MAHLE Powertrain

MAHLE Powertrain Downsizing Demonstrator Vehicle

- High torque at low speed
- Strong performance with low CO_2
- Recognised industry benchmark

Downsizing Demonstrator Vehicle

>> MAHLE downsizing engine

The general principle of engine downsizing is based on replacing the current engine in a vehicle with another of smaller capacity but with equivalent performance. This approach is most relevant for large or medium-sized vehicles where the potential fuel economy and emissions benefits can be maximised.

Normally downsizing comes together with downspeeding. The VW Passat Estate (weighing 1,600 kg) was selected as the 'mule' vehicle for this project, with the 1.8 litre turbo gasoline variant of this car providing the dynamic performance targets for the project.

MAHLE and its engineering service provider MAHLE Powertrain started the development of its own advanced downsizing engine in 2006. The first generation MAHLE downsizing engine was designed and developed from clean sheet to running prototype in 12 months.

Having completed the initial development of the MAHLE downsizing engine with a two-stage turbo configuration, the decision was taken in mid-2009 to adopt a single turbo design for the demonstrator vehicle.

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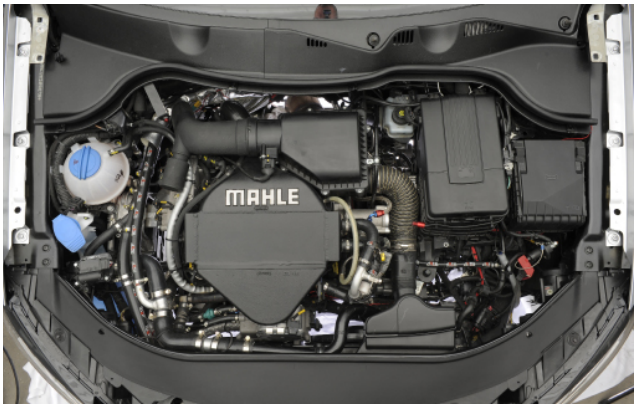
Downsizing Demonstrator Vehicle

Benefits

- Fuel economy:
  - › 5.8 l/100 km (~49 UK mpg)
- CO_2 emissions:
  - › 135 g/km on the NEDC
- Achieves 30.4 miles per US gallon
- Flexible & dynamic performance
- Development of bespoke turbocharger from Bosch MAHLE Turbo Systems (BMTS)



>> DI-3 engine

Technical Specifications	
Engine displacement:	1.2 litres
No. of cylinders:	3 in-line
Bore/stroke:	83.0 / 73.9 mm
Compression ratio:	9.3 : 1
Fuel injection:	Multihole central DI
Spark plug:	M10
Engine control:	MAHLE Flexible ECU
Turbocharger:	Bosch MAHLE Turbo System
Maximum power:	161 hp [5000 - 6000 min^{-1}]
Maximum torque:	286 Nm [1600 - 3500 min^{-1}]
Torque at 1200 rpm:	161 Nm
Engine dry weight:	125kg

Vehicle Targets & Results	Targets	Results
Fuel consumption FTP75:	N/A	5.8 l/100 km
CO_2 output NEDC:	135 g/km	135 g/km
Emissions target:	Euro 5	Euro 5
Acceleration 80-120 km/h (5th gear)	10.0 secs	8.9 secs

Summary

MAHLE Powertrain's original downsizing engine programme started the global trends towards gasoline engine downsizing. A high efficiency engine with fewer cylinders and reduced capacity to provide significant fuel economy benefits, but also delivering high output and increased torque at low speed through the application of advanced turbocharging.

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