

Engine components



System structure

The engine consists of the following main components:

- Engine block
- Cylinder head gasket
- Cylinder head
- Cylinder head cover
- Valve gear
- Crankshaft
- Flywheel
- Connecting rods with bearings
- Pistons with rings and pins
- Chain drive
- Oil pan
- Timing case cover



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Fig. 10: Engine components and add-on parts - M57

Differences between the components for the M57 and M67 engines are listed separately.

Component description



Engine block

The engine block represents the central component of the power plant. It houses the crankshaft, connecting rods and pistons.

The following features apply both to the M57 and M67:

- Crankshaft position/rpm sensor mounted on crankcase for radial sensing at inner incremental wheel (last crankshaft web)
- Oil supply gallery for oil spray nozzles with central pressure control valve

M57-specific features

- Material: Grey cast iron
- Support spar concept as on the M47 (i.e. interconnected horizontal and vertical box profiles)
- Cast flange for mounting common rail high pressure pump
- Reinforcement shell with integrated oil deflector function, split design in area of cylinder 1 to 2 (oil pump)
- Oil spray nozzles (common part M47)

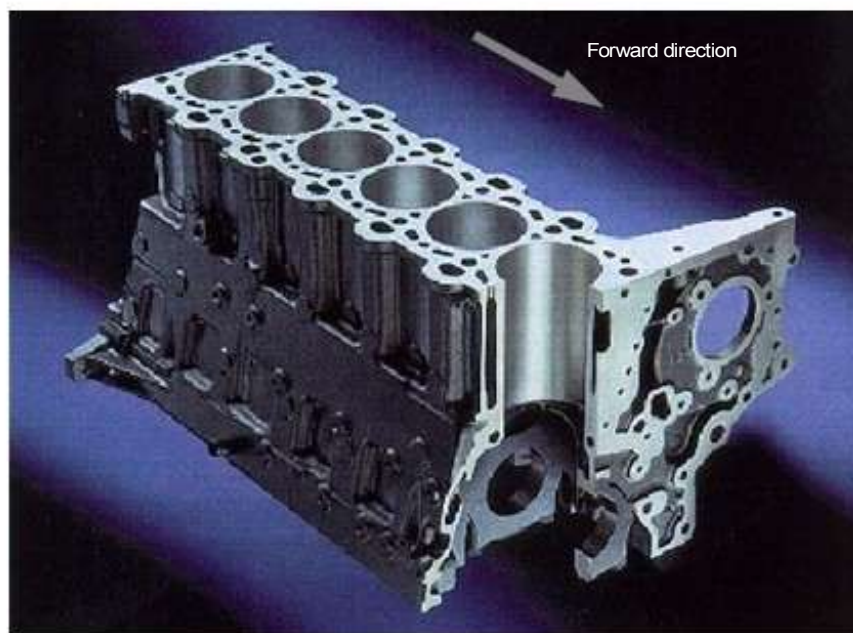


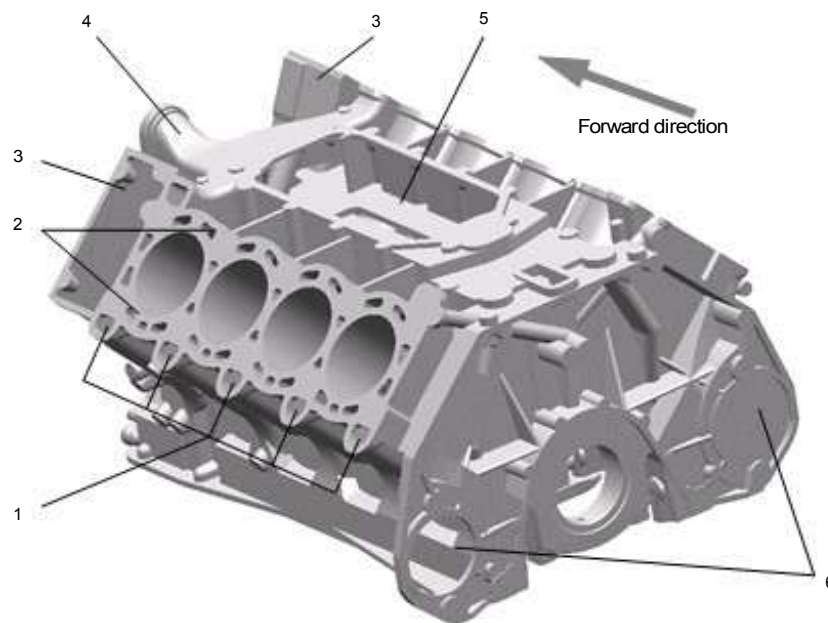
Fig. 11: Engine block - section M57

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M67-specific features



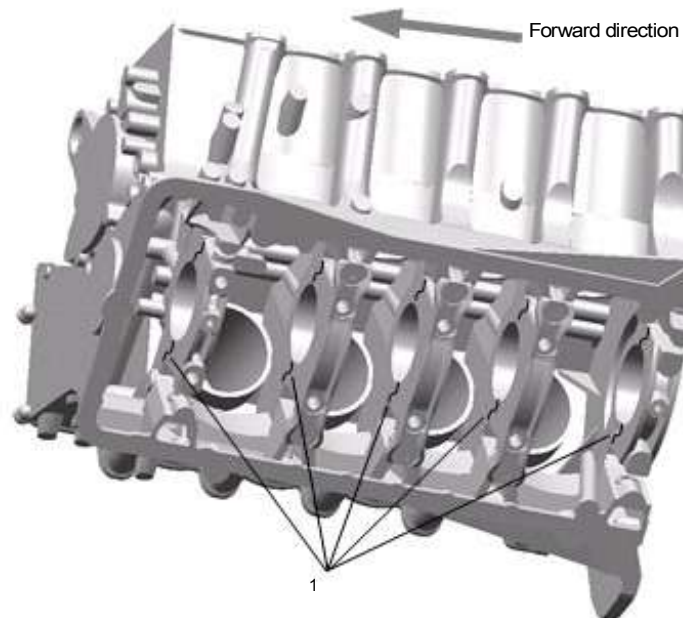
- Cast starter flange on both sides, cast timing case
- Integrated water flow control to water pump
- Oil supply gallery for oil spray nozzles with central pressure control valve
- Piston spray nozzles each with two spray openings



- 1 - Oil return
2 - Coolant ducts
3 - Timing case cover (cast)
4 - Coolant return, integrated collection duct
5 - Space for oil-to-water heat exchanger directly in water pump feed
6 - Starter flange (LHD or RHD)

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Fig. 12: Engine block - view M67



1 - Cracked bearing cap

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Fig. 13: Engine block - view M67 (from below)

- Cracked bearing caps
- V-engine-compliant threaded connection of main bearing caps with additional support brackets

Technical data:

	M57	M67	
Cylinder spacing	91	98	mm
Crankcase height	225 ¹ , 285 ²	245.0	mm
Bore	84.0		mm
Bank offset		18.0	mm

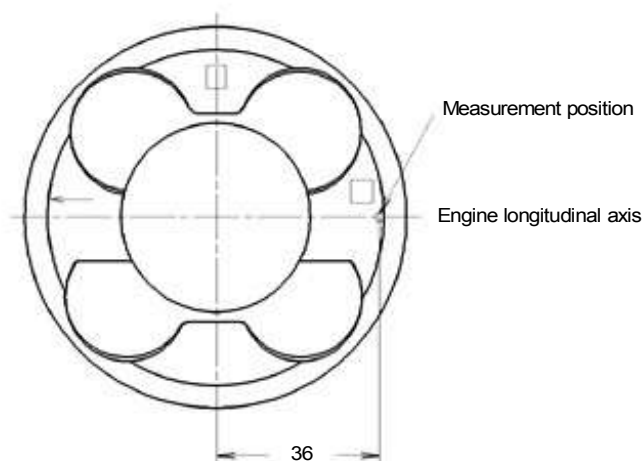
1.) 225.0 from centre of crankshaft to sealing surface of cylinder head
 2.) 285.0 overall height

Cylinder head gasket

The cylinder head gasket seals off the transition points between the engine block and cylinder head.



- Multi-layer steel gasket
- Water flow cross-sections adapted (cylinder-specific) to requirements facilitating uniform coolant flow
- 3 different gasket thicknesses, selected according to determined piston clearance



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Fig. 14: Determining thickness of cylinder head gasket

	Piston clearance x
1-hole gasket	$x \leq 0.92 \text{ mm}$
2-hole gasket	$0.92 \text{ mm} < x \leq 1.03 \text{ mm}$
3-hole gasket	$1.03 \text{ mm} < x$

Cylinder head



The cylinder head represents the upper limit of the combustion chamber. It accommodates the necessary valve timing elements (valves, injectors, camshafts).

The following features apply both to the M57 and M67:

- Cast aluminium, cast timing case
- Coolant flow from exhaust to inlet side
- Central, vertical upright arrangement of common rail fuel injector
- 4-valve arrangement (as on M47)
- Exhaust ports combined in cylinder head (as on M47)
- Cylinder head bolts not accessible with camshafts mounted in position
- Glow plugs (heater plugs) arranged on inlet side
- Leak-proof arrangement of oil galleries/holes (e.g. for hydraulic valve lash adjusters)

M57-specific features

- Coolant outlet arranged in centre between cylinders 3 and 4
- Inlet port configuration (1 swirl/1 tangential port) adapted to common rail injection system



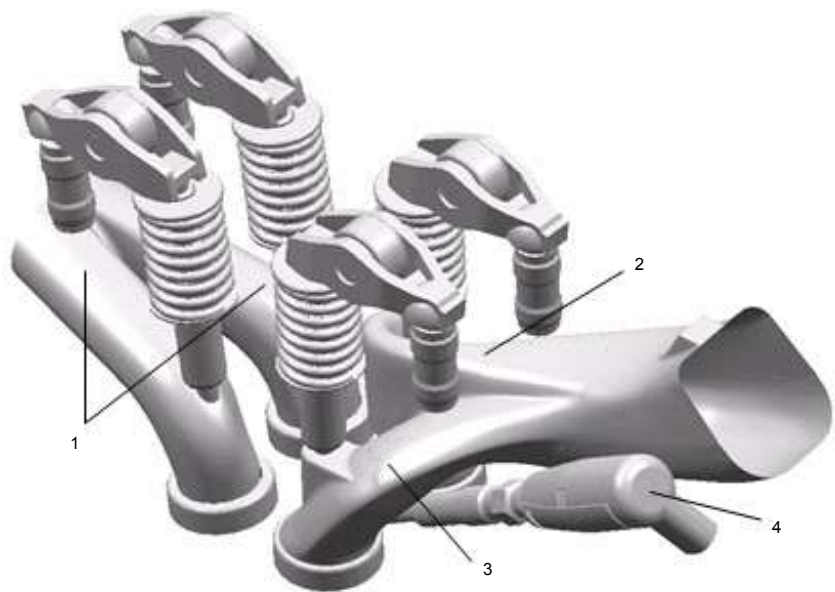
- 1 - Exhaust ports
- 2 - Fuel injector
- 3 - Swirl port (inlet)
- 4 - Tangential port (inlet)
- 5 - Glow (heater) plug

Fig. 15: Inlet port configuration - view M57

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M67-specific features

- Inlet port configuration (1 swirl/1 tangential port), twin-port arrangement



- 1 - Exhaust ports
- 2 - Swirl port (inlet)
- 3 - Tangential port (inlet)
- 4 - Glow (heater) plug

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Fig. 16: Inlet port configuration - view M67 with twin port

Technical data:

		M57	M67	
V-angle	Inlet valves	3.75		degrees
	Exhaust valves	3.0		degrees

Cylinder head cover



The cylinder head cover combines the oil separator and intake silencer in the intake module system.

The following feature applies both to the M57 and M67:

- Mounting on cylinder head by means of decoupling elements

M57-specific features

- Plastic housing
- Integrated oil separator, preliminary separation with cyclone, fine separation with threaded winding downstream

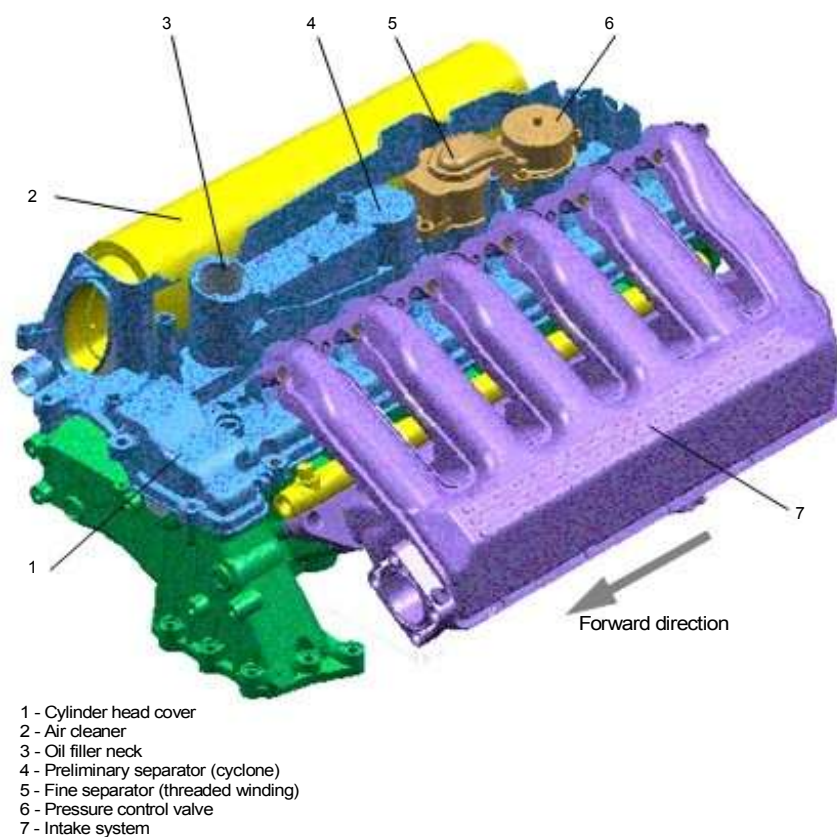
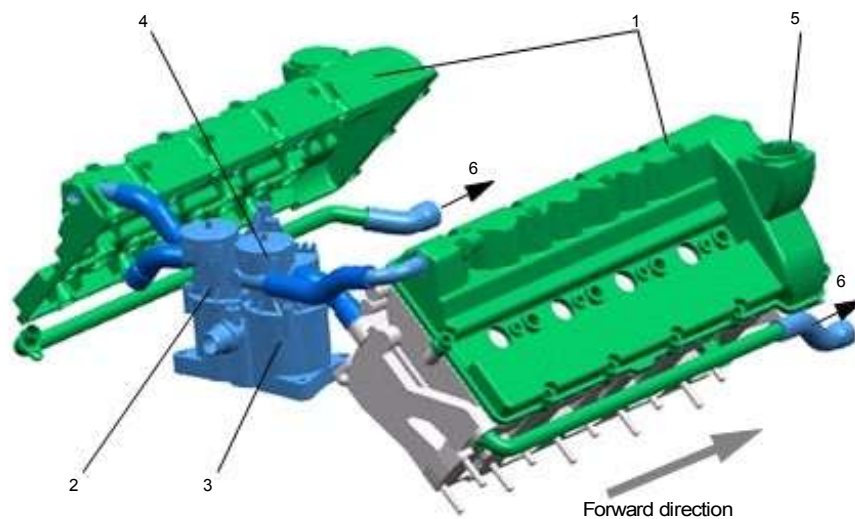


Fig. 17: Intake module - M57

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M67-specific features

- Aluminium casing
- Integrated oil separator, preliminary separation by means of cyclone separator, fine separation with threaded winding downstream



- 1 - Cylinder head cover
- 2 - Preliminary separator (cyclone)
- 3 - Fine separator (threaded winding)
- 4 - Pressure control valve
- 5 - Oil filler neck
- 6 - To clean air line

Fig. 18: Intake module - M67

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Valve gear

The valve gear consists of the camshafts, rocker arms as well as the valves and springs.



The following features apply both to the M57 and M67:

Camshaft

- Chilled cast iron
- New inlet and exhaust camshafts
- Negative cam radius 67 mm

Rocker arm

- Roller-type rocker arm with one hydraulic valve lash per valve (common part with M47)
- Mounted on valve lash adjuster with oil supply

Valves and springs

- Common part with M47
- Inlet and exhaust valves identical
- Bottom valve plate with integrated valve stem seal



Fig. 19: Valve gear - M47/M57/M67

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M57-specific features

- Vacuum pump driven by front of exhaust camshaft



M67-specific features

- Vacuum pump driven by front of inlet camshafts 1 - 4

Technical data:

	M57	M67
Valve diameter	25.9	mm
Valve seat angle	45	Degrees
Valve stem diameter	6	mm

Crankshaft



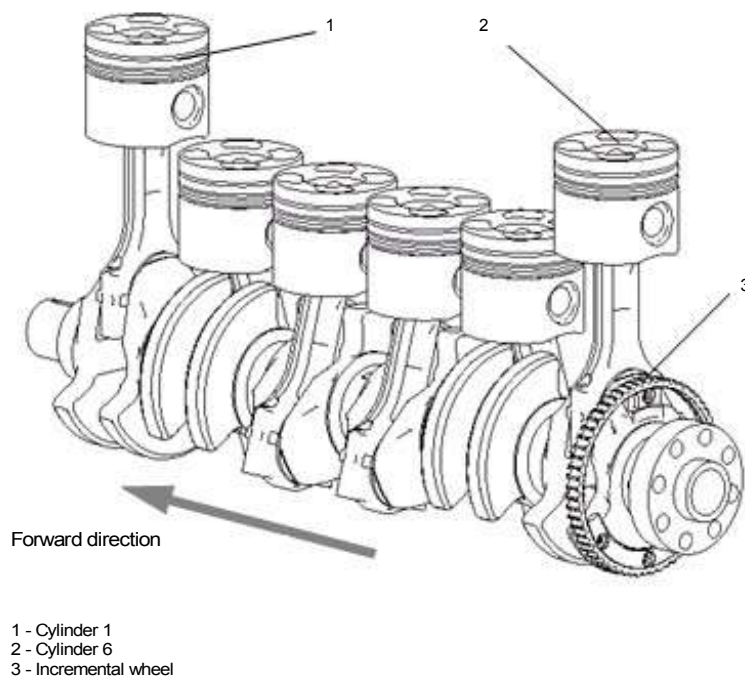
The crankshaft converts the linear stroke motion of the pistons into rotary motion.

The following features apply both to the M57 and M67:

- Threaded connection on front end of crankshaft designed as 4-hole mounting (replaces central bolt)
- Thrust bearing designed as constructed bearing

M57-specific features

- Material C38 mod.
- Bearing surfaces and radii inductively hardened
Main bearings (as on M47)
- Thrust bearing arranged between cylinders 5 and 6
- RPM signal taken from last crankshaft web, incremental wheel screwed on crankshaft web



- 1 - Cylinder 1
2 - Cylinder 6
3 - Incremental wheel

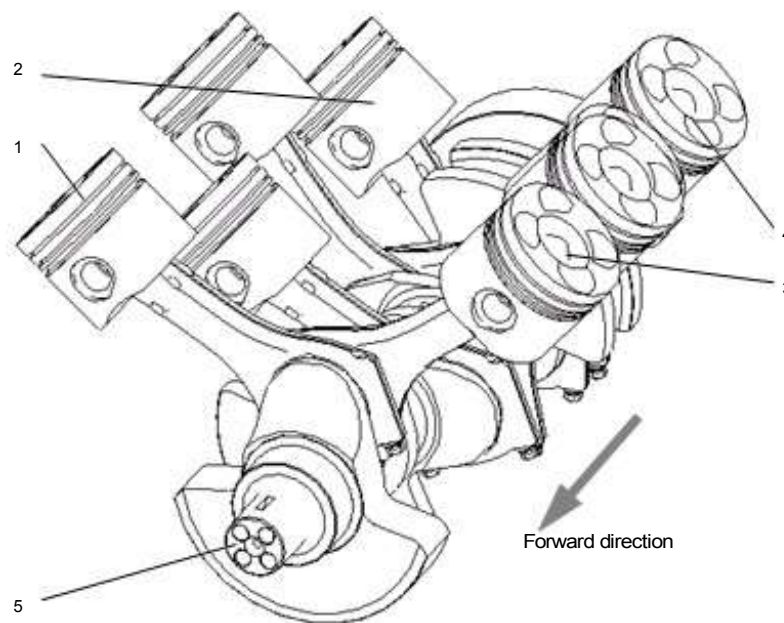
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Fig. 20: Crankshaft drive - view M57

M67-specific features



- Material 42 CrMo 4, nitrocarburized
- Shaft cranked at two levels (similar to M62)
- Main bearing, common part with M62
- Thrust bearing with integrated bearing, arranged on flywheel end of main bearing



- 1 - Cylinder 1
2 - Cylinder 4
3 - Cylinder 5
4 - Cylinder 8
5 - Connection for torsional vibration damper

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Fig. 21: Crankshaft drive - view M67

Flywheel



The flywheel is located between the engine and gearbox. The task of the flywheel is to increase the rotating mass so as to enable more uniform rotary motion.

Various types of flywheel are used depending on the type of gearbox installed.

M57-specific features

- Manual gearbox: Dual-mass flywheel
- Automatic gearbox: Sheet-metal flywheel based on sandwich design

M67-specific features

- Automatic transmission (5HP30):
Sheet metal flywheel with integrated incremental wheel,
TDC allocation adapted to control unit

Technical data:

		M57	M67
V-angle	Inlet valves	3.75	degrees
	Exhaust valves	3.0	degrees

Connecting rods with bearings



The connecting rod connects the piston to the crankshaft. Each connecting rod is mounted such that it can rotate.

The following features applies both to the M57 and M67:

- Big-end bearing half on connecting rod end designed as sputter bearing

M57-specific features

- Connecting rod : Common part with M47
- Material C40 mod.
- Cracked version

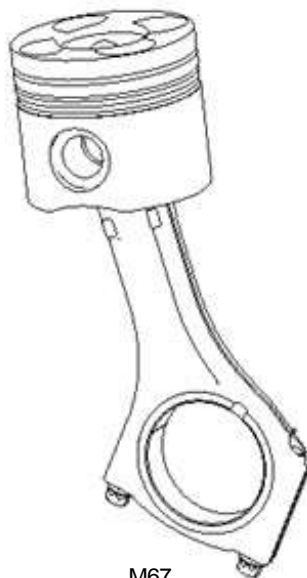
M67-specific features

- Material C70
- For assembly reasons, obliquely split trapezoidal connecting rod, cracked



M57

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M67

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Fig. 22: Piston with connecting rod

Technical data:



	M57	M67	
Distance between hole centres	135	155	mm
Piston pin (gudgeon pin) diameter	30.0		mm
Crankshaft diameter			mm
Cracked connecting rods	48	57.6	mm

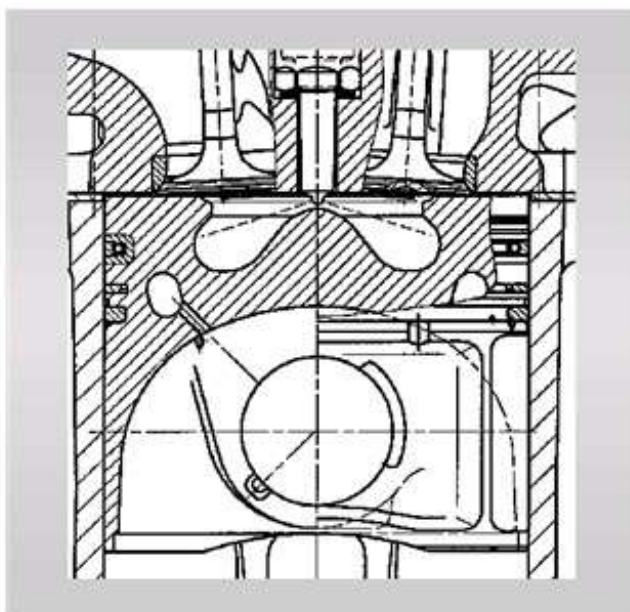
Pistons with rings and pins



The piston forms the moving bottom wall of the combustion chamber. Its specially designed shape contributes to ensuring optimum combustion. The piston rings seal off the gap to the cylinder wall so as to ensure high compression and as little gas as possible enters the crankcase.

The following features apply both to the M57 and M67:

- Cooling duct piston with rotationally symmetrical piston crown bowl specific to DI common rail
- The lobe in the piston crown bowl is higher than on the M47



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Fig. 23: Sectional view of combustion chamber

M67-specific features

- The pistons of cylinder bank 1 (1 - 4) and cylinder bank 2 (5 - 8) differ as the valve arrangement is not symmetrical (different valve pockets on piston); the pistons are identified accordingly

Chain drive



The rotary motion of the crankshaft is transferred to the camshaft via the chain drive. In this way it defines the interaction between the stroke motion of the piston and the movements of the valves.

The following features apply both to the M57 and M67:

- 2-piece chain drive
- Tensioning rail made from aluminium die casting with plastic slide lining
- Bushed roller chains

M57-specific features

- Chain drive 1: From crankshaft to common rail high pressure pump
- Chain drive 2: From common rail high pressure pump to camshafts
- Double-acting chain tensioner

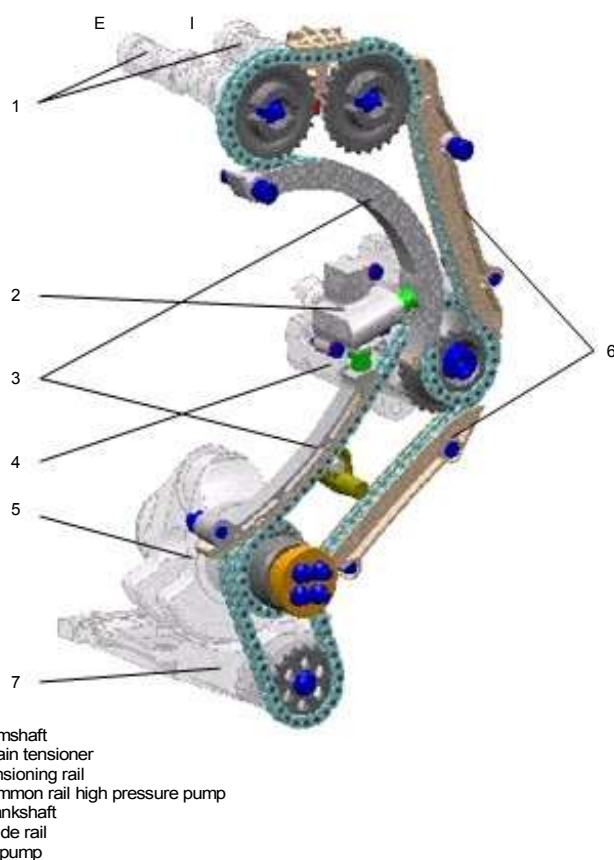


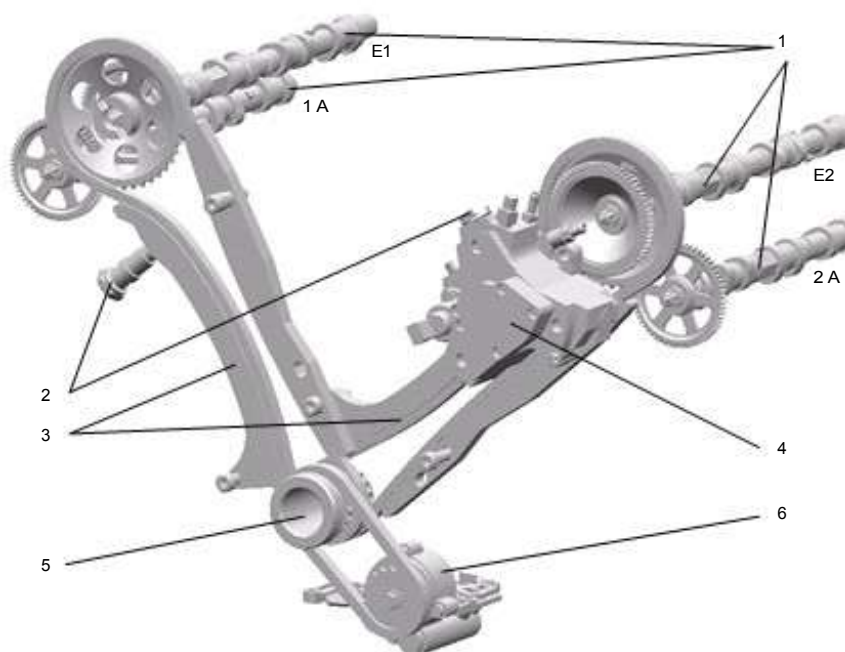
Fig. 24: Chain drive - M57:

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M67-specific features



- Chain drive 1: From crankshaft to inlet camshaft, bank 1 (cyls. 1 - 4)
- Chain drive 2: From crankshaft to inlet camshaft, bank 2 (cyls. 5 - 8)
- Drive of camshafts with respect to each other by means of spur-toothed gearwheels
- Common rail high pressure pump driven by gearwheels for engine speed adaptation of inlet camshaft, bank 2
- Two chain tensioners mounted in cylinder head from outside



- 1 - Camshaft
- 2 - Chain tensioner
- 3 - Tensioning rail
- 4 - Common rail high pressure pump
- 5 - Crankshaft
- 6 - Oil pump

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Fig. 25: Chain drive - M67:

Oil pan

The oil pan represents the bottom end of the engine and serves as an oil collection reservoir. The position of the oil pan (sump) depends on the design of the front axle.



M57-specific features

- Aluminium die cast with integrated thermal oil level sensor
- Oil pan gasket designed as metal-backed gasket (same as on M47, common part E38 and E39)
- Return flow pipe (E38) so that oil from the oil separator can return to the oil sump below the oil level (blow-by gases)

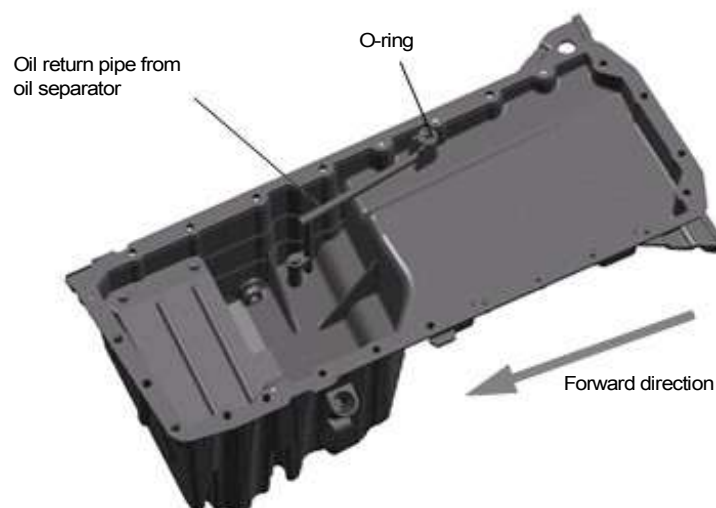
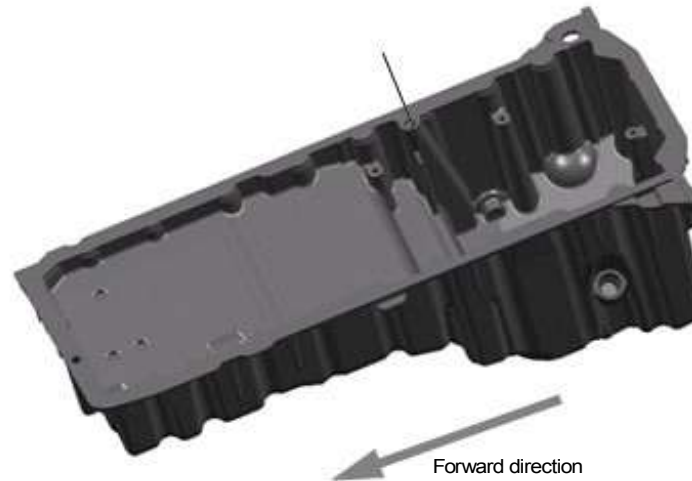


Fig. 26: Oil pan - M57 in E38

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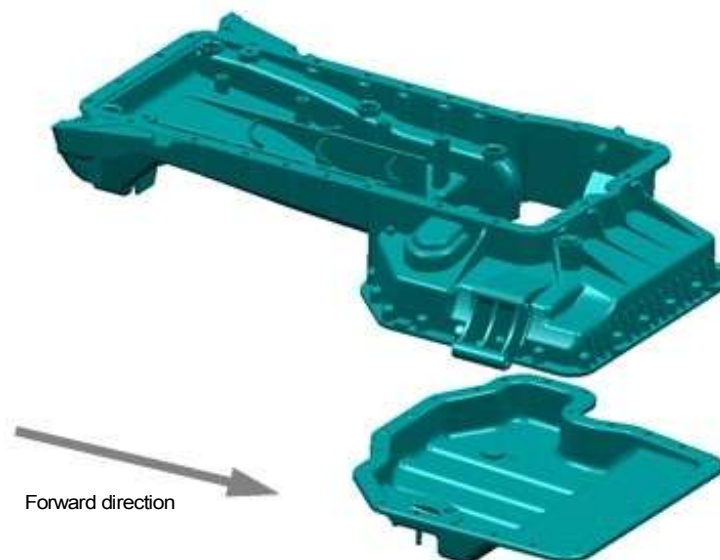


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Fig. 27: Oil pan - M57 in E39

M67-specific features

- Two-piece casing
- Upper section made of pressure die cast aluminium with integrated thermal oil level sensor, sheet metal bottom section (common part with M62)
- Oil pan gasket designed as sheet metal backed gasket, gasket of bottom section of oil pan common part with M62



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Fig. 28: Oil pan - M67 in E38

Timing case cover (M57)



On the M57 the timing case cover covers the chain drive in the area of the crankcase. On the M67 this cover is integrated in the crankcase.

- Aluminium die casting
- Sealed off from crankcase by means of sheet metal beaded gasket (replace gasket after disassembly)
- Unit and belt tensioner connection on cover

Rear end cover (M67)

The rear end cover houses the rotary shaft seal and seals off the rotating crankshaft from the outside.

- Aluminium die casting
- Sealed off from crankcase by means of sheet metal beaded gasket (replace gasket after disassembly)