

## RDE Process



End-to-end RDE development process



High specification 4WD chassis dyno

### Comprehensive Development Process

MAHLE Powertrain has introduced a new end-to-end test and development process that helps vehicle manufacturers achieve the optimal powertrain configuration for any given application. The development process, which has been designed to help meet the challenges posed by new real-world emissions testing targets, is broken down into five key stages: steady state powertrain testing; transient powertrain testing; four-wheel drive dyno testing; and on-road RDE testing all linked via vehicle simulation.

The initial simulation phase allows early understanding of powertrain operation requirements over RDE cycles and enables optimisation of transmission and hybrid control strategies before physical hardware is available. This phase involves an early assessment of RDE boundary conditions based on three key factors: vehicle performance, driving style and test route characteristics. MAHLE applies advanced analysis techniques to generate a test programme for implementation throughout the complete development process. Hundreds of digitised RDE routes are used to simulate the varying traffic conditions, road layouts and topographies that are experienced in realworld driving scenarios.



From initial concept to certified vehicle  
Fully optimised emissions compliance

## Steady State Powertrain Testing

- Initial testing of prototype powertrain hardware
- Steady state dyno with constant speed & load values
- Optimised base engine mapping
  - › Advanced DoE tools
  - › Automated testbed running
- RDE vehicle simulation feedback loop
  - › Increased model accuracy
  - › Performance assessment without physical hardware
- Reduced project cost & prototype hardware reliance

## PEMS System

- Certified real-world drives on VCA approved RDE routes
- Test vehicles fitted with PEMS (Powertrain's Portable Emissions Measurement System)
  - › Measures tailpipe emissions
- Systems capable of achieving emissions compliance

### Technical specifications

Engine layout:	900 cc, 2 cylinder
Bore/stroke:	83.0 / 83.0 mm
Installation angle:	Vertical or horizontal
Engine control:	MAHLE Flexible ECU
Maximum power:	30 kW [4000 min-1 ]

### Vehicle specifications

CO <sub>2</sub> output NEDC:	< 45 g/km
Emissions target:	Euro 6
Pure Electric Range:	70 km
Combined Range:	500 km
Maximum Speed:	145 km/h
Kerb Weight:	1350 kg



PEMS testing on vehicle

## Powertrain System Simulation

- Transient testing phase at higher levels of maturity
- Simulation of complete drive cycles
  - › In line with specific territory regulations
  - › Precise recording of emissions
- Conduction of analysis correlation
- Validation of powertrain performance



Overload 30 secs every 5 minutes