date of engine manufacture	1999	
Advertised Output (SAE gr.)	142 kW (190 HP) / 2300 rpm	
Fuel rate at adv. output	130 138 mm $\bar{?}$ stroke	
Valve lash cold (ins.)	0.016 int. 0.024 exh.	
Basic injection timing	19+1 degrees BTDC	
Idle speed	700 \pm 50 rpm	

This engine conforms to U.S. EPA, California and Canada regulations, applicable to 2000 Model Year new heavy duty engines. This engine has a primary intended service application as a medium HD diesel engine. This engine is not certified for use in an urban bus as defined at 40 CFR 86.093.2. Sales of this engine for use in an urban bus is a violation of Federal Law under the Clean Air Act.

This engine is certified to be operated on diesel fuel.

42961

Emission Label for the 4-Cylinder Non-EGR Engine

Important Engine Information
DaimlerBenz AG, Stuttgart, Germany



MercedesBenz Engine, Model	OM 906 LA	CID 388
Engine Family / Engine code	4MBXH6.37DJA / Code 1	
Exhaust Emission Control System	TC, EMC, CAC, EGR	
Date of engine manufacture	2004	
Advertised Output (SAE gr.)	260 HP / 2200 rpm	
Fuel rate at adv. output	132.7 mm ³ / stroke	
Valve lash cold (ins.)	0.016 int. 0.024 exh.	
Basic injection timing	18+1 degrees BTDC	
Idle speed	600 + 50 rpm	

This engine conforms to U.S. EPA, California and Canada regulations, applicable to 2004 Model Year new heavy duty engines. This engine has a primary intended service application as a medium HD diesel engine. This engine is not certified for use in an urban bus as defined at 40 CFR 86.093.2. Sales of this engine for use in an urban bus is a violation of Federal Law under the Clean Air Act.
This engine is certified to be operated on diesel fuel.

44449

Emission Label for the 6-Cylinder EGR Engine

Important Engine Information
DaimlerBenz AG, Stuttgart, Germany



MercedesBenz Engine, Model	OM 904 LA	CID 259
Engine Family / Engine code	4MBXH4.25DJA / Code 1	
Exhaust Emission Control System	TC;EMC;CAC; EGR	
Date of engine manufacture	2004	
Advertised Output (SAE gr.)	170 HP) / 2200 rpm	
Fuel rate at adv. output	128.4 mm ³ / stroke	
Valve lash cold (ins.)	0.016 int. 0.024 exh.	
Basic injection timing	11+1 degrees BTDC	
Idle speed	700 ± 50 rpm	

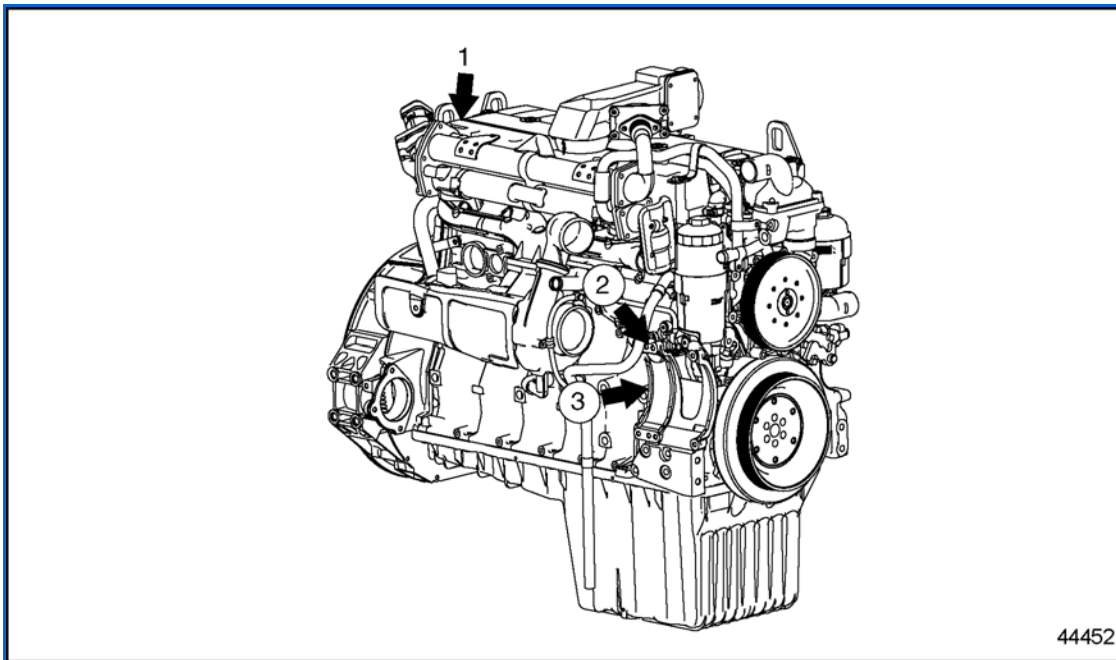
This engine conforms to U.S. EPA, California and Canada regulations, applicable to 2004 Model Year new heavy duty engines. This engine has a primary intended service application as a medium HD diesel engine. This engine is not certified for use in an urban bus as defined at 40 CFR 86.093.2. Sales of this engine for use in an urban bus is a violation of Federal Law under the Clean Air Act.
This engine is certified to be operated on diesel fuel.

44448

Emission Label for the 4-Cylinder EGR Engine

Sensor Locations

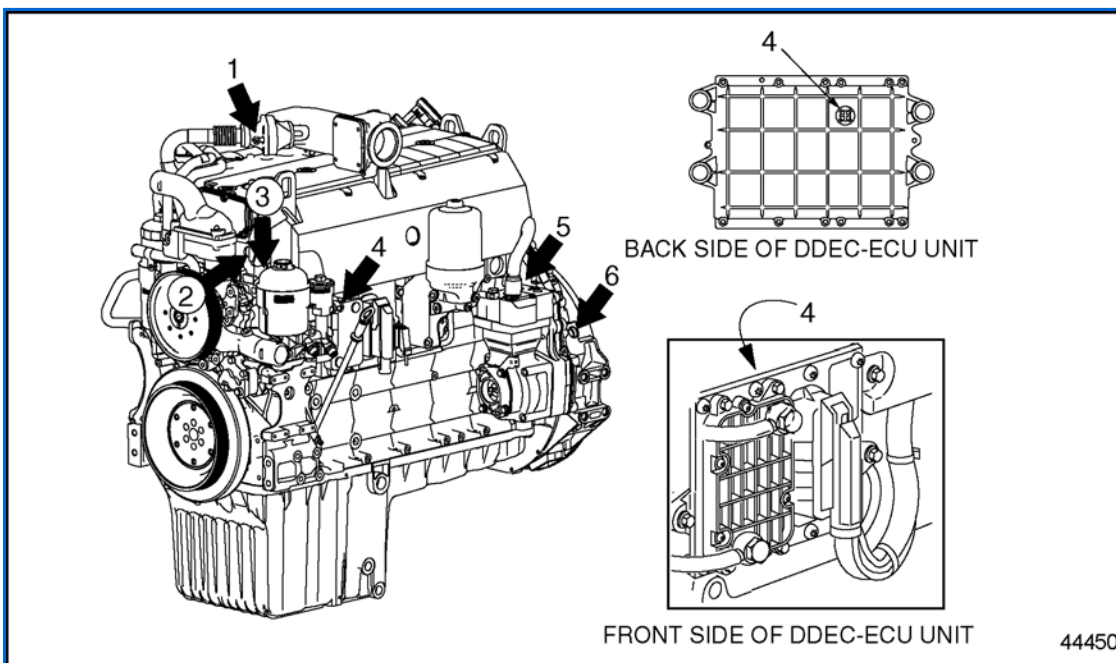
See [Figure 44452](#) and [see Figure 44450](#) for sensor locations for MBE 900 EGR engines. [See Figure 44451](#) for sensor locations on the MBE 900 non-EGR engines.



44452

1. Intake Manifold Pressure/Temperature Sensor	3. Engine Oil Pressure Sensor
2. Engine oil Temperature	

Sensor Location on the Right Side of the MBE 900 EGR Engine

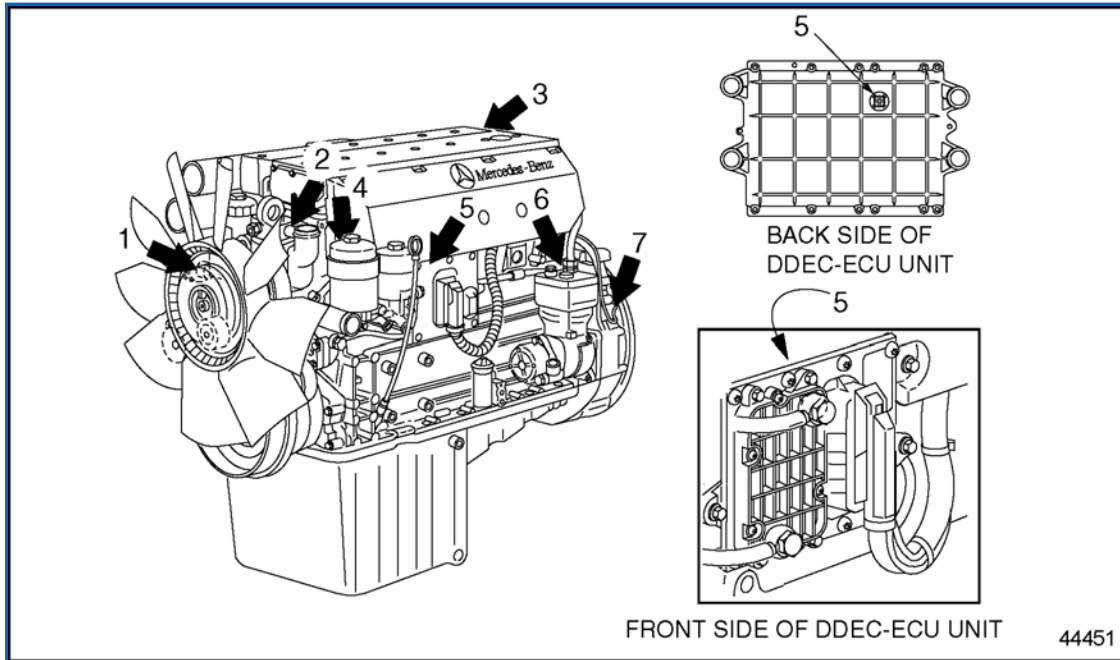


44450

1. EGR Temperature Sensor	4. Barometric Pressure Sensor (integrated into DDEC-ECU)
2. Engine Coolant Temperature Sensor	5. Camshaft Position Sensor (on camshaft)
3. Supply Fuel Temperature Sensor	6. Crankshaft Position Sensor (on timing case)

Sensor Location on the Left Side of the MBE 900 EGR Engine

Note: Some early non-EGR engines had a single oil temperature/pressure sensor.



1. Engine Oil Pressure/Temperature Sensor	5. Barometric Pressure Sensor (integrated into DDEC-ECU)
2. Engine Coolant Temperature Sensor	6. Camshaft Position Sensor (on camshaft)
3. Intake Manifold Pressure/Temperature Sensor	7. Crankshaft Position Sensor (on timing case)
4. Supply Fuel Temperature Sensor	

Sensor Location on the MBE 900 Non-EGR Engine

Despite this, the engine may constitute a risk of damage to property or injury to persons under the following conditions:

- It is not used for its intended purpose.
- It is modified or converted in an incorrect manner.
- The safety instructions are disregarded.

SAFETY INSTRUCTIONS AND PRECAUTIONS

The following safety measures are essential when working on the MBE 900 engine.

To reduce the chance of personal injury and/or property damage, the following instructions must be carefully observed:

- Proper service and repair are important to the service technician and the safe, reliable operation of the engine. If part replacement is necessary, the part must be replaced with one of the same part number or with an equivalent part number. Do not use a replacement part of lesser quality.
- The service procedures recommended and described in this manual are effective methods of performing a repair. Some of these procedures require the use of specially designed tools.

Accordingly, anyone who intends to use a replacement part, procedure or tool that is not recommended, must first determine that neither personal safety nor the safe operation of the engine or warranty will be jeopardized by the replacement part, procedure or tool selected.

Note: It is important to note that this manual contains various "Dangers", "Warnings", "Cautions" and "Notices" that must be carefully observed in order to reduce the risk of personal injury during repair or the possibility that improper repair may damage the engine or render it unsafe. It is also important to understand that these "Dangers", "Warnings", "Cautions" and "Notices" are not exhaustive, because it is impossible to warn personnel of all the possible hazardous consequences that might result from failure to follow these instructions.


Air

Cautions involving the use of compressed air are indicated throughout the manual.


 CAUTION:
<i>EYE INJURY</i>
<i>To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 40 psi (276 kPa) air pressure.</i>

Batteries

Electrical storage batteries emit highly flammable hydrogen gas when charging and continue to do so for some time after receiving a steady charge.

 CAUTION:
<i>Battery Explosion and Acid Burn</i>
<i>To avoid injury from battery explosion or contact with battery acid, work in a well ventilated area, wear protective clothing, and avoid sparks or flames near the battery. If you come in contact with battery acid:</i>
<ul style="list-style-type: none">• <i>Flush your skin with water.</i>• <i>Apply baking soda or lime to help neutralize the acid.</i>• <i>Flush your eyes with water.</i>• <i>Get medical attention immediately.</i>

Always disconnect the battery cable before working on the electrical system.

 CAUTION:
<i>PERSONAL INJURY</i>
<i>To avoid injury from accidental engine startup while servicing the engine, disconnect/disable the starting system.</i>

Disconnect the batteries or disable an air starter when working on the engine to prevent accidental starting.

Cleaning Agent

Avoid the use of carbon tetrachloride as a cleaning agent because of the harmful vapors that it releases. Ensure the work area is adequately ventilated. Use protective gloves, goggles or face shield, and apron. Exercise caution against burns when using oxalic acid to clean the cooling passages of the engine.