



Diesel Engines

M57/M67 Common Rail

Course contents/Background material

Information status:

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BMW
Service Training

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Introduction

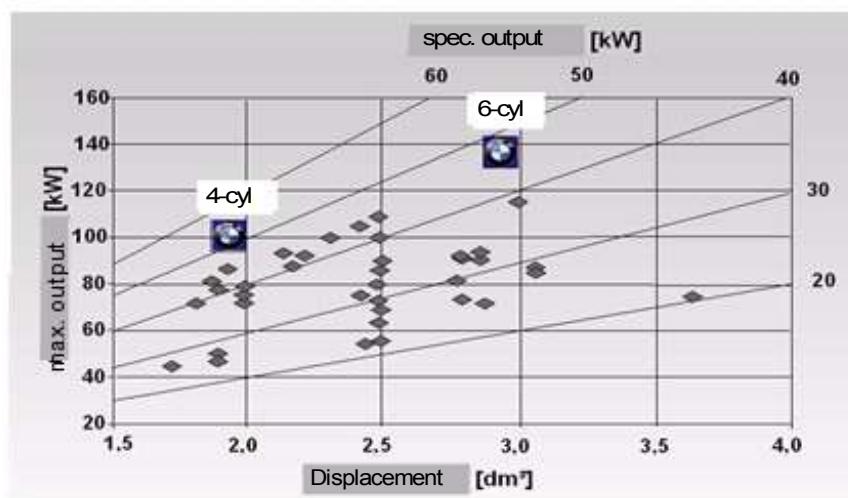


BMW is successively developing a new family of diesel engines with direct injection (DI) that will include 4-cylinder, 6-cylinder and 8-cylinder engines.

Following the successful introduction of the M47D20 4-cylinder engine, a new 6-cylinder engine will soon be phased into series production.

This engine features all the design characteristics of the second generation of direct injection diesel engines and represents the currently most advanced diesel technology available in passenger vehicles.

Thanks to its outstanding performance and high comfort properties in conjunction with excellent exhaust quality and integral fuel economy, this engine enjoys a leading position in the competitive environment.



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Fig. 1: Competitive situation M47/M57

Initially, the new M57 engine will be installed in the form of a top-of-the-range diesel engine in the 5 and 7 Series. The M67 will enhance the top end of the diesel engine range in the 7 Series.

Parallel to this, the well-proven indirect injection engines (IDI) will still remain in the product range.

Objectives



The layout and design particularly of the six-cylinder engine is based on the following primary objectives:

- The creation of a top-of-the-range diesel engine for all BMW model series
- Maintaining the leading competitive position with regard to output power and torque development as well as comfort in the entire diesel vehicle segment
- Securing marketability by the use of future-oriented technical concepts incorporating further development capabilities

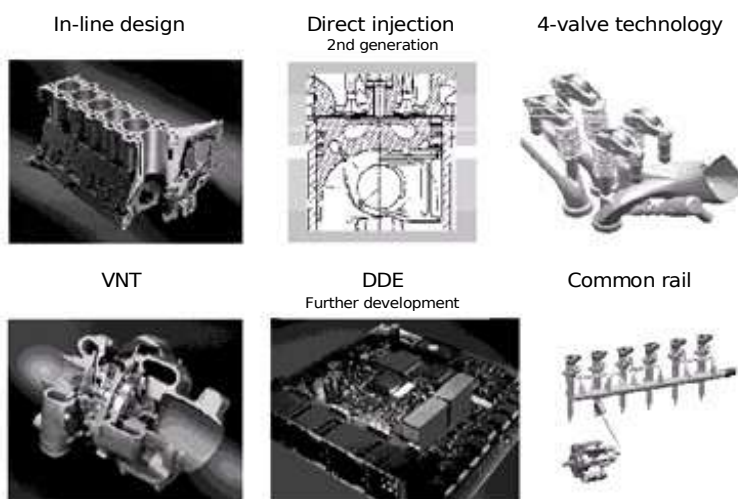
Concepts



The concept features of the new engines correspond to those of second generation DI diesel engines.

The advantages in fuel consumption offered by the first series-produced DI diesel engines were offset by a series of disadvantages regarding acoustic comfort, performance, emission, passenger compartment heating and costs compared to modern IDI diesel engines.

In contrast to this, with second generation DI diesel engines it has been possible to improve all customer-relevant features, with the exception of costs, by incorporating new or further developed technical concepts.



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Fig. 2: Technical concepts

The superiority of these engines is the result of non-compromising basic engine design (modular system) in conjunction with progressive technical concepts.

Engine views



Fig. 3: M57 engine - General view

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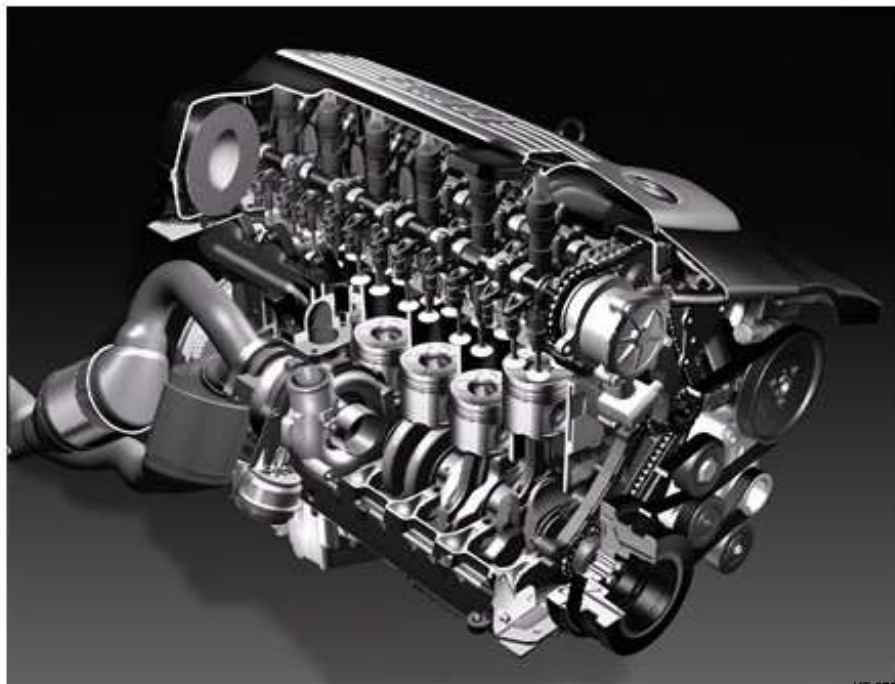


Fig. 4: M57 engine - Sectional view

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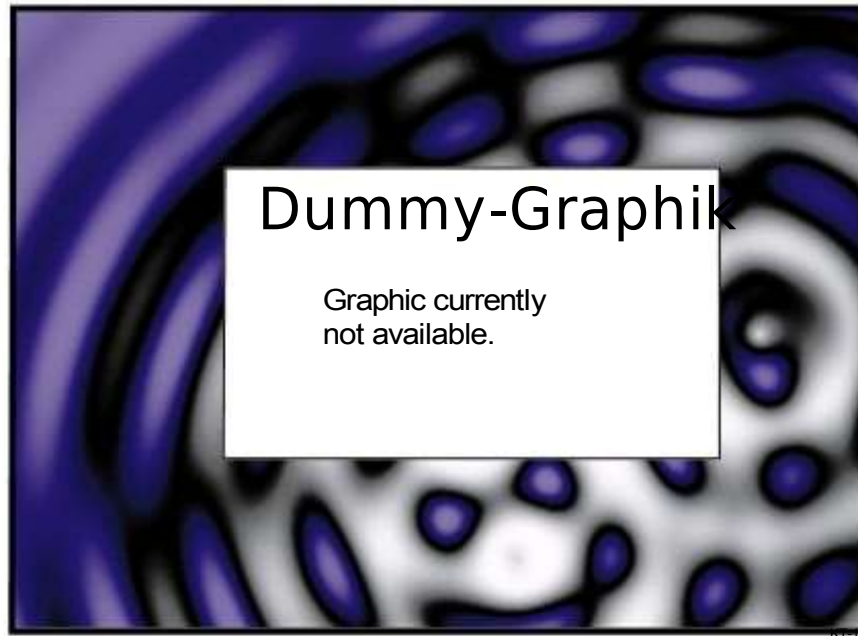


Fig. 5: M67 engine - General view

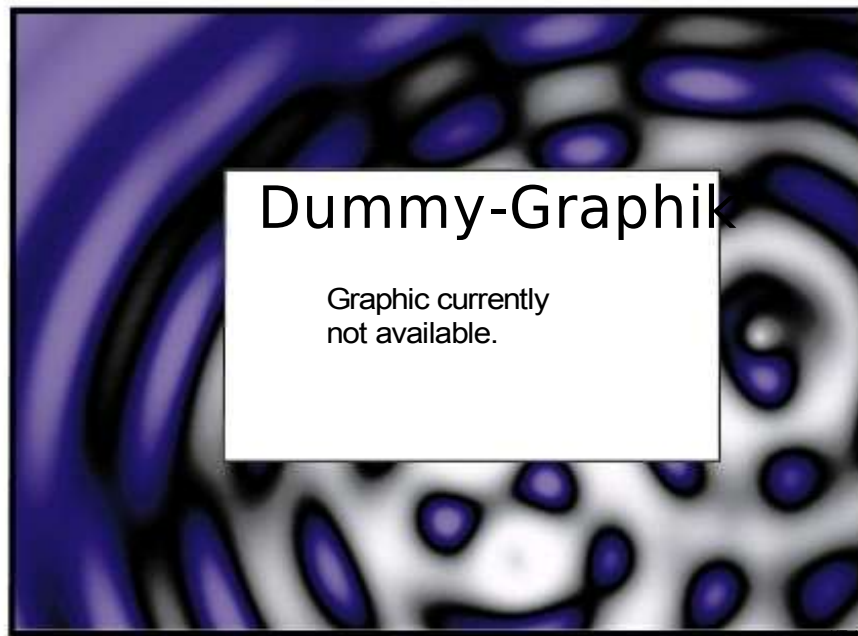


Fig. 6: M67 engine - Sectional views

Technical features



Common features

- Light-alloy cylinder head
- 4-valve technology with centrally arranged injection nozzle
- Valves and springs identical to M47
- Exhaust turbocharger with variable nozzle turbine (VNT)
- Compression ratio 18:1, compression 20 - 25 bar (operating temperature)
- Common rail injection system
- Air mixture $1.15 \leq \lambda \leq 4$
- Cooling duct pistons with central crown bowl
- Electronically controlled exhaust gas recirculation
- Exhaust re-treatment by means of diesel-specific oxidation catalytic converter and engine-close primary catalytic converter
- Switchable hydraulic engine mounts
- 7-blade fan wheel with viscous clutch drive
- Average inspection intervals 20 000 up to max. 25 000 km limited to 2 years
- The engine begins to cut out at 4000 rpm. The injected volume is reduced continuously. The cutout limit is reached at approx. 4800 rpm

M57-specific features

- In-line 6-cylinder engine with cast-iron crankcase
- High-pressure fuel pump (CP1)
- Plastic cylinder head cover
- Plastic manifold based on two-shell weld technology

M67-specific features

- Cast iron 90° V8 cylinder engine with cracked bearing caps
- High pressure fuel pump (CP3)
- Aluminium cylinder head cover
- Thin-walled cast air intake plenum
- Two-piece oil pan
- Bi-VNT with electrical guide vane adjustment

DDE control unit

Different control units are used depending on the type of engine:

- M57 - DDE 4 (different characteristic maps for E38/E39)
- M67 - DDE 4.1



Technical data

The data of the new M57 and M67 engines are as follows:

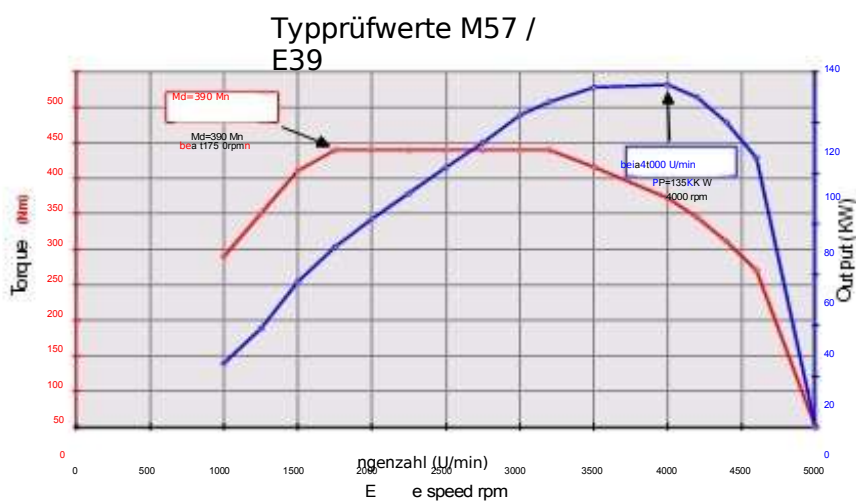
	M57	M67	
Engine type/valves	R6/4	V90-8/4	-
Displacement (eff.)	2926	3901	ccm
Stroke/bore	88.0/84.0	88.0/84.0	mm
Compression ratio	18 : 1	18 : 1	-
Engine weight	210	277	kg
Power to weight ratio	1.56	1.58	kg/kW

Production phase-in of each engine:

	530d	730d	740d
Production phase-in	09/98	09/98	03/99

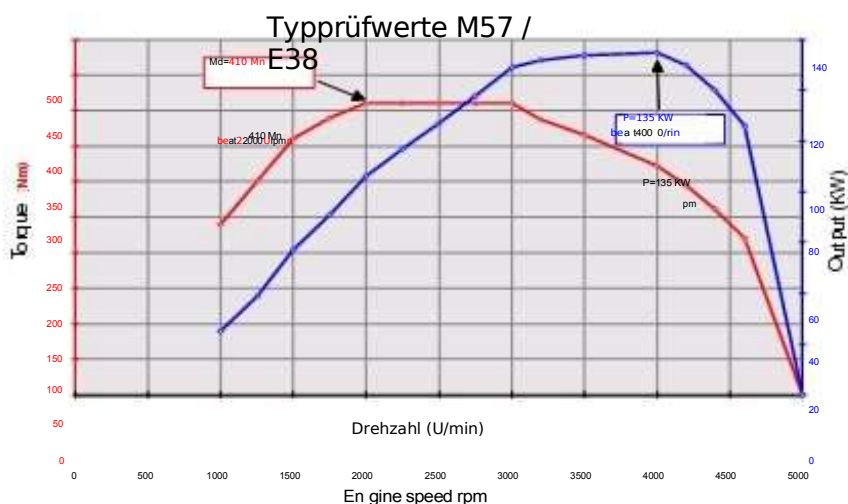
The engine values below apply to specific vehicles:

	530d	730d	740d
M57	135 kW/4000 rpm	135 kW/4000 rpm	
	390 Nm / 1750 - 3200 rpm	410 Nm / 2000 - 3000 rpm	
M67			175 kW/4000 rpm
			560 Nm/2000 rpm



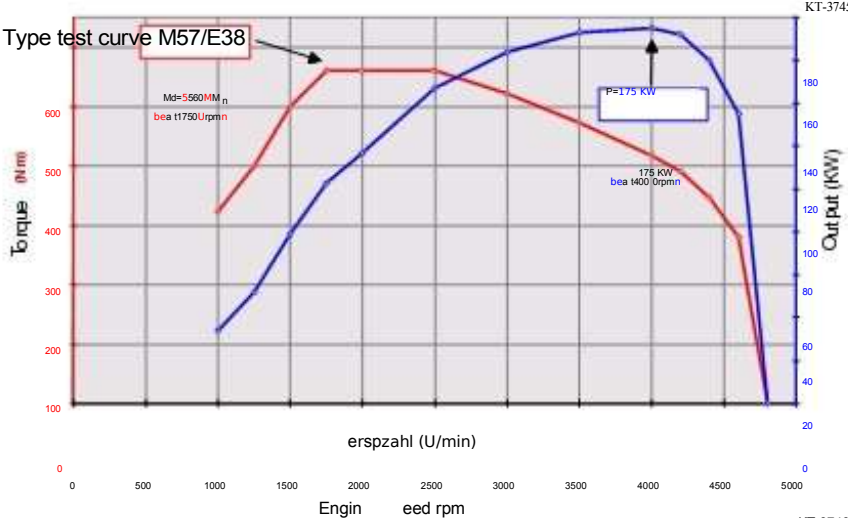
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Fig. 7: Type test curve M57/E39



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Fig. 8: Type test curve M57/E38



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Fig. 9: Type test curve M67/E38

Exhaust emission legislation

Pollutant limits have been further reduced in exhaust emission guidelines. These limits for EU-3 will come into force as from 01.01.2000 for new type approvals.



Pollutant	EU-2	EU-3	EU-3 D	
	Since 1996	As from approx. 2000	Since 01.07.97	
CO	1.00	0.64	0.60	g/km
(NO _x + HC)	0.70 (0.90)*	0.56	0.56	g/km
PM	0.08 (0.10)*	0.05	0.05	g/km

PM: Particle mass

*) Different limits applied in part to direct injection diesel engines

Tab. 1: Exhaust emission limits for diesel engines

The DI engines fulfil the more stringent requirements specified in the exhaust emission guidelines by means of the following measures:



- Internal engine measures
- Controlled exhaust gas recirculation (EGR) ϕ_{t} (refer to Sec. 8)
- Catalytic converter ϕ_{t} (refer to Sec. 8)
- Common rail (adaptation of injection characteristics)

Notes on exhaust emission standards/test cycles



EU-3 D

- Since 01.07.97 in Germany only (for tax reasons)
- Testing at room temperature 20 - 30 °C
- Cold run (40 sec. idling speed without measurement, conditioning)
- 2 test cycles (urban/extra-urban)
- Total duration: 11 km in 20 min.
- Average speed: 32 km/h
- Max. speed: 120 km/h

EU-3

- As from approx. 2000
- Tendency to more stringent values
- 40 sec. idle speed run dropped

The values of the EU-3 D standard and EU-3 standard are not comparable due to different test cycles.

EU-4

- As from approx. 2005