



BMW Technical Reference Information



Group 11
Engine

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Woodcliff Lake, NJ
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Product Engineering

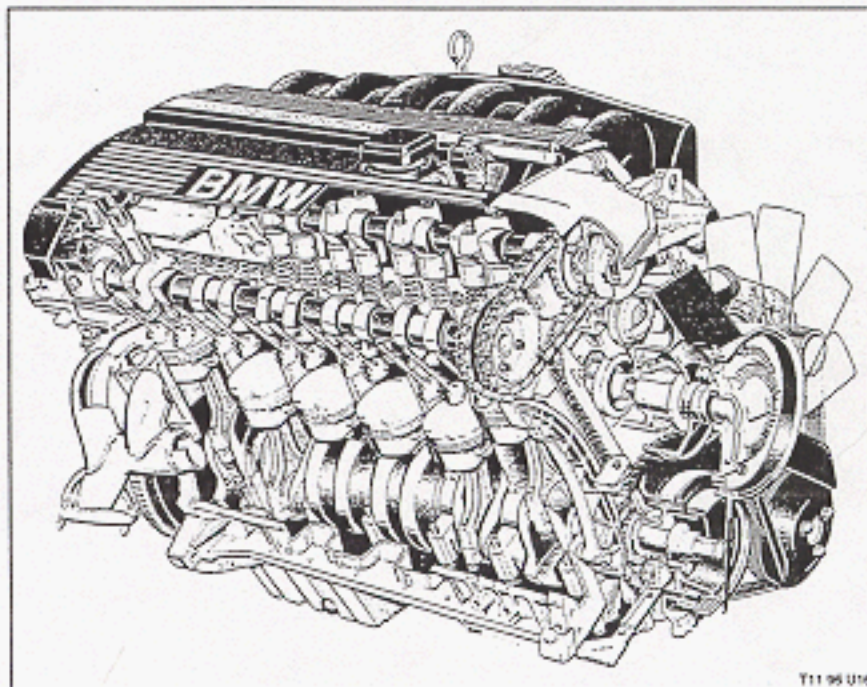
SUBJECT: 2.8 Liter Six Cylinder Engine (M52)

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MODELS: 1996 328i (E36), 1997 528i (E39)

Situation: With the introduction of the 1996 E36 328i, a new four valve cylinder engine designated M52, has been designed with the following objectives in mind:

- Reduced fuel consumption
- Lower exhaust emissions
- Increased torque output
- Lower engine noise levels



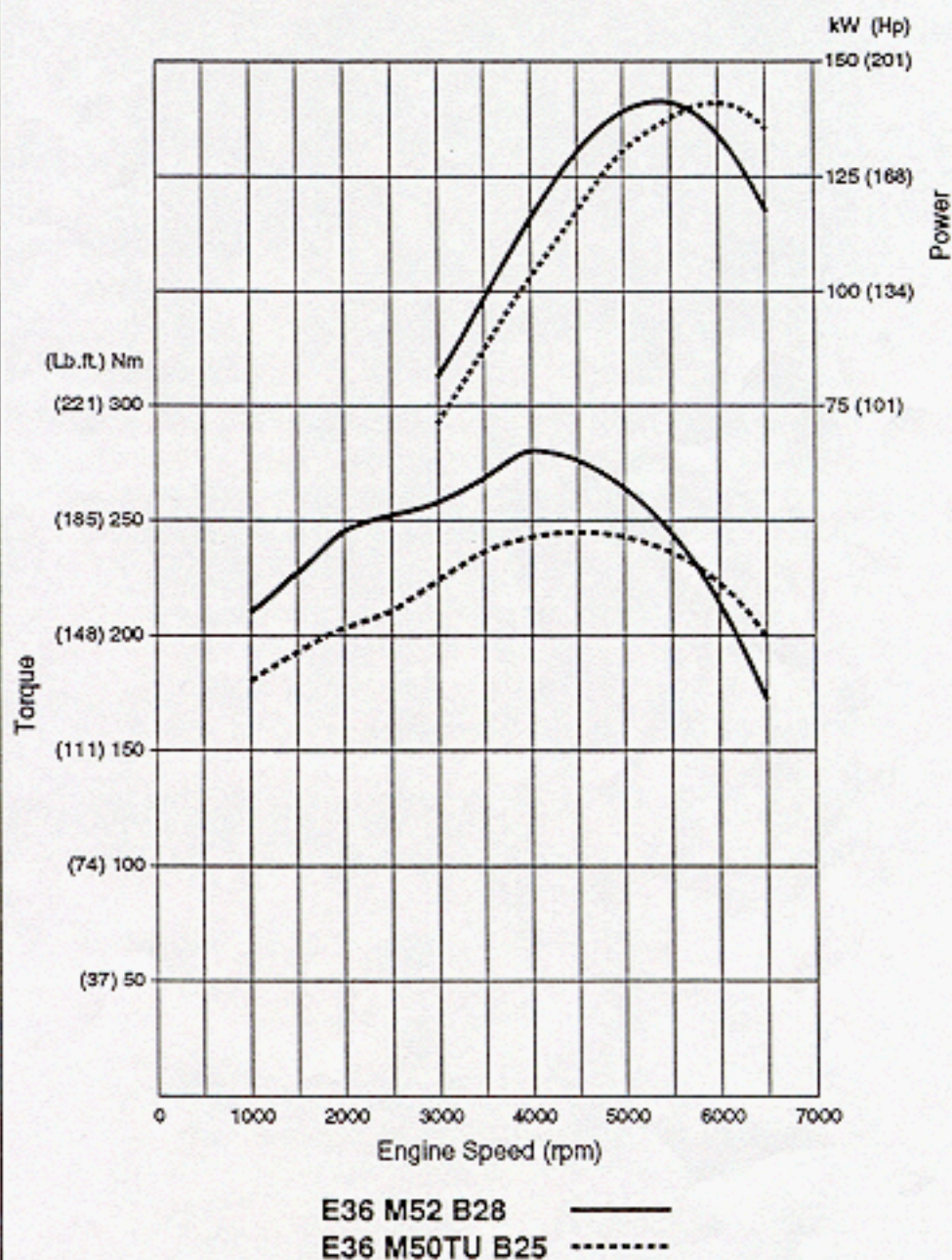
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The power and torque output of the new M52 engine compared to the M50 TU engine are:

	M52	M50 TU
Maximum Power	190 hp @5,300rpm	189 hp @5,900rpm
Maximum Torque	207ft.lbs.(280Nm) @3,950rpm	181ft.lbs.(245Nm) @4,200rpm

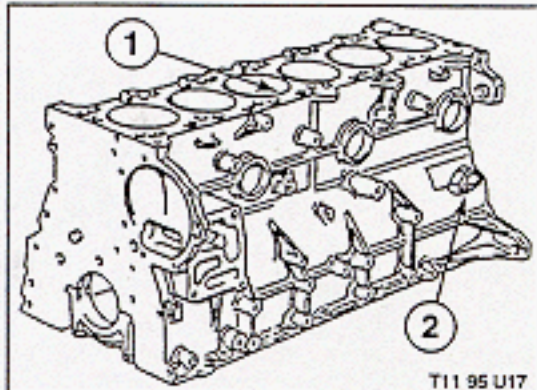
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Torque/Power Comparison M52 vs. M50TU



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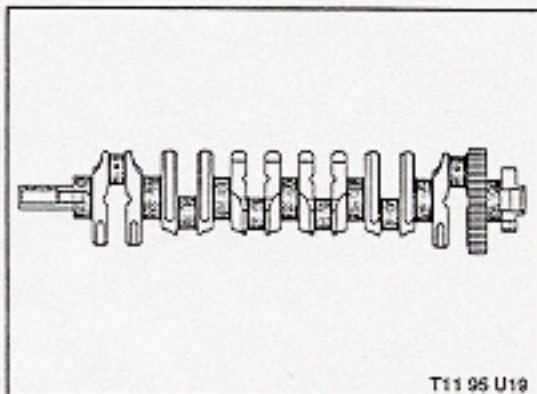
The M52 engine is weight optimized in design, initially incorporating a cast iron cylinder block. A cylinder block made of an aluminum silicone alloy called Alusil will be introduced as soon as production capacities allow.



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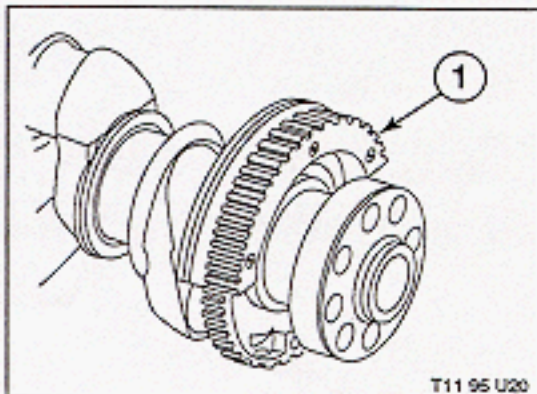
The cylinder bores remain at 84mm (1) as on the M50 block, with an increased stroke of 84 mm (75mm on the M50), which increases the displacement by .3 liters, to 2.8 liters.

The new cylinder block also incorporates a hole and mounting boss (2) on the left rear side used for mounting the RPM/reference sensor for the MS41.1 control module.



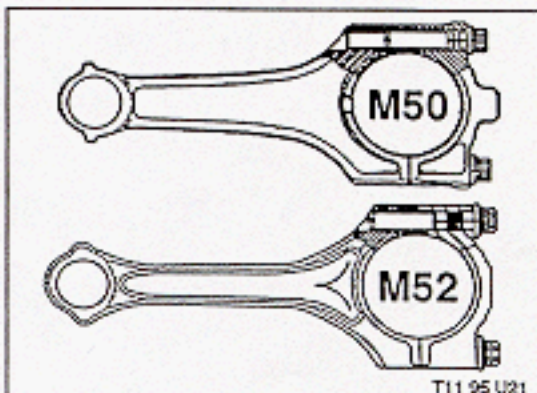
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A forged steel crankshaft is used on the M52 engine for increased stiffness and improved vibration damping characteristics. It has 7 main bearings which conform to the triple color code classification and 12 counter weights.



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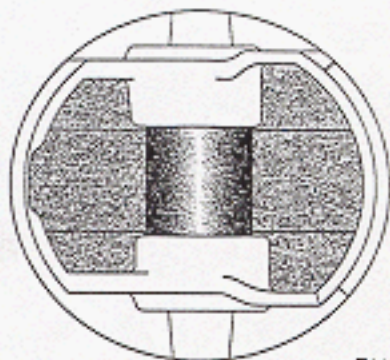
The trigger wheel (1) for the RPM/reference sensor is bolted directly to the crankshaft on the rear main counterweight. This trigger wheel/reference sensor configuration is used to meet the OBDII regulations.



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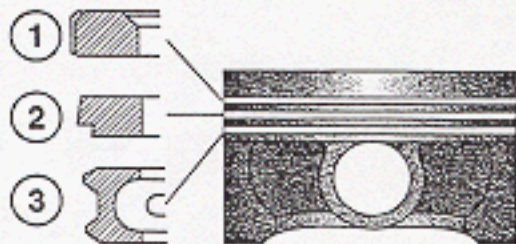
Redesigned connecting rods are used on the M52 engine which have been weight optimized. They are 12% lighter than M50 TU rods.

Dowels are used to align the connecting rod with the cap as on the M50TU version.



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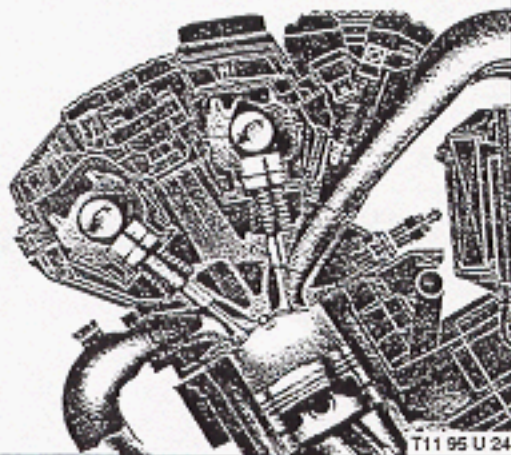
The asymmetrical piston design used on the M52 engine incorporates a wider skirt on the pressure side of the piston. This allows the piston to be manufactured with a shorter skirt while still maintaining the required strength and rigidity for the 2.8 liter displacement. Other advantages of this design include reduced piston weight and friction.



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The piston ring configuration is as follows:

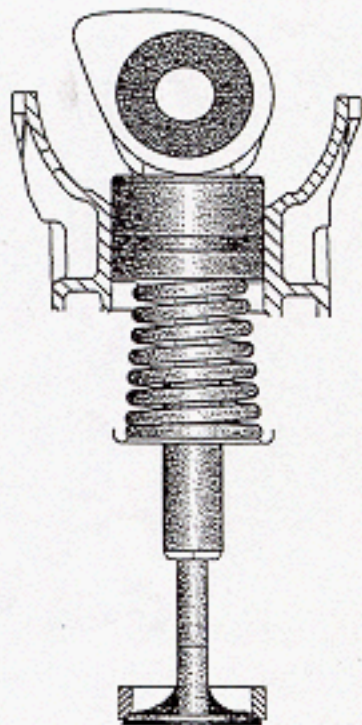
- (1) - 1.5mm Plain Compression Ring
- (2) - 1.5mm Tapered Compression Ring
- (3) - 2.0mm Spring Loaded Oil Scraper Ring



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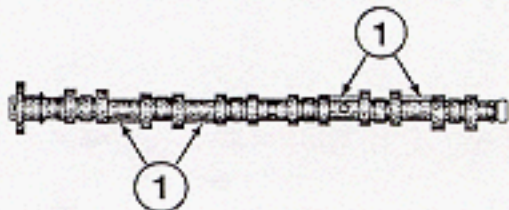
The cross-flow cylinder head used on the M52 engine is similar in design to the M50 TU. The combustion chambers and intake ports have been redesigned to optimize air flow and burn rates in the combustion chamber.

Two additional ports are cast into the head for the exhaust side of the head for the secondary air injection system.



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The use of smaller hydraulic bucket tappets (M52 = 33mm, M50TU = 35mm) and single conical shaped valve springs has reduced the total moving mass of the valve train which contributes to improved fuel economy and reduced engine noise.

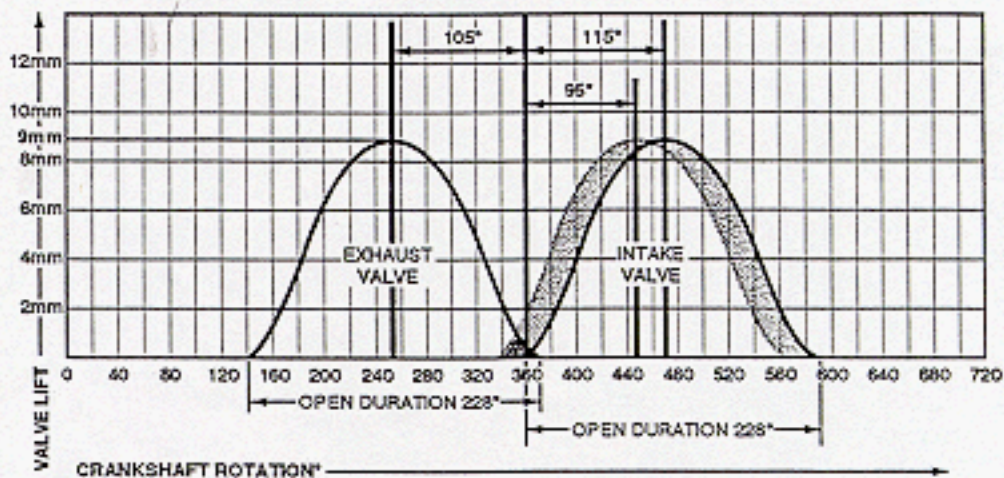


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Additional material (1) is cast onto the camshafts between the cam lobes. This improves the balance of the shafts thus smoothing the engines running characteristics at low engine speeds. The camshafts are driven by single roller timing chains as on the M50 TU engine. A new light weight tensioner assembly and chain tensioner rail are used for further engine weight reduction.

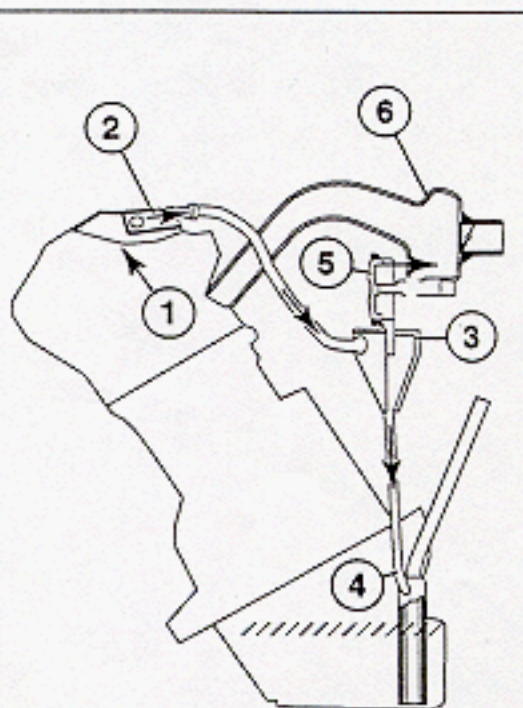
The M52 engine also incorporates the Variable Camshaft Control System (VANOS) which varies the intake valve timing thus improving engine torque output, idle characteristics, increases throttle response and reduces exhaust emissions.

THEORETICAL VALVE LIFT/OVERLAP – M52 VANOS



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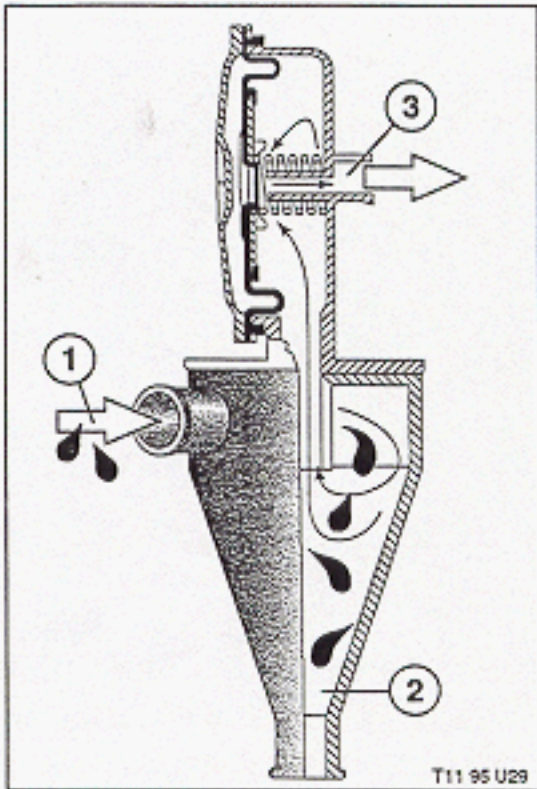
The cylinder head cover on the M52 engine is made of plastic. The oil filler opening is now located at the front of the cover.



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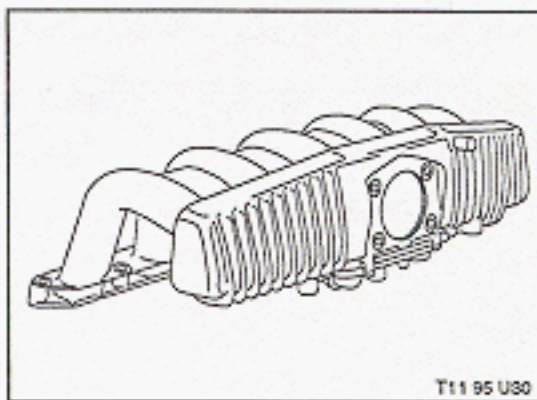
The M52 engine uses a redesigned crankcase ventilation system which is pressure controlled similar to the system used on M60 engines.

The blow-by gasses (1) exit the valve cover vent port (2) and enter a cyclone type liquid/vapor separator (3) which allows the liquid oil to return to the oil pan via the dip stick tube connection (4). The oil vapors pass through the regulating valve (5) into the intake manifold (6).

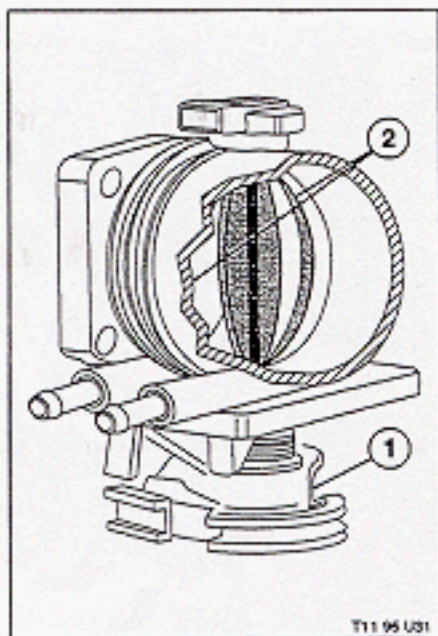


The crankcase regulating valve varies the pressure in the crankcase continuously depending on load and speed conditions. This prevents blue exhaust smoke and excessive oil consumption on deceleration due to peaking manifold vacuum, and assures reliable crankcase venting during all other operating conditions.

- (1) - Blow-by gases from the valve cover vent port
- (2) - Liquid oil return to the dip stick tube
- (3) - Oil vapors to the intake manifold

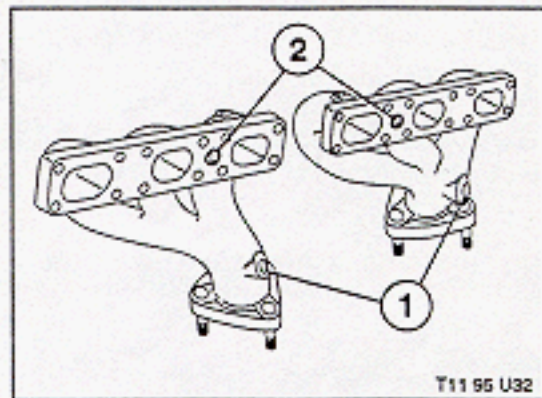


A new style plastic intake manifold is used on the M52 engine which incorporates an increased wall thickness and additional reinforcement ribs. These modifications contribute to the reduction of engine noise levels.



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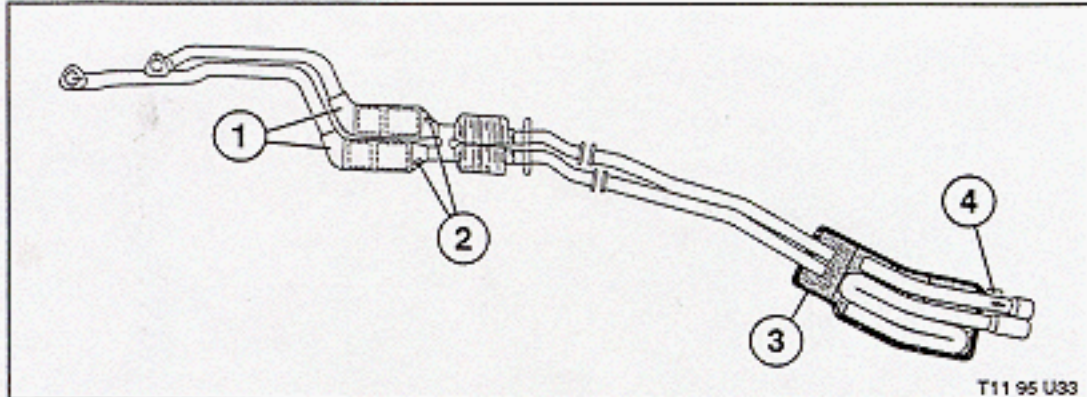
A redesigned throttle body is used on the M52 engine. The throttle plate movement is now controlled through a simple circular pulley (1) and bowden cable arrangement which ensures consistent and smooth movement of the throttle plate. Machined wedges (2) in the throttle body bore precisely meter air during slight throttle application.



T11 95 U32

The M52 exhaust manifolds are made of stainless steel instead of cast iron as on the M50 TU engine. This new design allows for a faster warm up time of the catalytic converters and a reduction in weight.

The oxygen sensors (one per manifold) are mounted in the exhaust manifold ports (1) which allows for a faster response time to changes and corrections of the air/fuel mixture. Secondary air injection ports (2) are also incorporated in the new manifold design.



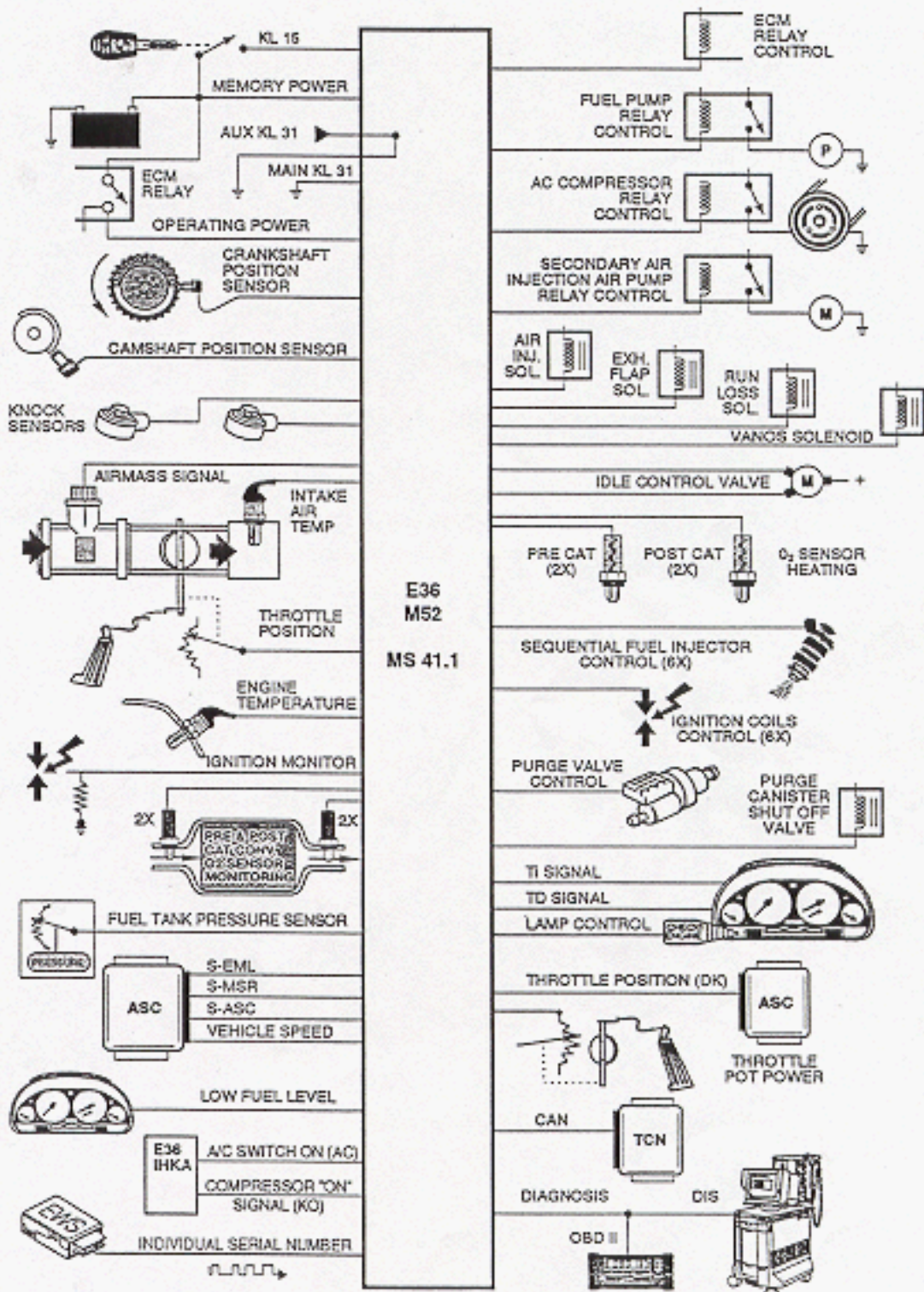
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Two separate catalytic converters (1) are used on 328i models with the M52 engine. Each catalyst has an oxygen sensor at the outlet side (2) which monitors the converters' performance. The rear muffler, also called the active silencer (3), is designed to reduce noise in the low and mid range power bands without performance reduction in the high engine speed range. This is achieved by using two separate resonator pipes (short and long) inside of the muffler assembly. An exhaust flap incorporated into the outlet side of the short pipe is controlled by a vacuum actuator (4) and the new Siemens MS41.4 engine control module.

- At idle and engine speeds up to 2500 rpm - the exhaust flap is held closed (vacuum applied to the actuator). This allows exhaust gasses to flow through the long resonator pipe only, reducing low frequency noises which may be generated.
- Above 2500 rpm - the exhaust flap is open (no vacuum applied to the actuator) which allows exhaust gasses to flow through the short pipe for maximum performance in the mid to high rpm range.

With the introduction of the M52 engine a new engine management system is also introduced. The system is manufactured by Siemens and is designated MS41.1. The new engine management system operation is similar to the Bosch DME M5.X versions currently used on other BMW models and includes the following features:

- Ignition Control
- Fuel Injection Control
- Running Losses Fuel Control
- Secondary Air Injection Control
- Idle Speed Control
- Oxygen Sensor Heating
- Purge Control
- Main Relay/Fuel Pump Relay Control
- VANOS Control
- Exhaust Flap Control
- ASC Control (ignition/injection)
- A/C Compressor Control
- EWS II Drive Away Protection
- OBD II Fault Monitoring



Technical Data

Engine Designation	M52 B28
Design	Inline Six Cylinder
Displacement	2793cc (170cu.in.)
Stroke	84mm (3.307in.)
Bore	84mm (3.307in.)
Maximum Power	190hp (142kw)
At engine Speed	5300rpm
Maximum Torque	280Nm (207lb.ft.)
At engine Speed	3950rpm
Maximum Permitted Engine Speed	6500rpm
Compression Ratio	10.2:1
Intake Valve Diameter	33mm (1.299in.)
Exhaust Valve Diameter	30.5mm (1.201in.)
Minimum Oil Pressure at Idle/Max Speed	0.5bar (7psi) / 4bar (58.8psi)
Oil Capacity with Oil Filter	7.0qts. (6.50ltr.)
Coolant Thermostat (Opening Temp.)	88° C (190° F)
Engine Control	Siemens MS41.1
Firing Order	1-5-3-6-2-4
Spark Plugs	Bosch F8LDCR NGK BKR5EK
Spark Plug Dual Electrode Gap	0.9mm ± 0.1mm 0.035in. (non-adjustable)
Idle Speed	700 ± 100rpm
Recommended Fuel	Unleaded Gasoline 91 AKI