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E85 M54 Engine

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E85 M54 Engine

Model: E85

Production: Start of Production MY 2003

Objectives:

After completion of this module you will be able to:

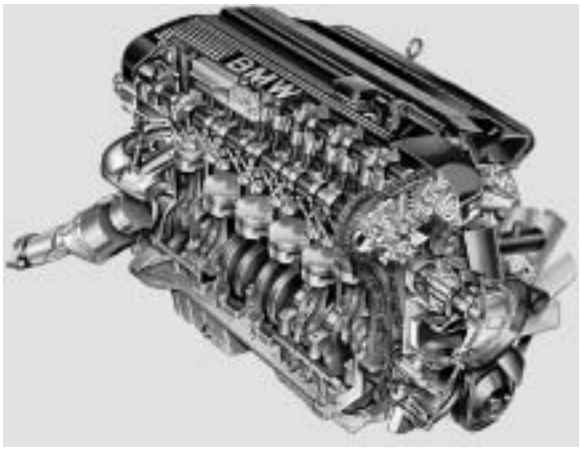
- Identify the changes on the M54 Engine as applied to the E85.
- Understand the E85 cooling system operation.
- Remove and Install Electric fan.
- Explain the Motor Sound System (MSS).

E85 M54 Engine

Purpose of the System

To provide the “sporty” power, the E85 is equipped with either the M54B25 or M54B30 engine. The M54 engine is adapted for use in the E85 and the changes include:

- Engine peripherals:
  - Cooling system
  - Exhaust system
  - Secondary air system
  - Fresh air system
  - Ancillary components and belt drive
- MS45 Engine Management System
- Fuel system



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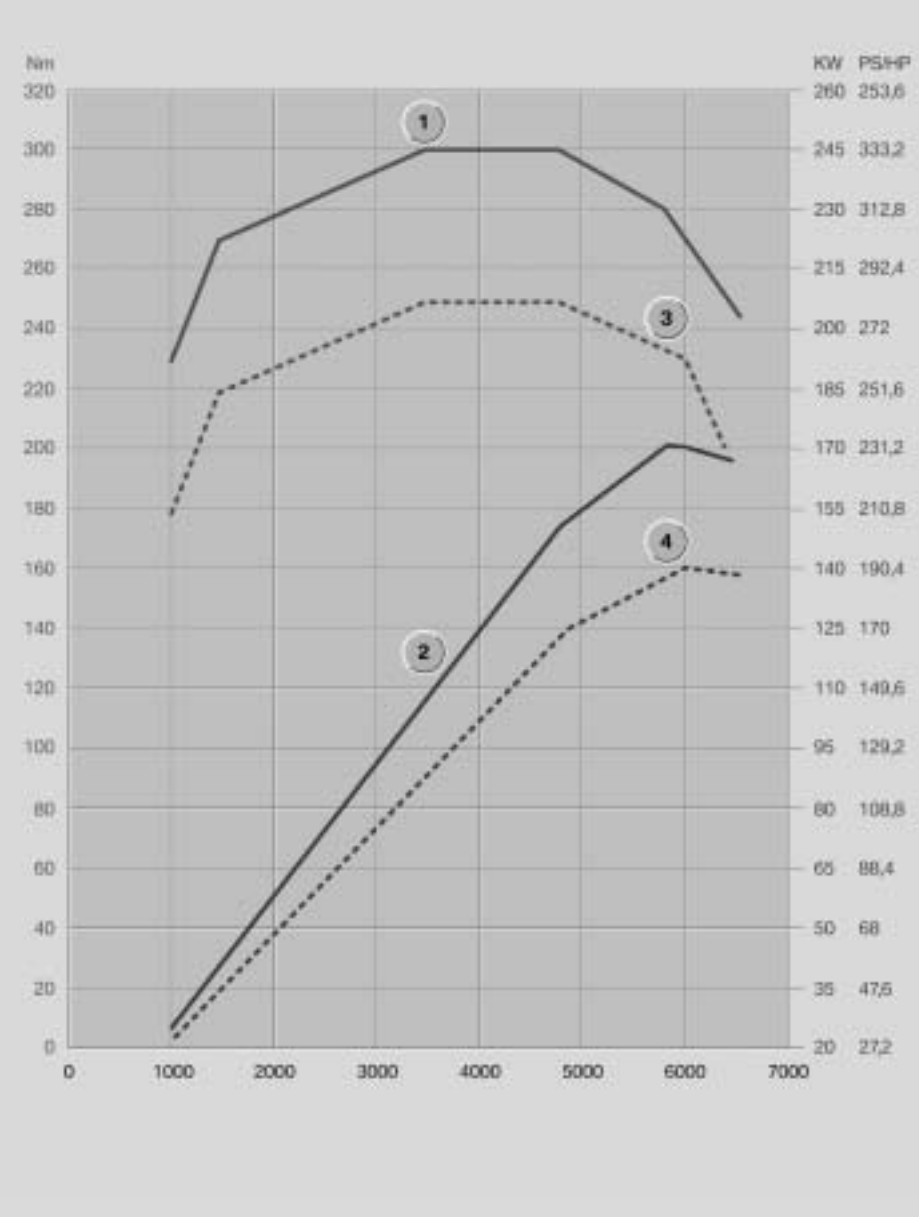
Technical Data	M54B25	M54B30
Design	6-cylinder/in-line engine	6-cylinder/in-line engine
Displacement - cm^3	2494	2979
Bore/stroke - mm	84 x 75	84 x 89.6
Power output - kW/HP at engine speed (rpm)	141/191 6000	170/231 5900
Torque - Nm at engine speed (rpm)	245 3500	300 3500
Idling speed - rpm Cut-off speed - rpm	700 6500	700 6500
Compression ratio	10.5:1	10.2:1
Valves per cylinder	4	4
Knock control	yes	yes
Digital Motor Electronics	Siemens MS45.0	Siemens MS45.0
Emission Compliance	LEV	ULEV
Firing order	1 5 3 6 2 4	1 5 3 6 2 4

Power Output and Torque Characteristics



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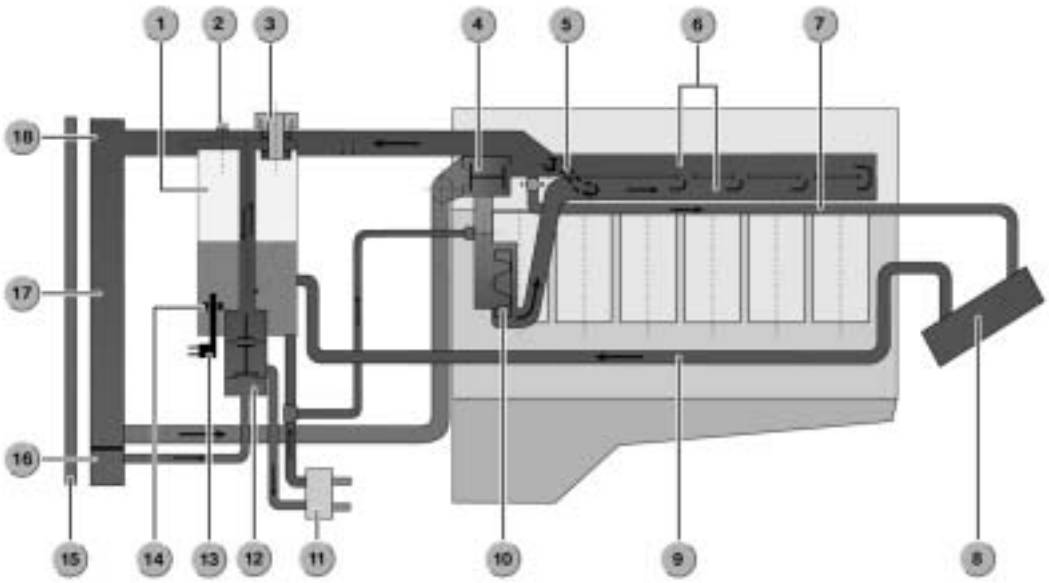
1 M54B30 torque curve
2 M54B30 power output curve
3 M54B25 torque curve
4 M54B25 power output curve

System Components

Cooling System

The E85 cooling system is similar to the E46 with the exception of the following changes:

- Cooling module (viscous fan eliminated)
- Air-controlled IHKA system (water valves eliminated)
- Use of Electric Power Steering (power steering cooler eliminated)



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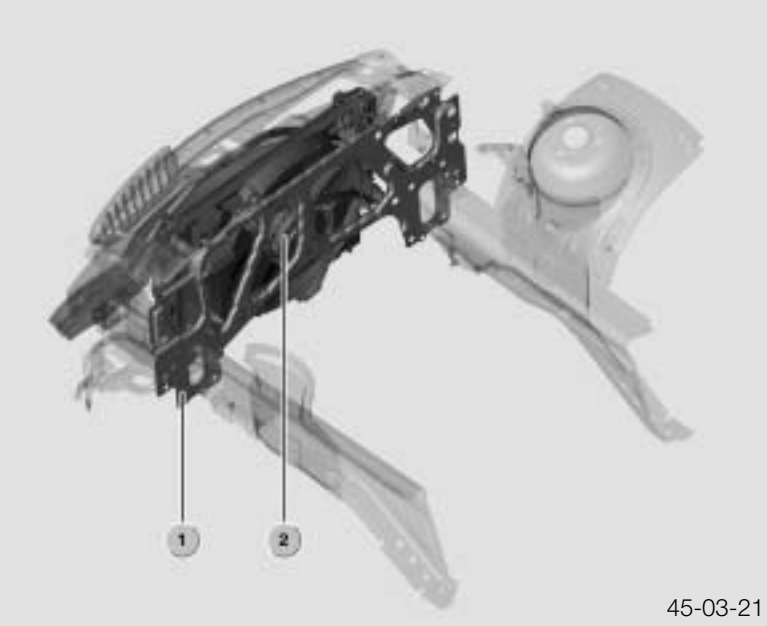
1. Coolant expansion/reservoir tank	10. Water pump
2. Bleed screw	11. Automatic transmission (if equipped) heat exchanger
3. Radiator cap	12. Automatic transmission (if equipped) thermostat cartridge
4. Map-controlled thermostat	13. Coolant level sensor
5. Ventilation port	14. Coolant level sensor float
6. Engine flow through (to cylinder)	15. A/C condenser
7. Supply to heater core	16. Low-temperature area (partition)
8. Heater core	17. Main coolant area
9. Return from heater core	18. Radiator

Cooling Module

The E85 cooling system uses a cooling module similar to the E46.

On the E85, the cooling module is separated by a partition (radiator core support) from the engine.

1. Partition (structural/core support)
2. Cooling module

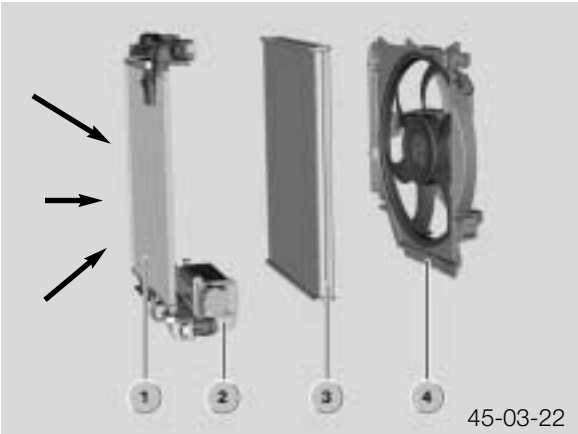


Cooling Module in Installation Position

The cooling module contains the following cooling system components:

1. Cooling radiator
2. Coolant expansion/reservoir tank
3. Air conditioning condenser
4. Electric fan (suction or puller type)

• Automatic transmission fluid radiator (only if equipped)



Coolant Expansion Tank

When filling the coolant expansion tank, the engine can be almost completely filled with coolant and self bled. The heater core return flows directly into the coolant expansion tank.

This prevents air pockets in the heating system and ensures trouble-free bleeding of the cooling system.

Notes:

Principle of Operation

Cooling System Function

The concept of the cooling system in the E85 M54 ensures high coolant temperature in the crankcase which reduces the friction between cylinder walls and pistons, reducing fuel consumption. The increase of coolant temperature in the crankcase is achieved by flowing the coolant mainly through the cylinder head.

A low coolant temperature in the cylinder head has a positive effect on the entire torque characteristics of the engine: Low temperatures in the cylinder head lead to a high engine charge (air and fuel) and a rise in the anti-knock limit. In addition, a low coolant temperature in the cylinder head improves the durability of the components. This concept is referred to as the partial engine flow cooling concept (MTK).

The coolant is fed by the water pump via a cast-on feed duct to the rear end of the cylinder head and from there towards the front to the coolant outlet (radiator outlet if engine warmed up). The water jacket in the crankcase is connected to the flow in the cylinder head via bore holes in the crankcase and through the cylinder head gasket. This means that only a part volume of the coolant flows through the crankcase.

The MTK principle leads to a significant temperature increase in the crankcase with virtually unchanged temperature in the cylinder head.

Map-controlled Thermostat

The effect of the MTK cooling concept is additionally supported in the M54 by control of the coolant temperature using the map thermostat. With low load, the map thermostat sets a high coolant temperature that has a favorable effect on fuel consumption. At full load and/or high engine speed, the coolant temperature is lowered to protect the components.

Notes:

Exhaust System

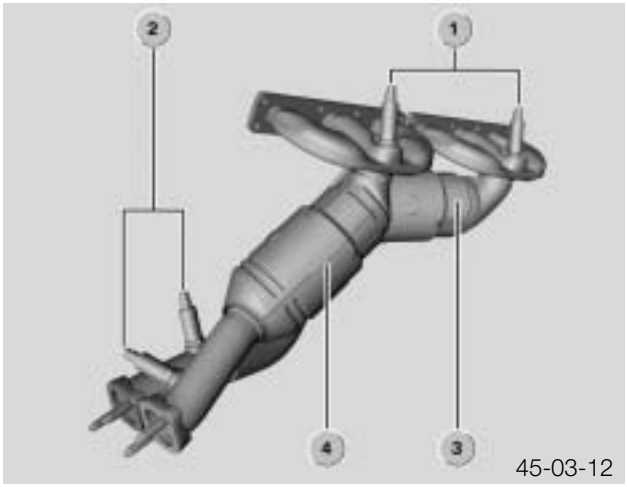
The E85 exhaust system is designed for the sporting engine sound of a roadster. The exhaust systems for the M54B25 and M54B30 engines are identical. The exhaust system consists of the following components:

- Exhaust manifold (with catalytic converter, cylinders 1-3)
- Exhaust manifold (with catalytic converter, cylinders 4-6)
- Front silencer
- Center silencer
- Rear silencer (with tailpipes).

Each exhaust manifold forms a component together with the catalytic converter housing.

In the catalytic converter housing, a metal monolith pre-catalytic converter and a metal monolith main catalytic converter are arranged in sequence.

1. Oxygen sensors (primary oxygen sensors, Bosch LSH-25)
2. Lambda sensors (secondary oxygen sensors, Bosch LSH-25)
3. Catalytic converter housing (cylinders 1-3)
4. Catalytic converter housing (cylinders 4-6)



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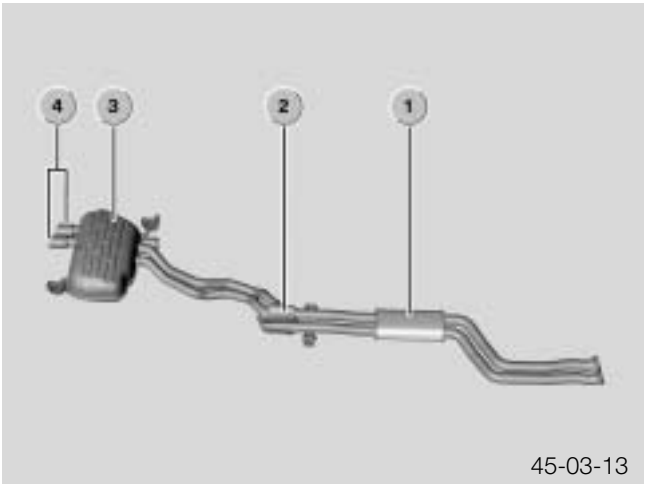
The front silencer has a volume of 3.4 litres. The center silencer has a volume of 1.5 litres. The rear silencer has a volume of 22.7 litres. The two oval tailpipes and the rear silencer form one component. In order to absorb oscillations and noises, the rear silencer is fitted with a rubber damper.

1. Front silencer
2. Center silencer
3. Rear silencers
4. Tailpipes



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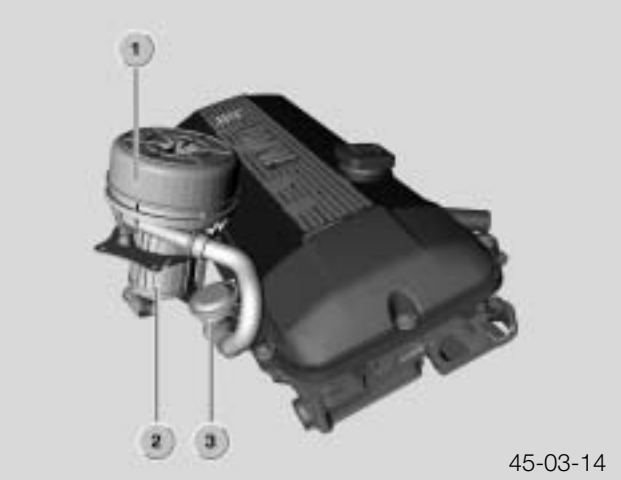
Secondary Air System

For use in the E85, the M54 secondary air pump has a high output supply rate (45 kg/hour).

1. Air filter
2. Secondary air pump (SLP)
3. Secondary air valve (SLV)



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The electrically driven secondary air pump is mounted to the body in the engine compartment (in the area of the right-hand strut tower). To draw in secondary air, the SLP has an integrated air filter element. The air filter element is maintenance-free during the service life of the vehicle.

After the engine is started, the ECM activates the secondary air pump relay to provide power to the secondary air pump. It remains on until the engine has taken in a certain amount of air. The ON period may be a maximum of 90 seconds and depends on the following engine operating conditions:

- Coolant temperature (from -10 ºC to approximately 60 ºC)
- Air mass
- Engine speed

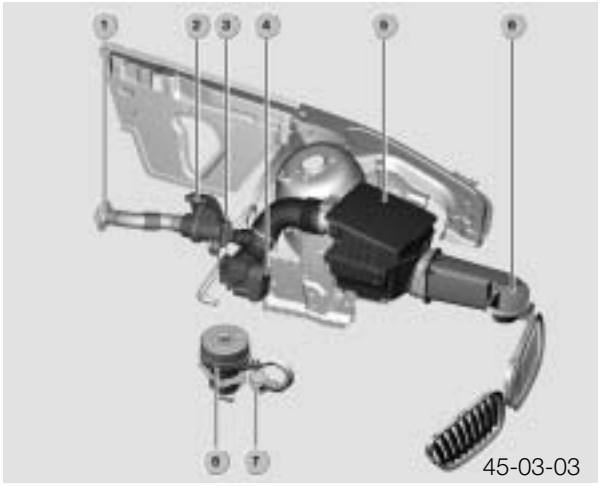
The secondary air valve is mounted to the side of the cylinder head. The SLV is opened by the pressure generated by the secondary air pump. The secondary air is led through a pipe to the secondary air ducts. The SLV closes as soon as the secondary air pump switches off, preventing emission “back flow” to the secondary air pump.

Notes:

Fresh Air System

The fresh air system of the E85 is specifically configured for the M54 engine and on the M54B30 engine, there is an integrated Motor Sound System (MSS).

1. Connection of MSS at front bulkhead
2. Motor Sound System (MSS)
3. Suction jet pump, brake power assistance
4. Electronic throttle valve (EDK)
5. Air-cleaner housing
6. Intake air guidance



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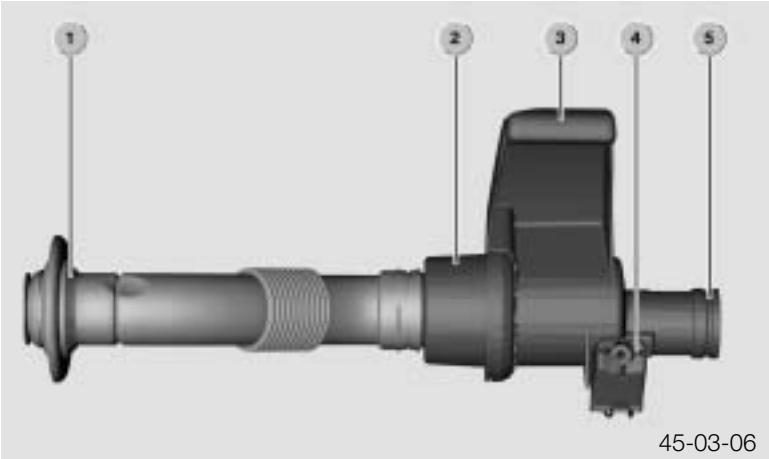
Motor Sound System (MSS)

The Motor Sound System is a membrane system for modulating and transmitting the intake system pressure pulses to the passenger compartment. This generates a sporting sound that is typical of a roadster.

In this market segment, BMW is the first manufacturer to deliberately transmit pressure pulses from the intake system to generate sound in the passenger compartment. *The MSS is only installed on the M54B30 engine.*

1. Connection of MSS at front bulkhead
2. Housing
3. Upper support
4. Lower mounting
5. Connection to the intake system



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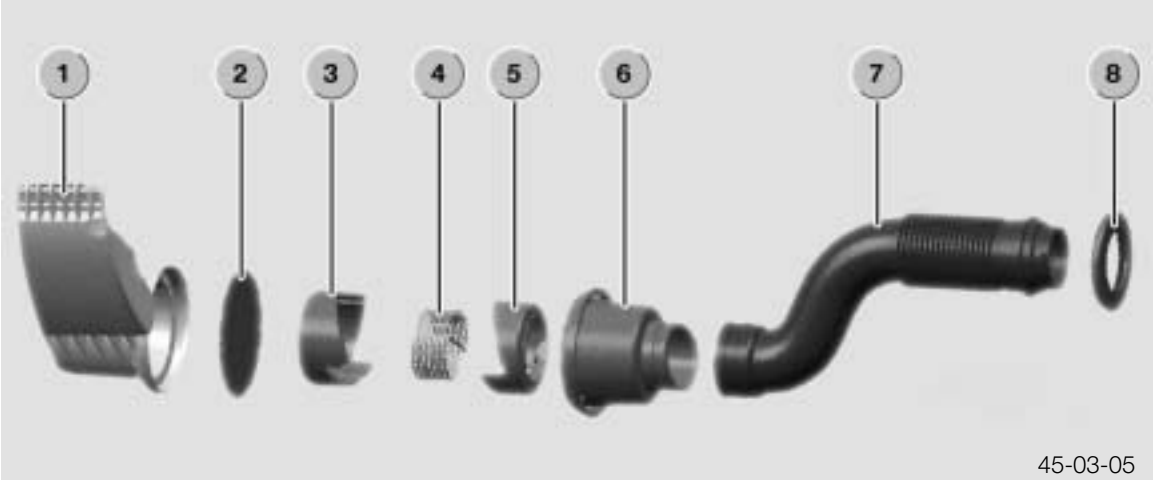
Structure of the Engine Sound System (MSS)



1. Housing with support	5. Rotating element
2. Membrane	6. Housing
3. Thrust piece	7. Sound channel
4. Tensioning spring	8. Sealing sleeve - in bulkhead

The sound generator is connected by a membrane (2) to the column of air in the intake manifold. The pressure pulse is transmitted into the passenger compartment via this membrane, which also ensures a “sealed” intake system.

A clamping mechanism ensures a constant preload on the membrane for even acoustics, balancing out temperature and material aging influences on the membrane. The tensioning spring (4) generates an axial motion of the plunger (3) by turning the rotating element (5). The plunger continuously tensions the membrane.

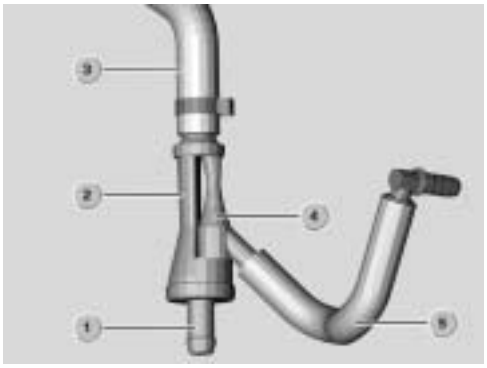
Note: There are foam inserts in the sound channel (7). These must not be removed during repairs, because the noise generated in the vehicle interior will increases to an unacceptable level.

Notes:

Suction Jet Pump

The suction jet pump ensures the necessary vacuum in the brake booster so that the braking force is retained for a certain period even after the intake system vacuum depletes. Two non-return valves are integrated in the suction jet pump for brake power assistance.

1. Connection to intake boot
2. Suction jet pump
3. Connection to intake manifold
4. Venturi pipe
5. Connection to brake booster



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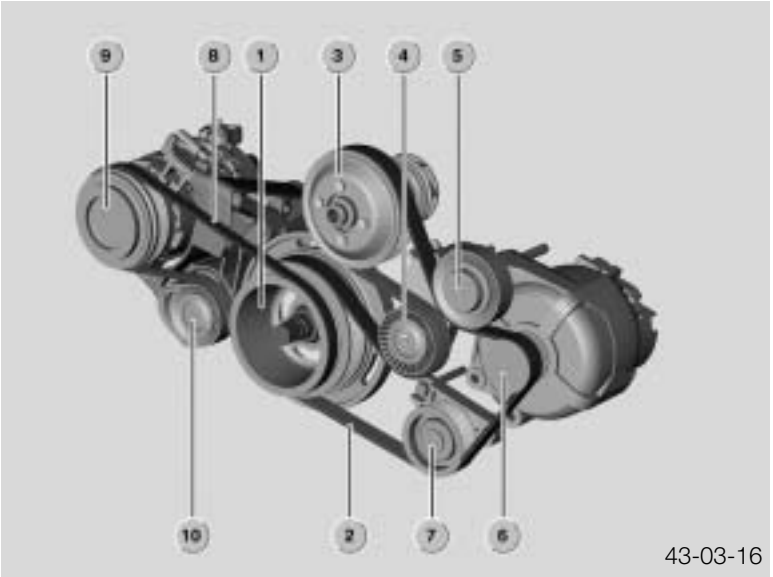
The suction jet pump works according to the Venturi principle: generation of a pressure difference by increasing the flow speed. This means that the suction jet pump creates a higher vacuum for the brake booster than that already present in the intake system.

Ancillary Components and Belt Drive

The ancillary components and the belt drive of the M54 engine are slightly modified for the E85. The viscous fan and power steering pump are eliminated. Depending on the vehicle equipment, alternators with 90 A or 120 A are used in the E85.

1. Belt pulley, crankshaft
2. Ribbed V-belt (main drive)
3. Coolant pump
4. Tensioning roller (main drive)
5. Deflection pulley
6. Alternator
7. Deflection pulley
8. Ribbed V-belt (air conditioner drive)
9. Air conditioning compressor
10. Tensioning roller (air conditioner drive)



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Review Questions

1. List the changes on the M54 Engine that apply to the E85:

2. What is the purpose of the low-temperature area partition in the radiator?

3. What is the purpose of foam inserts in the sound channel of the Motor Sound System?