

## MAHLE Powertrain Transmissions Design & Development



Innovative Gear Development & Production

Specialist Testing of eMachines

Comprehensive Customer Support



>> Compact 4-speed transmission

### Transmissions Design & Development

Vehicle transmission systems transfer rotary energy from the motive power source to the driven wheels, irrespective of how the energy is generated.

Forward and reverse motion is also enabled by the transmission using additional gear sets whilst a clutch allows a smooth transition of power during pull-aways and also complete disengagement to allow engine idle when stationary. Automatic and 'double clutch' transmissions are now in widespread use allowing vehicle developers to control the engine speed and therefore the emissions and fuel economy more closely, and also providing a more comfortable driver experience.

Electric vehicles, or hybrids with pure electric drive, do not require such a wide range of fixed ratio gears within the transmission, as their electric traction motors are capable of a much greater range of operating speeds, but reduction gears are often still required to match optimum motor speed with road speed. Electric motors provide maximum torque output from zero which then gradually decreases with speed, so the transmission gears must be designed with this in mind.

Contact Us:  
Powertrain@mahle.com

MAHLE Powertrain Ltd  
Costin House, St James Mill Road  
Northampton, NN5 5TZ, UK  
Tel. +44 (0)1604 738 000

MAHLE ZG Transmissions  
Georg-Kollmannsberger-Straße 3  
85386 Eching, Germany  
Tel. +49 89 18 94 169-0

MAHLE Powertrain LLC  
14900 Galleon Court  
Plymouth, MI 48170 USA  
Tel. +1 734 738-52 01

[www.mahle-powertrain.com](http://www.mahle-powertrain.com)

## Design Process

- In-house development of powerful 'PlanGear' software solution
- Fully-automated gear synthesis approach
  - › Generates & evaluates all gear configurations to meet required criteria
  - › Applied for automatic, dual-clutch & hybrid gears
  - › Consists of any number of shafts, spur gear stages & planetary gear sets
- 'PlanGear' provides visual display output showing:
  - › Gear mechanics
  - › Switching matrix
  - › Load capacity matrix
  - › Corresponding ranking
- Allows critical decisions to be made at an early stage in the project



## Services

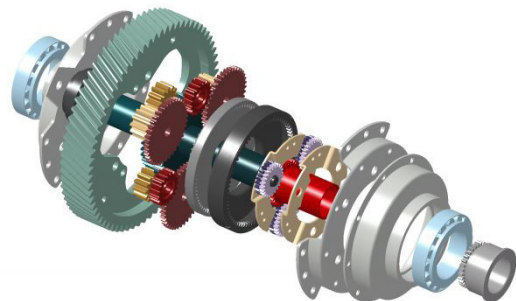
- Gear Synthesis
- Gearing Calculations
- Spur & Helical Gears
- Bevel and Hypoid Gears
- Special Gears
- Gear Construction
- Housing Construction
- Prototype Manufacture
- Component Testing
- Failure Analysis
- Consulting



>> Modular test rig

## PlanGear Programme

- Process is based on output of the 'PlanGear' programme
  - › Automatic dimensioning of gears
  - › Creation of high resolution 3D CAD model
- Complete set of drawings for all gear components
  - › Shafts
  - › Bearings
  - › Switching elements
  - › Housing
- Model meshed for finite element analysis
  - › Stress
  - › Fatigue
  - › NVH



>> Front differential

Contact Us:  
Powertrain@mahle.com

MAHLE Powertrain Ltd. 2020

MAHLE Powertrain GmbH  
Einsteinring 5  
85609 Aschheim, Germany  
Tel. +49 89 962915-0

MAHLE Powertrain Ltd  
13.210-877  
Jundiaí / São Paulo, Brazil  
Tel. +55 11 4589-0400

MAHLE Automotive Technologies  
No. 1299 Huan Cheng Bei Road, Fengpu Industrial Park  
201 401 Shanghai, Fengxian District, China  
Tel. +86 21 5136-0595