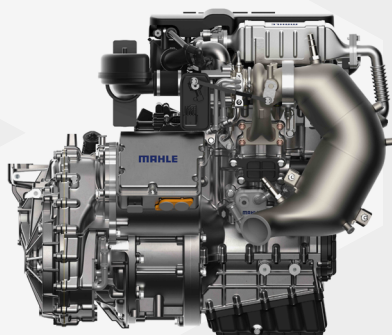
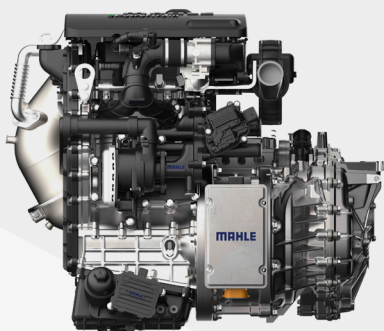


MAHLE Powertrain Modular Hybrid Powertrain



- > Powertrain modularity in multiple applications
- Reduced complexity for lower costs
- Low, weighted drive cycle CO₂



Modular Hybrid Powertrain

Electrification and hybrid technologies are now widely accepted as the preferred approach to achieving future vehicle emissions targets. In Europe, for example, OEMs must comply with a fleet average CO₂ emissions target of <60 g/km by 2030.

So, there is an urgent need for the rapid adoption of appropriate, scalable solutions across a broad spectrum of vehicle segments to meet these objectives. In response, MAHLE has developed the Modular Hybrid Powertrain concept using a dual-mode (series and parallel) configuration to provide the best features of both series and parallel architectures.

- Dual mode plug-in hybrid (PHEV) powertrain
- Dedicated Hybrid Internal Combustion Engine (DHE)
- Scalable across multiple vehicle applications
- Improved emissions & reduced after treatment complexity
- Seamless torque delivery provided by the traction motor
- Low, weighted drive cycle CO₂ (< 2030 proposed target)

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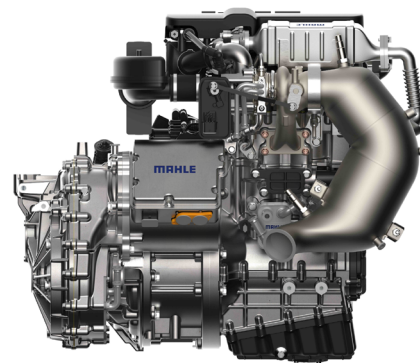
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MAHLE Modular Hybrid Powertrain

The new MAHLE Modular Hybrid Powertrain (MMHP) provides a realistic, scalable solution for a high efficiency, series and parallel hybrid powertrain for a wide range of vehicle applications.

The MMHP incorporates a turbocharged gasoline IC engine, traction motor, generator, inverters and bespoke transmission (with 1,2 or 4 speeds) in a compact, fully integrated package.



Benefits

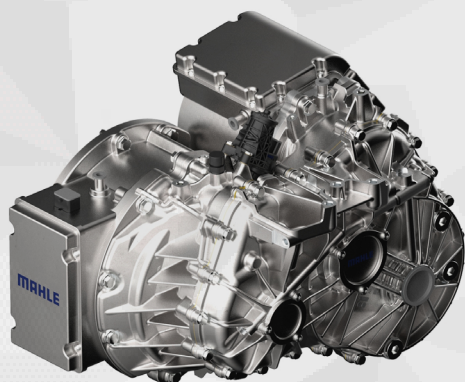
- IC engine, traction motor, generator and transmission arranged in compact, fully integrated package
 - › Vehicle operates in different modes according to battery charge and driving speed
- Traction motor connected directly to wheels
 - › Engine de-coupled by transmission and so runs at limited speed / load range ensuring low fuel consumption and CO₂ emissions
- Engine, motor and HV battery all scaled easily to different outputs
- MHP offers several advantages:
 - › Scalability
 - › Fuel efficiency
 - › Low emissions
 - › Reduced weight

Dedicated Hybrid IC Engine (DHE)

- Parallel twin cylinder, with contra-rotating balancer shaft
- 2 valves per cylinder, SOHC, fixed valve event timing
- Port fuel injection with MAHLE Jet Ignition (MJJ[®])
- Turbocharger with MAHLE electronic wastegate actuator
- Miller-cycle operation with high geometric compression ratio
- Limited speed/load range operation for fuel efficiency
- Minimum BSFC = 207 g/kWhr (target < 200g)
- Compact, light weight and low cost engine
- Low technology requirement



>> Dedicated hybrid engine



>> Hybrid electric drive & 2 speed transmission

Hybrid Electric Drive and Transmission

- Direct drive HV MAHLE traction motor with optimised cooling
- HV MAHLE generator mounted on transmission input shaft
- MAHLE Inverters integrated into motor and generator housing
- Simplified transmission - no torque interruption
- Traction motor provides full vehicle dynamic performance
- No clutch as neutral selection decouples DHE from driveline

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MAHLE product information 05/2022

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