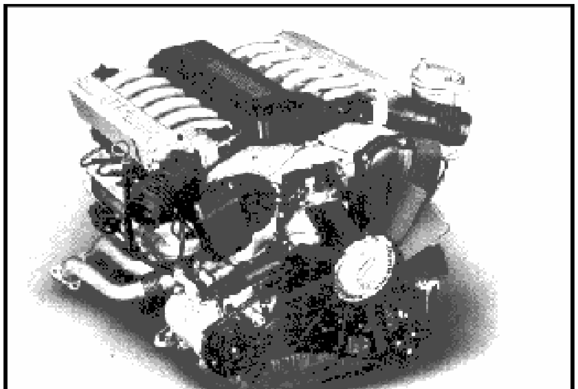

SUBJECT: 5.0 Liter V-12 Engine (M70)

MODEL: 750iL

BMW has developed a completely new, light alloy engine which becomes the premier engine of the new 7-Series. Designated the M70, this development demonstrates many advances in modern engine engineering.


T 87 11 U 04

A broad power band and smooth operation are assured as the new V-12 produces 295 horsepower and the torque output is rated at 450 Nm.

The compact, high performance engine radiates a balanced functional design. In addition to the impressive visual appearance, the new V-12 maintains a power-to-weight ratio of 1.77 lbs/hp.

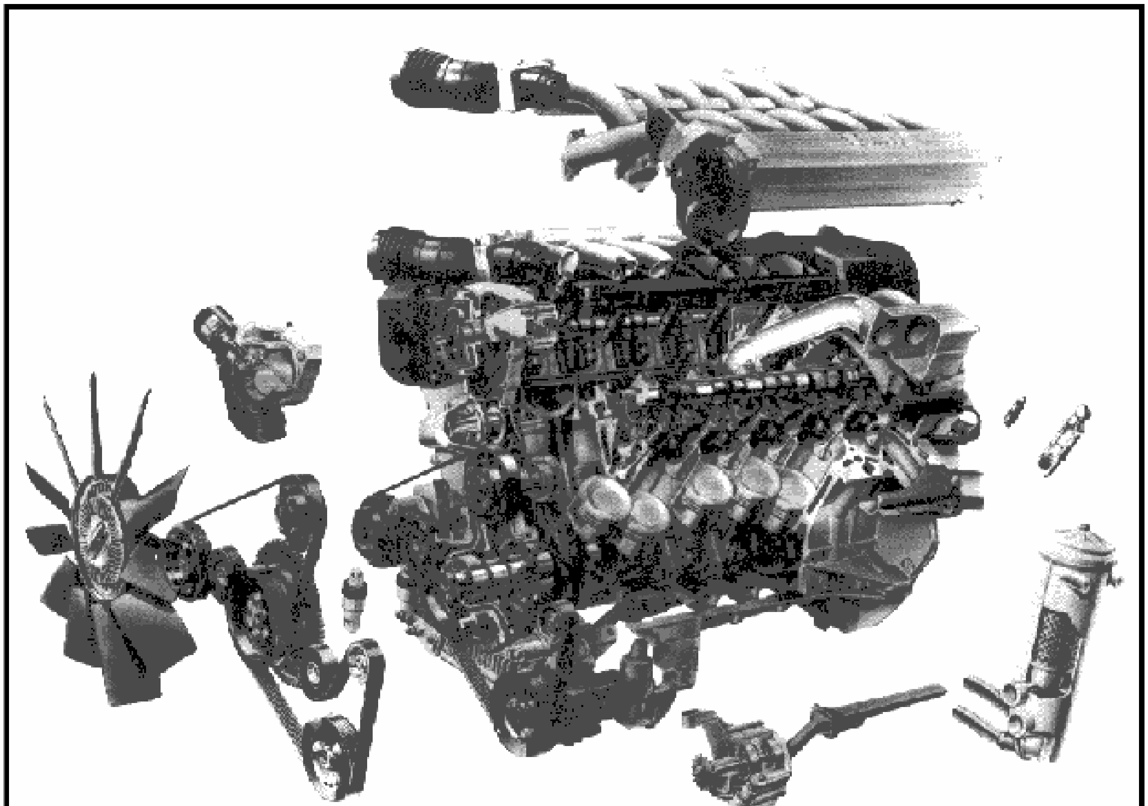
From the beginning of development, fuel economy and emission control were assigned high priorities, resulting in a combination of V-12 performance with economical operation and low emissions.

Additional technological refinements include individual cylinder bank management, precise electronic throttle operation and hot wire air flow sensing. Maintenance has been reduced with the employment of self-adjusting valves and drive belts.

The M70 is equipped with a powerful 2.2kW gear reduction starter motor which provides easy starting at all temperatures.

Smooth running is enhanced with the use of small, lightweight pistons which limit the oscillating mass. Further, the strong drop-forged crankshaft with twelve counterweights and the unitized engine/transmission assembly reduce vibration and resonance.

The M70 exemplifies quiet operation resulting from the use of self-adjusting valves, more precise internal clearances, optimized timing chain tensioning and a silent oil pump. These noise reduction features combine with unique laminated metal/fiber/metal cylinder head covers and oil pan which act as sound barriers.



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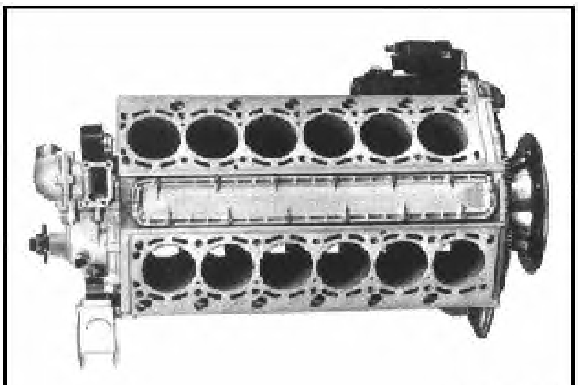

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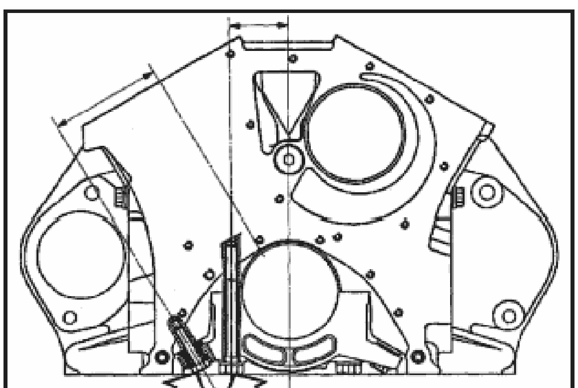


T 87 11 U 07

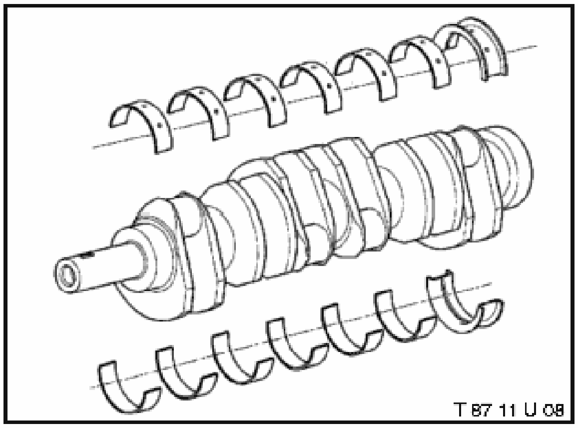
The lightweight aluminum crankcase is manufactured hypereutectically. That is to say, special measures are employed during the formation, casting and cooling which promote torsional resistance and dimensional stability.

The crankcase is symmetrical and can be machined to accept the starter motor on either side to accommodate market demands of left- or right-hand drive.

The cylinder banks are arranged in a 60°V configuration with a constant cylinder center-to-center distance of 91 mm. Cooling is achieved with horizontal coolant flow.

The cast iron main bearing caps, which are heat treated, are fastened to the crankcase with four bolts (**arrows**). Two are attached parallel to the vertical axis and two parallel to the cylinder axis. This patented configuration promotes bottom end stability and strength.

During crankcase formation, a concentration of silicon crystals is maintained in the cylinder bore areas. Special cylinder wall treatment and honing produces a wear resistant silicon surface that, in combination with metal-coated pistons, provides minimal wear and long life.

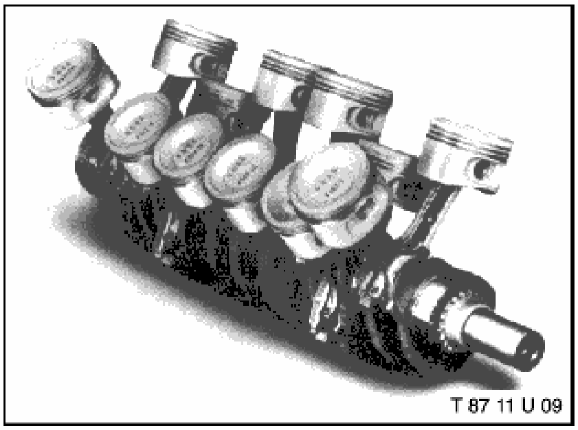


T 87 11 U 08

The drop forged steel crankshaft has excellent torsion resistant qualities and is supported in seven main bearings.

Connecting rod journals are spaced 1200 apart with two counterweights per journal. The axial thrust bearing is now located at the No. 7 bearing position for improved vibration damping. Similar to the M21 design, all bearing shells are triple layered.

The main bearing shells conform to the triple classification.

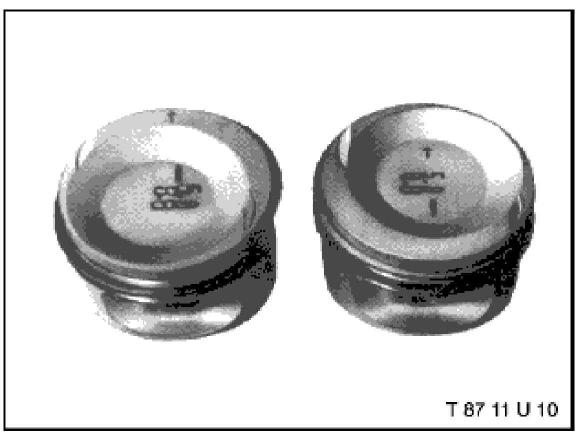


T 87 11 U 09

The connecting rods are made of drop forged steel and are similar to the M20 type. The center to center distance is 135mm, however, unlike the M20, the big end is machined asymmetrically. The special machining allows two rods to run on one journal, thus there is an "installed direction" requirement.

The connecting rod bearing shells conform to the double classification.

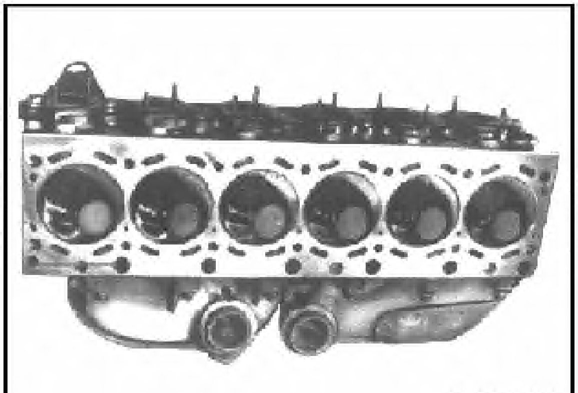
Vibration is held to a minimum with short 60° ignition intervals and the use of low mass, light alloy pistons. The pistons have a 0.1mm ferrous coating which provides a highly compatible operating surface for use in aluminum/silicon cylinders.



T 87 11 U 10

The combustion chamber bowl is located eccentrically to concentrate the air/fuel charge central to the spark plug. Correct wrist pin off-set is maintained with the use of different pistons for each cylinder bank.

The top and intermediate rings are compression rings having plain and tapered faces respectively. The oil control ring has a rubber-lined spring with a bevelled face for good oil control.

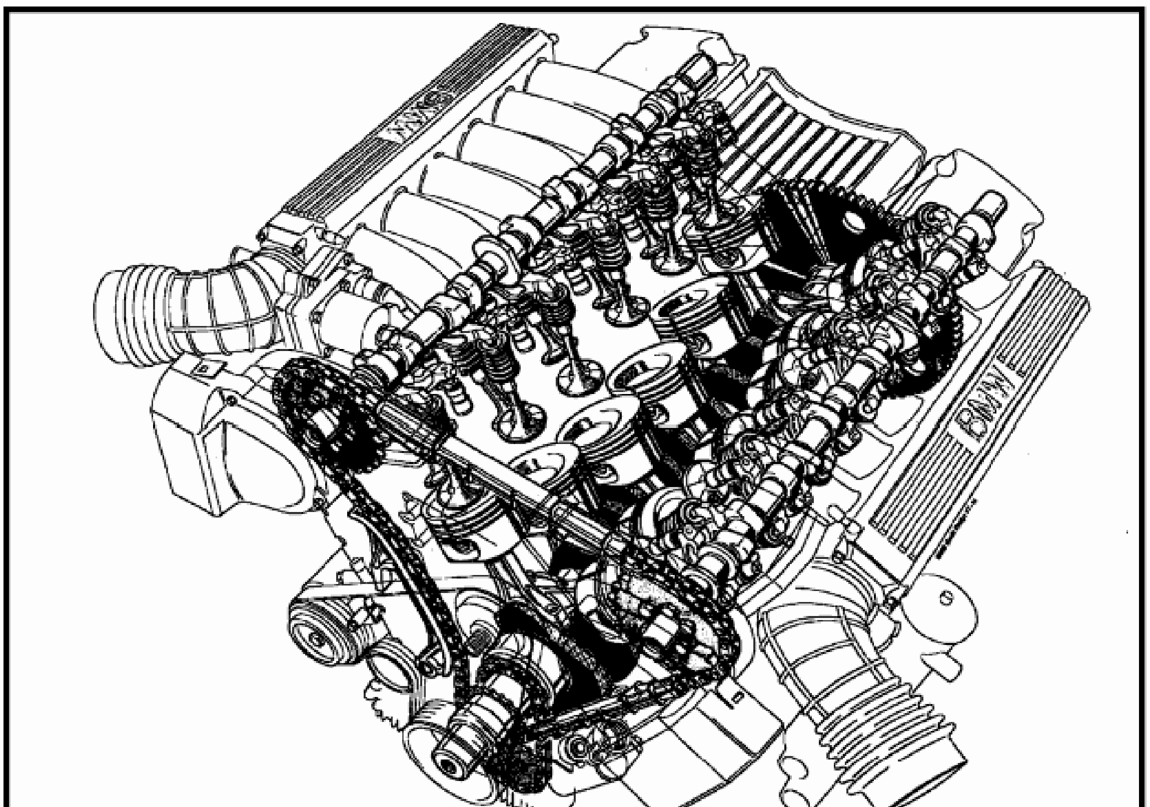


T 87 11 U 11

Cylinder heads are manufactured of die cast aluminum and are identical for both banks.

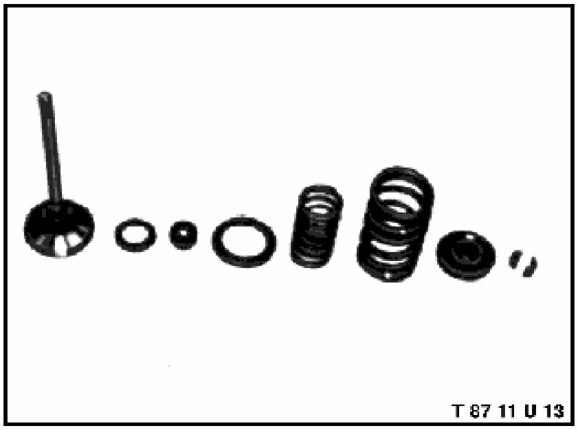
Cylinder head gaskets in various thicknesses are available so that combustion chamber volume uniformity can be maintained.

The intake and exhaust valves are arranged in a 14° V-configuration and operated by overhead camshafts which are supported in seven bearing journals each. Camshaft lubrication is pressure fed at the journals and with overhead oil pipes providing spray oil to the camshaft lobe/rocker contact area.



T 87 11 U 12

This valve arrangement in conjunction with the piston bowl forms a compact combustion chamber with excellent cylinder filling and evacuating characteristics.



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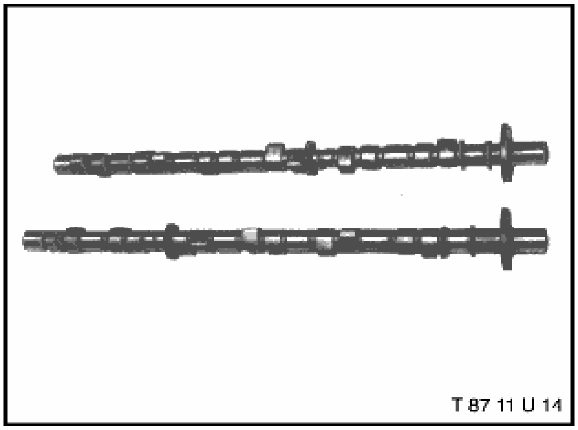
Low valve mass and dual valve springs insure reliable opening and closing between the short ignition periods.



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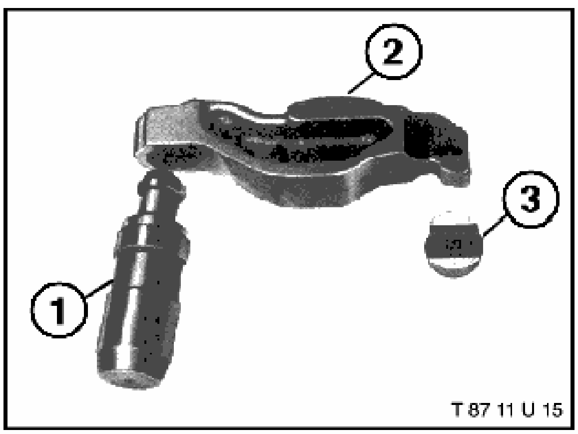
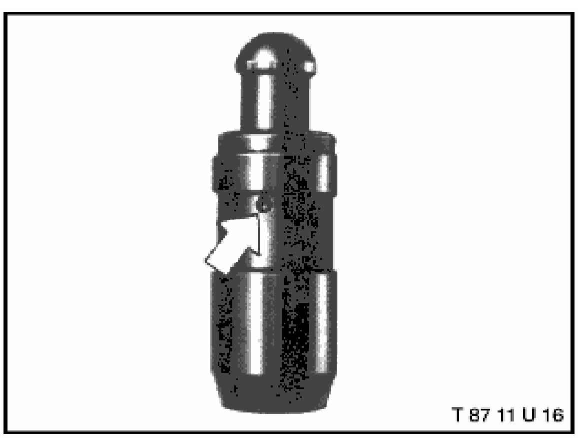
Due to the offset of the cylinder heads, the camshafts are of unequal length. The longer shaft is used in the left cylinder head.



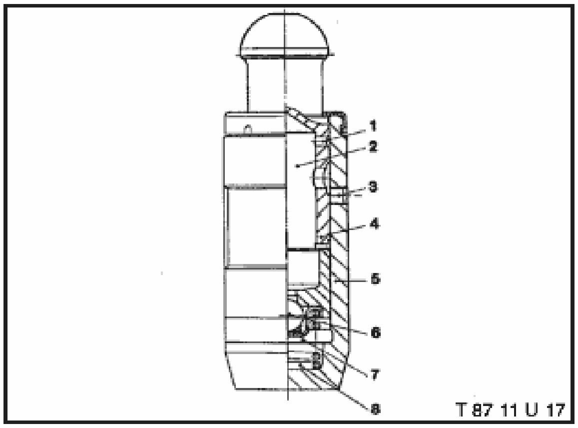
T 87 11 U 15

1. Ball pin type hydraulic tappet
2. Cast rocker arm
3. Thrust guide pad



T 87 11 U 16

The operation of the self-adjusting valve clearance system is based on engine oil pressure hydraulics. Clearances are taken up as oil pressure enters the hydraulic tappet through the oil feed bore (**arrow**) and internal one-way valve. The hydraulic pressure acts on the adjusting piston which is displaced to reduce any nonspecified clearance.

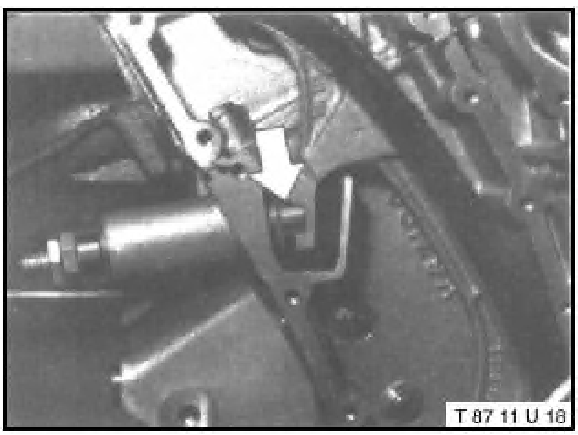


1 Bleeder bore
2 Oil supply chamber
3 Oil supply bore
4 Piston
5 Body
6 Ball valve
7 Tappet pressure chamber
8 Return spring

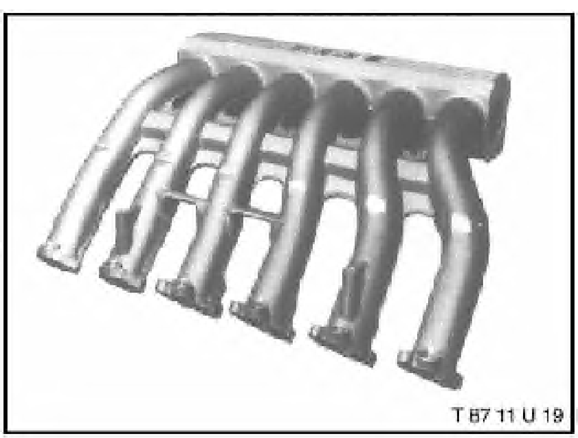
Engine start-up and shut-down present thermal changes that require compensation. The hydraulic tappet reacts to these thermally caused dimension changes by bleeding tappet pressure back into the supply chamber when necessary.

The hydraulic tappet is biased in the "clearance reduce" phase with the help of an internal return spring.

Replacement hydraulic tappets are supplied with full oil supply chambers, therefore, proper functioning after installation is assured. Specific procedures must be followed concerning hydraulic tappet spare parts storage, or oil leakage will occur. Please follow instructions on tappet package.



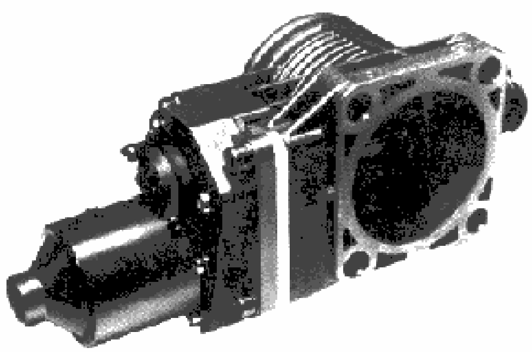
The twin camshafts are driven with a single row chain which operates in conjunction with low noise plastic guide tubes and tensioning rails. The camshaft drive chain lash is controlled with an automatic hydraulic tensioner (**arrow**).



The individual cylinder banks receive precisely balanced air charge delivery from two symmetrical intake plenums which have equal length ram intake runners. The fuel injectors are mounted in the inlet flanges.

T 87 11 U 20

Elastic sealing plates are used to attach the plenum assemblies to the cylinder heads. This feature acts as a sound barrier and limits vibration to the electronic throttle valve assemblies.



T 87 11 U 21

Each intake plenum chamber is equipped with a fast acting, electronic throttle valve assembly.

T 87 11 U 22

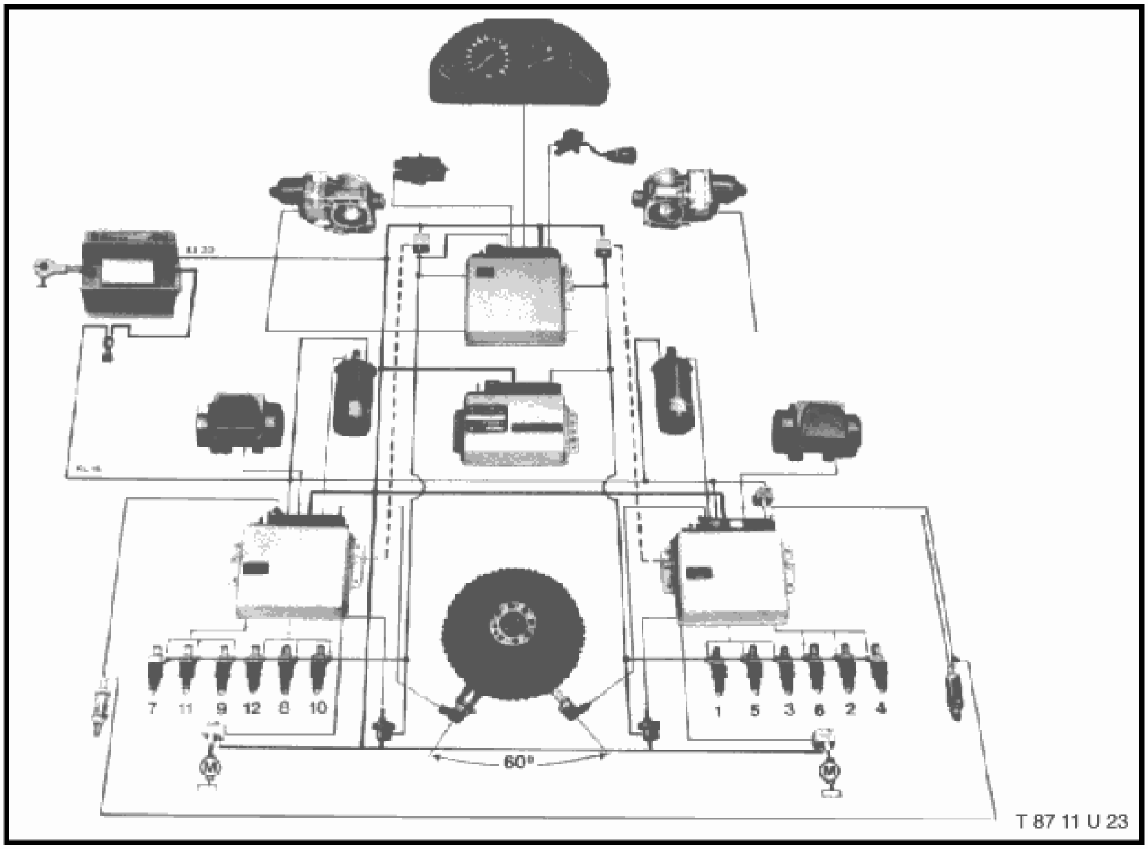
Hot wire air flow sensors are used in conjunction with Digital Motor Electronics for measurement of physical air mass. Precise and rapid load sensing allows improved adaptation to changing engine operating conditions.

The crankcase ventilation system vents crankcase vapors direct to the intake plenum to prevent oil mist contamination.

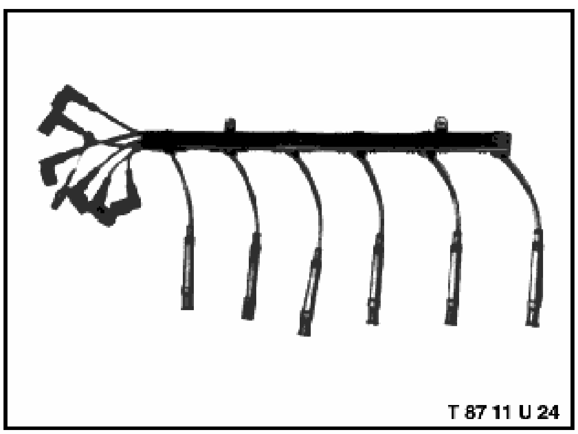
After engine shutdown, the air flow sensing wire is superheated to vaporize any contaminants which may have adhered during the previous engine operating period.

The DME 1.2 Engine Management System represents a further development in Motronic engine control. DME 1.2 is actually two individual Motronic six cylinder engines which share a common crankshaft. Precise balance and synchronization is achieved with the employment of a third management system - EML. In addition to throttle synchronization, EML provides failsafe throttle operating programs, maximum RPM and vehicle speed limits and cruise control operation.

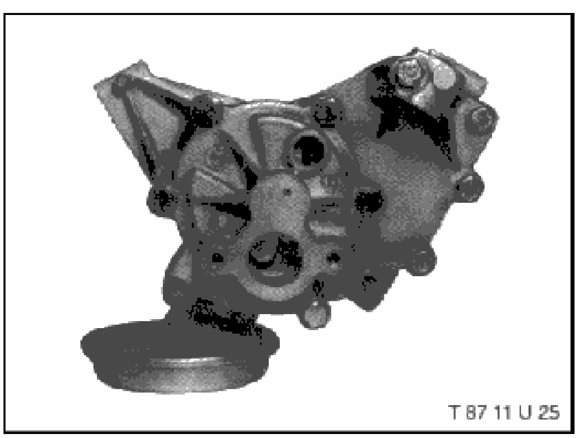
For complete DME information, see TRI 12 01 87 (2083).



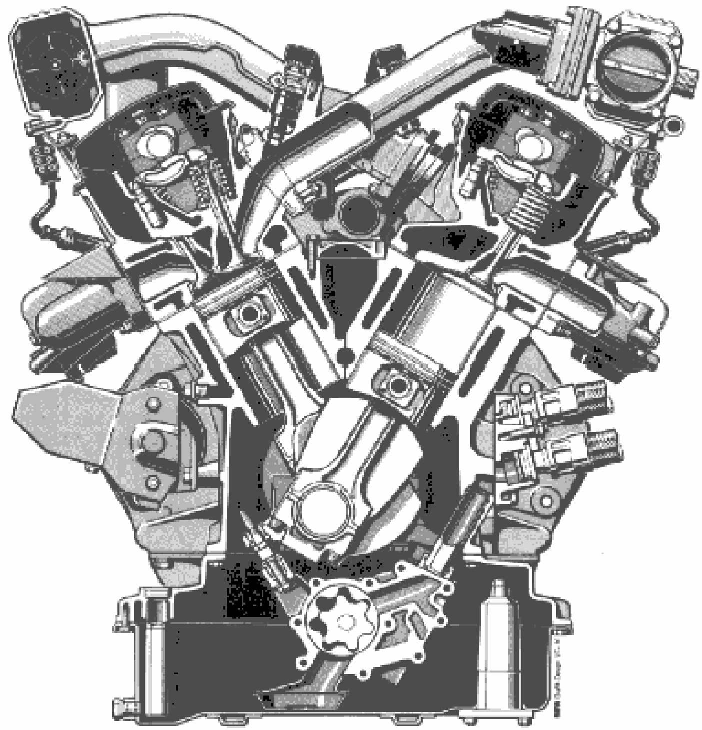
For complete EML information, see TRI 12 02 87 (2087).



Each cylinder bank has it's own secondary ignition distributor and high tension cables. All secondary wiring is routed and protected in a special plastic conduit developed for this purpose.



The oil pump is an Eaton Rotary type of tandem design. The front segment is the primary pump which provides high pressure lubrication for all internal engine components. The rear segment operates as a scavenger pump insuring an adequate oil supply for the primary pump under all operating conditions. The scavenger pump draws oil from the rear of the crankcase via a snorkel tube and delivers the oil to the primary pump pickup.



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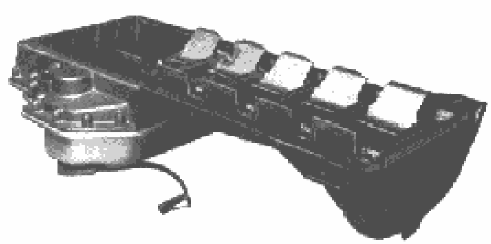
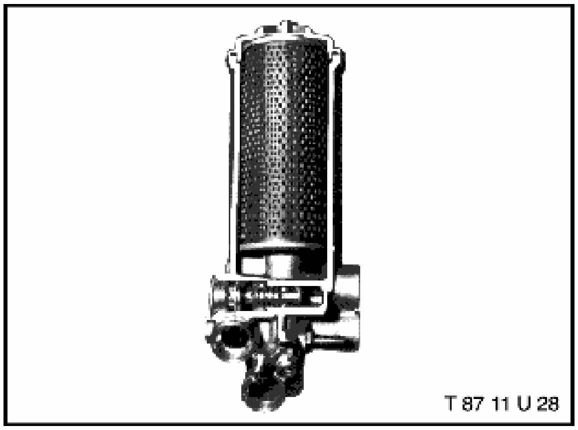


T 87 11 U 27

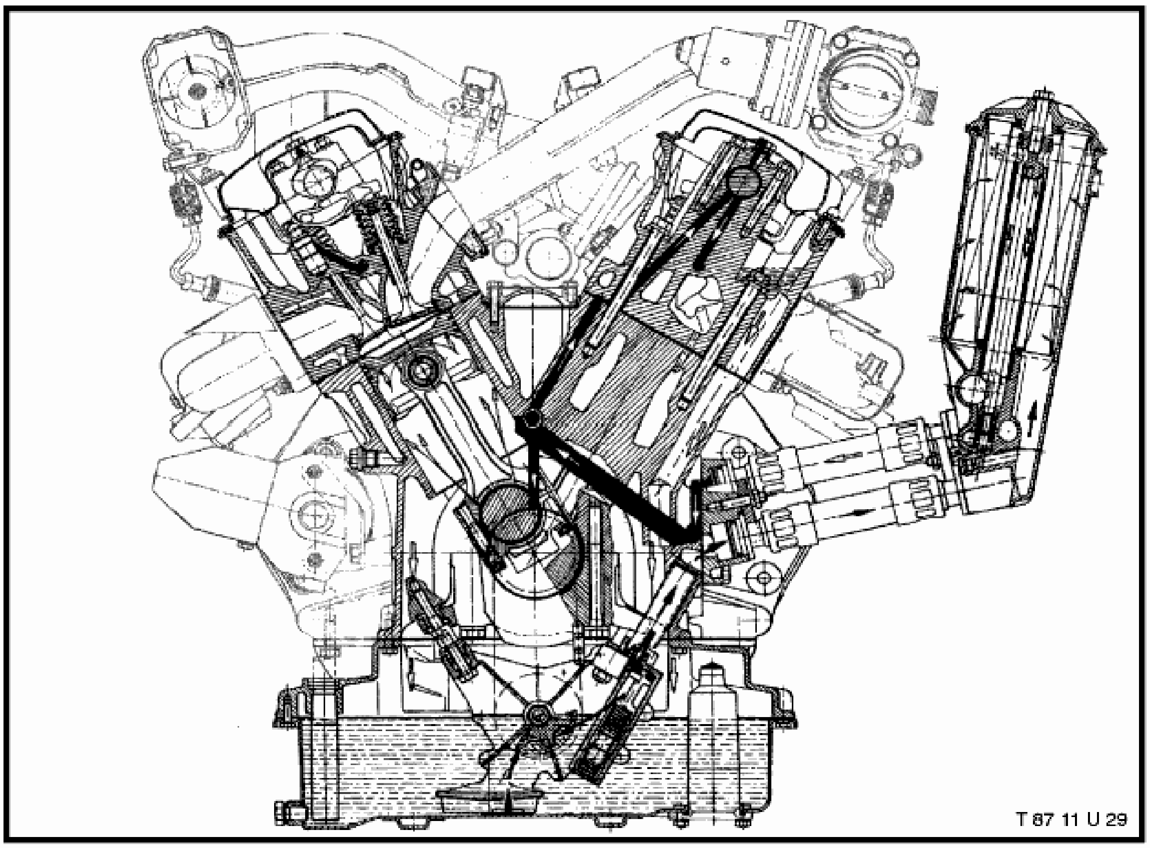
Correct hydraulic tappet operation requires engine oil which is free of all air bubbles. A special oil deflector (windage tray), located in the oil pan, defoams the oil and limits splash oil precipitation.

The engine oil pan is constructed of two sections. The upper section is cast aluminum and incorporates strengthening ribs at strategic attachment points. This feature creates a "unitized" engine and transmission assembly which reduces flex, vibration and noise. The oil pan sump cover, like the cylinder head covers, is constructed of laminated metal-fiber-metal material which acts as a sound barrier.

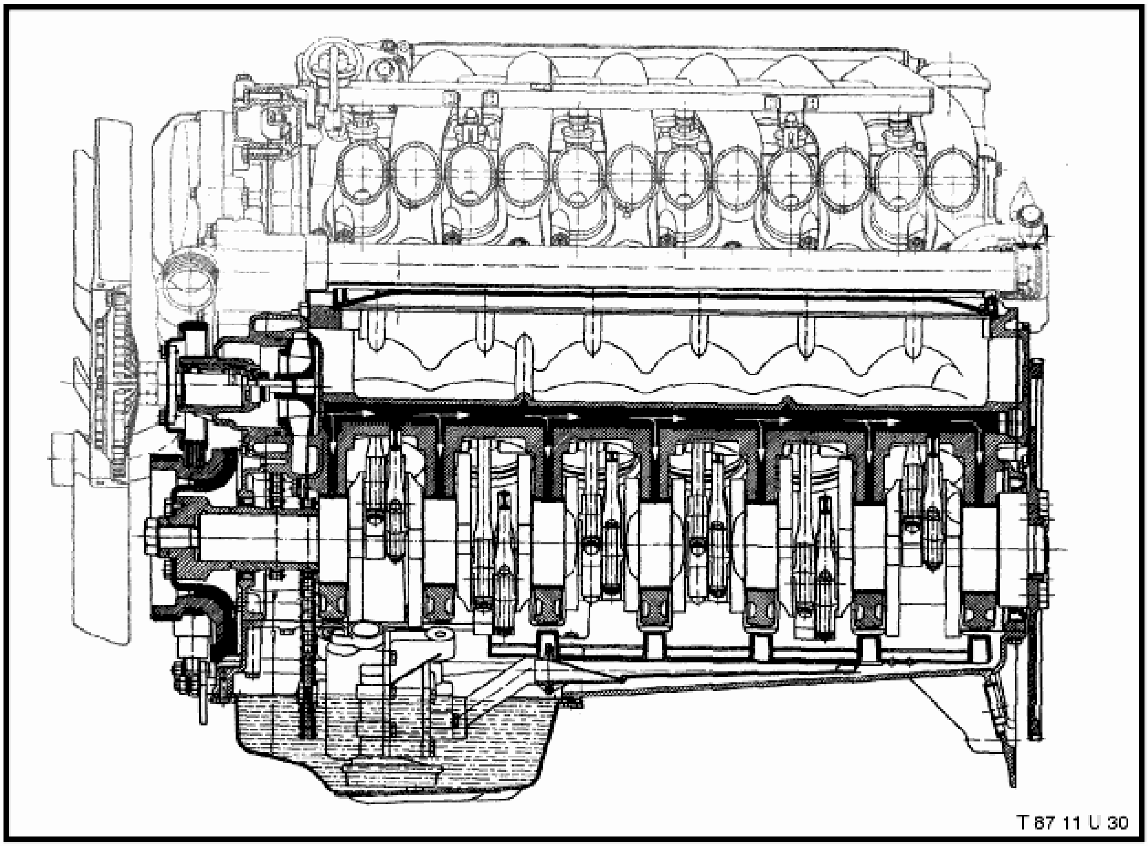


The easy access oil filter is mounted on the left inner fender. Features include large diameter hoses to insure ample oil flow and an anti-drain back valve. Thermostatic oil cooler control is located in the lower section. At a temperature threshold of 95°C, engine oil is directed to the external oil cooler for additional heat dissipation.

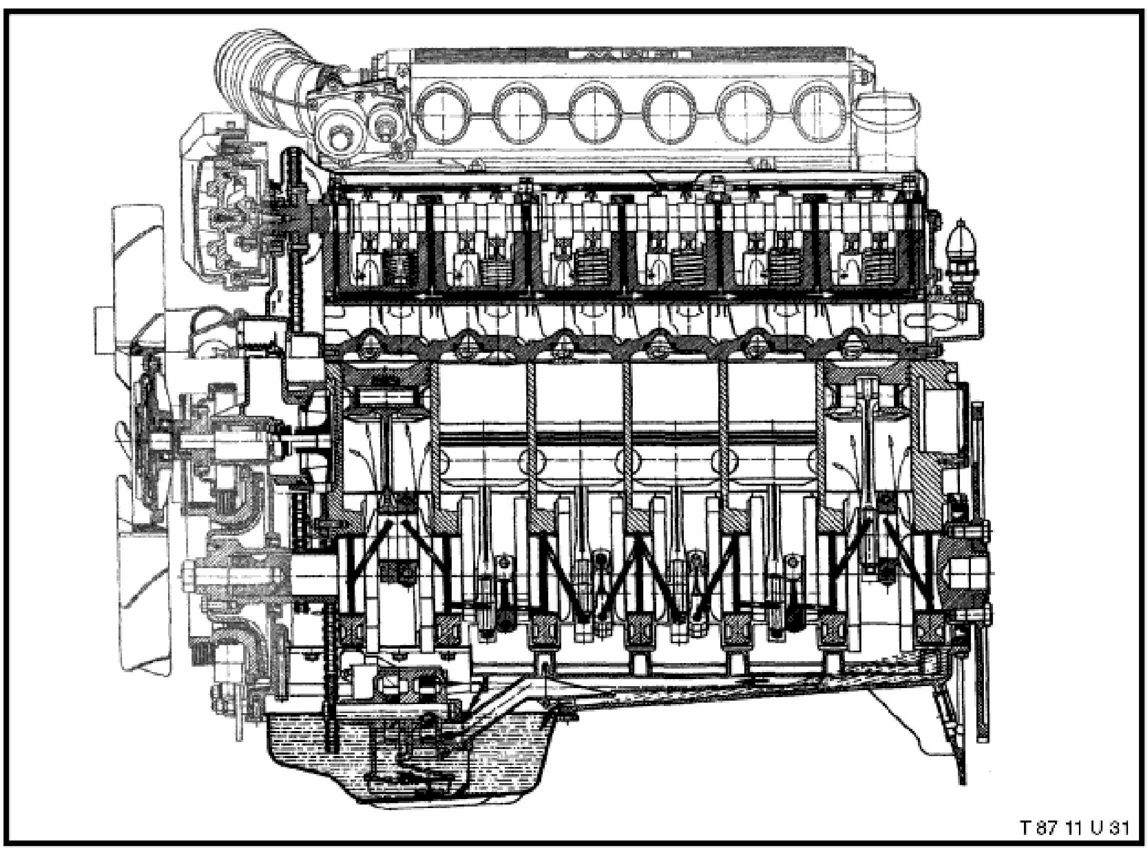
Lubrication oil routing - Engine cross section



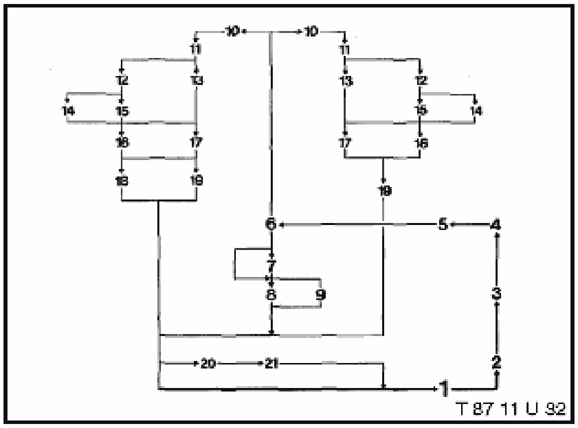
Lubrication oil routing - Main oil gallery



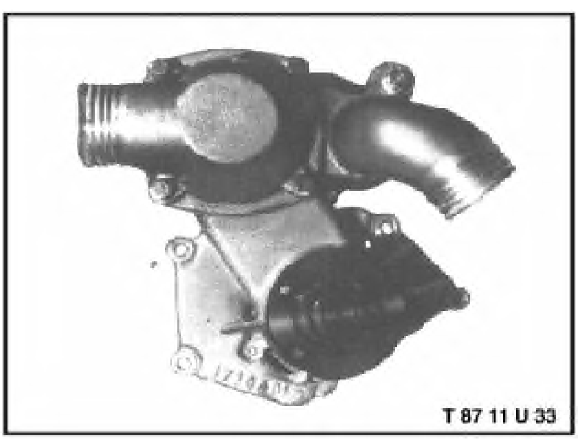
Lubrication oil routing - Camshaft, crankshaft and connecting rods



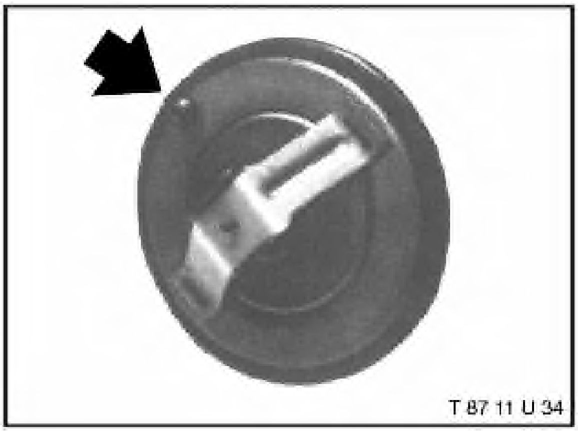
Schematic Presentation of Oil Circuit



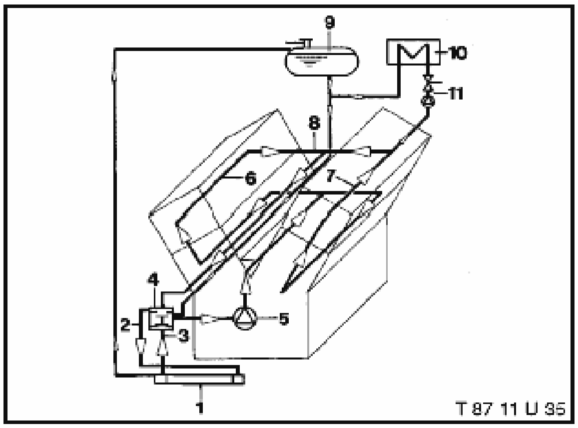
1 Oil pan
2 Oil intake, primary oil pump
3 Primary oil pump with relief valve (4 bar, activation via filtered oil pressure)
4 Oil filter (filter cartridge bypass valve-2.2 bar, one-way check valve, oil pressure switch, oil cooler valve-activated at 95° C)
5 Filtered oil, main gallery
6 Crankshaft main bearings
7 Connecting rod bearings
8 Piston pins (oil spray)
9 Cylinder wall surfaces (oil spray)
10 Oil feed bores in crankcase (cylinders 1 - 6 and 7 - 12)
11 Oil feed bores in cylinder heads
12 Oil gallery
13 Oil spray pipes for cam lobe lubrication
14 Camshaft bearings
15 Hydraulic tappets
16 Timing chain lubrication (oil splash)
17 Rocker arm thrust (guide) pads (oil splash)
18 Oil supply for hydraulically-damped chain tensioner
19 Oil drain bore
20 Oil intake, snorkel
21 Oil pump, scavenger



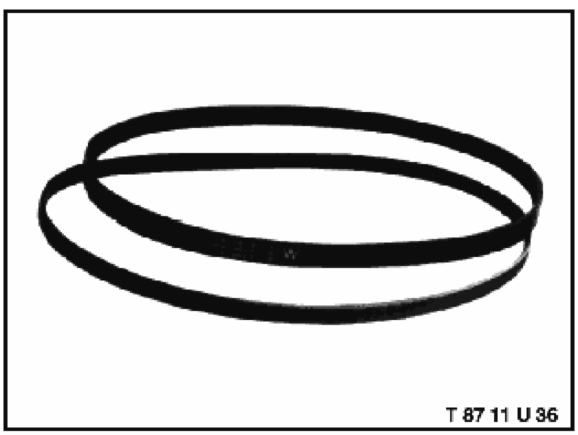
The cooling system is a high volume design flowing symmetrically through both cylinder banks. The compact aluminum cross-flow radiator with a high ratio of fins and tubes has excellent heat exchanger qualities.

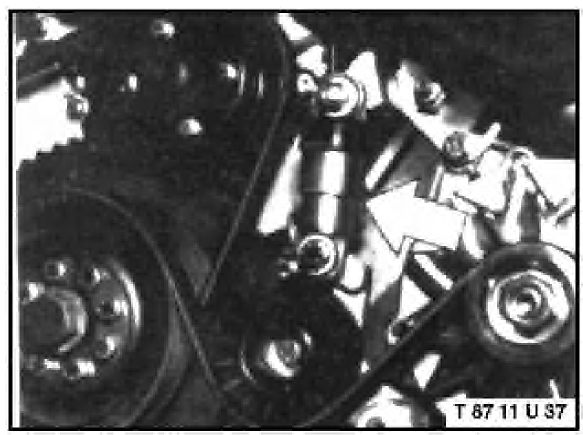


Cooling system flow to the radiator is regulated with an 800 C thermostat. A ball type valve (arrow) in the thermostat plate allows air bubble bleeding following cooling system service.

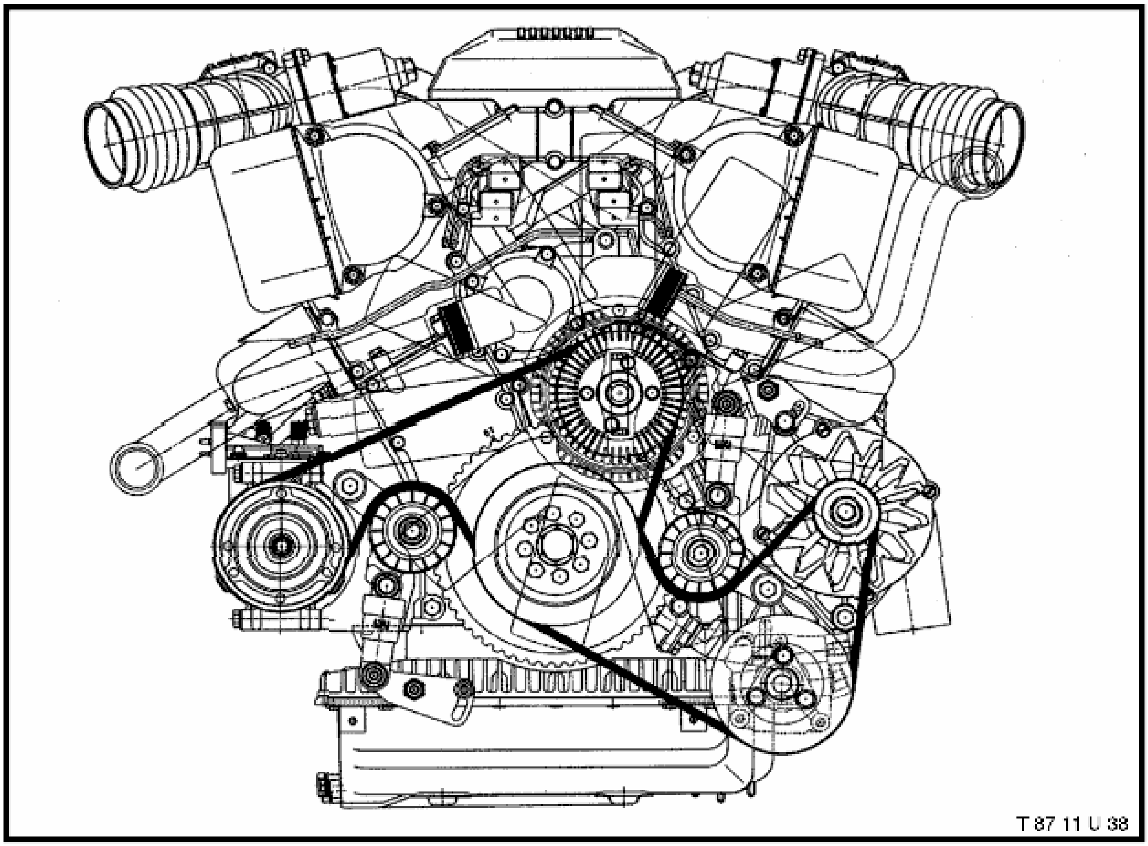


1. Radiator
2. Return
3. Feed
4. Thermostat
5. Water Pump
6. Right Cylinder Head
7. Left Cylinder Head
8. Connecting Pipe
9. Expansion Tank
10. Heater Core
11. Auxiliary Water Pump





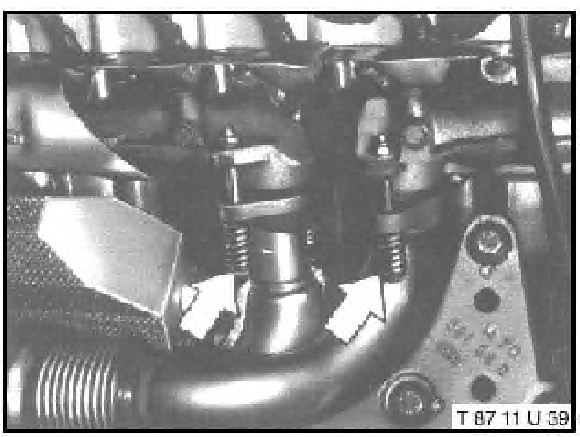
All accessory component rotary drive is accomplished with two poly-V type drive belts. Once correctly installed the belts are self-adjusting with automatic hydraulic tensioners (arrow) and thus are maintenance-free.



Component Drive Distribution:

Belt #1: Water pump, cooling fan and air conditioner compressor
Belt #2: Alternator, hydraulic fluid pump

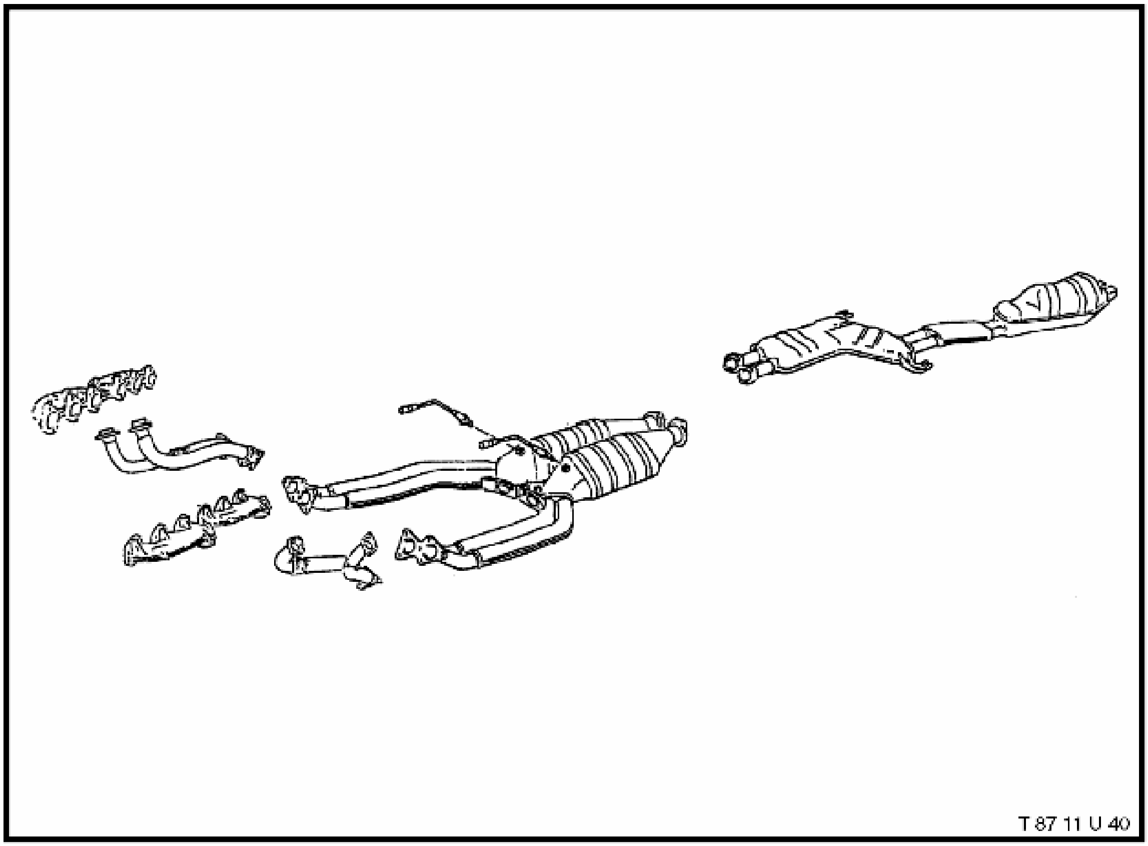
A special lock sensor control unit monitors the A/C compressor speed in relationship to engine RPM. In the unlikely event of A/C compressor seizure, the lock sensor system will immediately de-energize the compressor clutch, thus insuring uninterrupted water pump/fan operation.



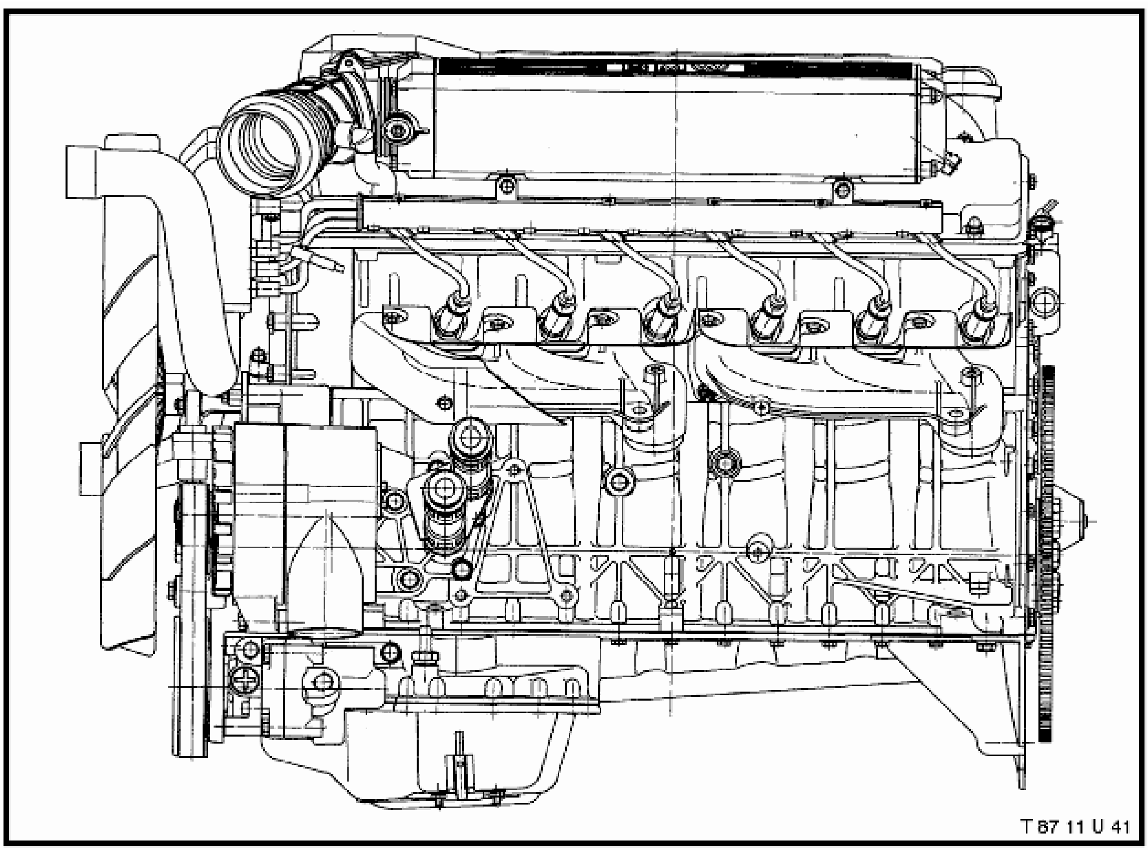
The four exhaust down pipes of the exhaust assembly are mounted with spring loaded ball flanges (arrows). This arrangement insures positive sealing and tends to release any trapped stress.

The four 63mm stainless steel down pipes are of a balanced configuration and limit flow restriction. Further, the pipes are insulated to minimize thermal loss from the exhaust manifolds to the dual 3-way catalysts.

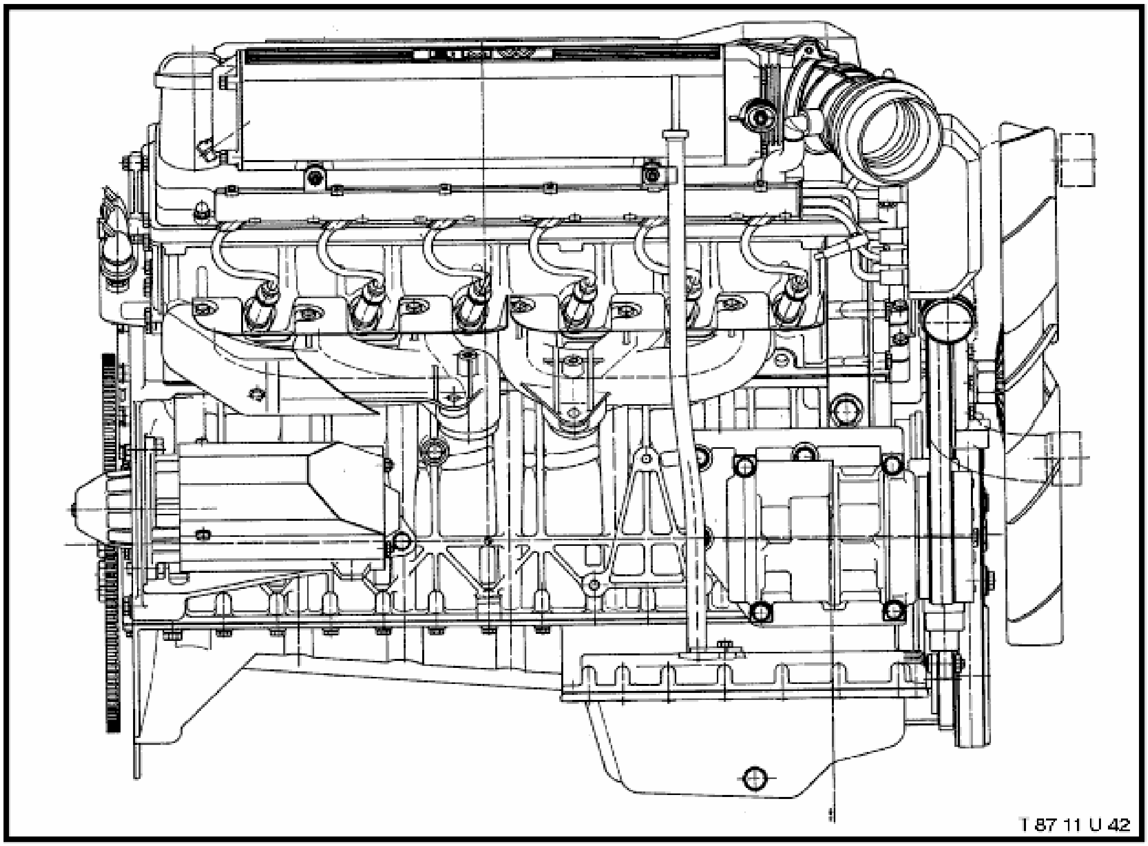
Exhaust system layout



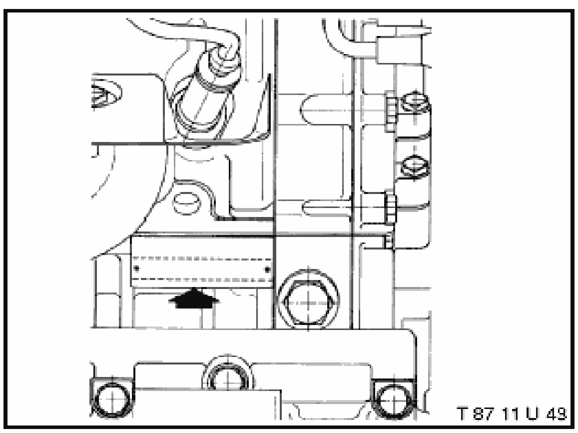
Engine side view left (cylinders 7-12)



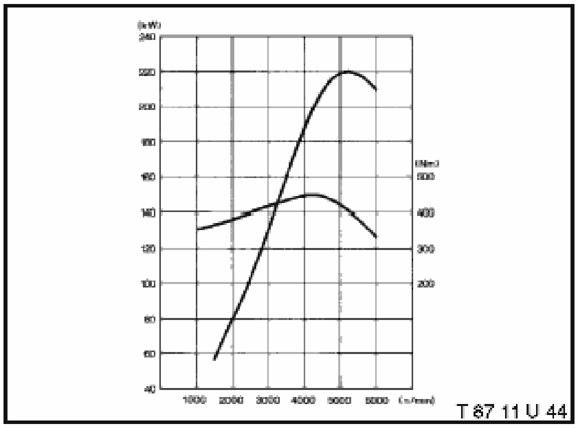
Engine side view right (cylinders 1-6)



Engine number location (right side, front)



Engine power and torque curves



Technical Data

Design	60° V, twelve cylinders
Displacement	4987.5 cc
Stroke	75 mm
Bore	84 mm
Power	295 hp/220 kW
at engine speed	5200 rpm
Max. torque	450 Nm
at engine speed	4100 rpm
Max. permissible engine speed	6000 ± 40 rpm
Constant engine speed	5900 rpm
Compression ratio	8.8 to 1
Combustion chamber volume	53.3 cc
Compression pressure	10 to 12 bar
Piston running clearance	0.01 to 0.034 mm
Valve diameter	
Intake valve	42 mm
Exhaust valve	35 mm
Valve clearance	self-adjusting, hydraulic
Oil pressure	4 bar
Oil volume	6.5 ltr. (+1 ltr. for oil filter and 1 ltr. for oil cooler)
Ignition	Digital Motor Electronics, 30 kV system
Firing order	1-7-5-11-3-9-6-12-2-8-4-10
Distributor	2 high tension distributors
Spark plugs	F8 LCR (Bosch)
Electrode gap	0.7 ± 0.1 mm
CO level	Max. 0.7 ± 0.5% by volume
Idle speed	700 rpm
Fuel injection	DME M1.2 with hot wire air flow sensors
Fuel grade	87 AKI (91 RON)