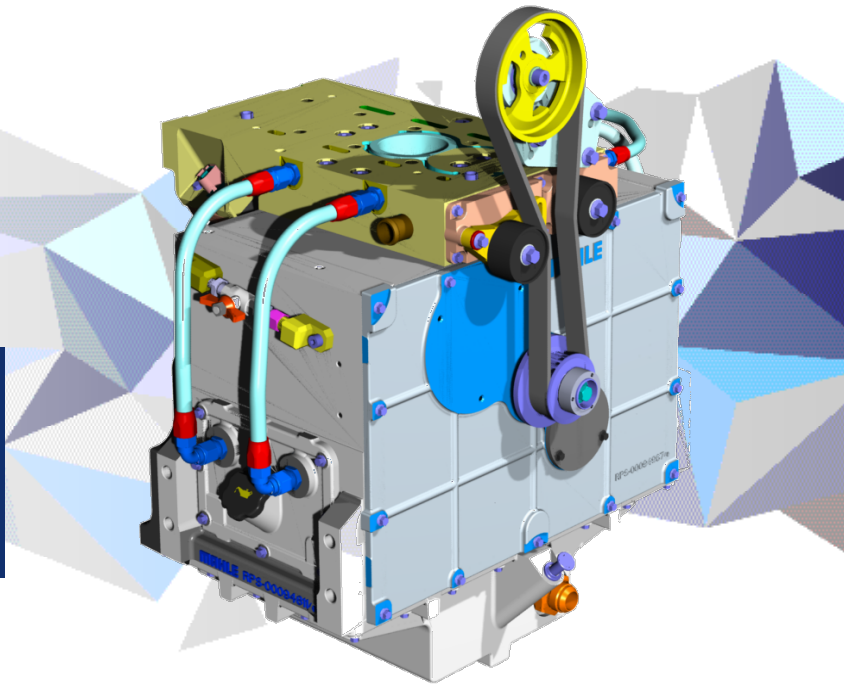
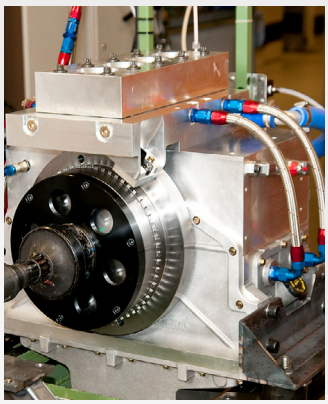
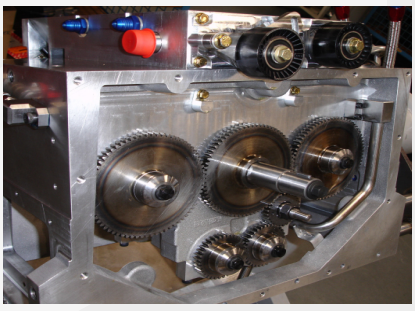
MAHLE Powertrain
High Speed Single Cylinder



- High efficiency
- Flexibility
- Combustion System Validation



>> High speed bottom end



>> Fully balanced bottom end

High Speed Single Cylinder

Single cylinder research engines have previously been limited to comparatively low speed operation due to the inherent out-of-balance characteristics of this configuration. This has restricted the correlation of results and data with normal engines running at higher speeds.

MAHLE Powertrain has developed a proprietary, fully balanced, single cylinder bottom end to further enhance test capabilities. The modular design allows high speed operation at up to 5000 rpm for optical engines and up to 8500 rpm for thermodynamic engines. (The maximum operating speed can be pushed in excess of 13000 rpm in special motorsport applications.) This enables testing at representative engine speeds and also ensures enhanced accuracy of imaging and measurements during optical testing.

The high speed bottom-end can be configured for use with a wide range of engine types and has been successfully utilized for advanced combustion development with both spark ignition and compression ignition cylinder heads. The versatile design allows simple modification of liner / barrel position for comparison testing of different compression ratios.

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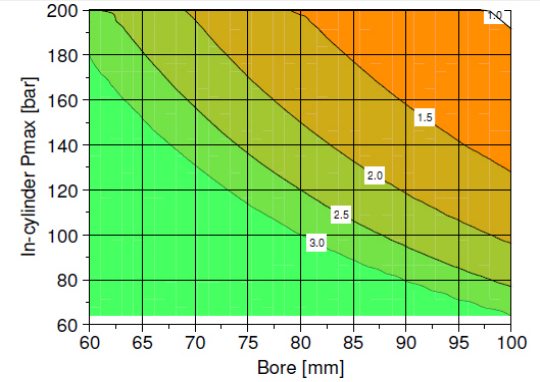
MAHLE Powertrain
High Speed Single Cylinder

Benefits

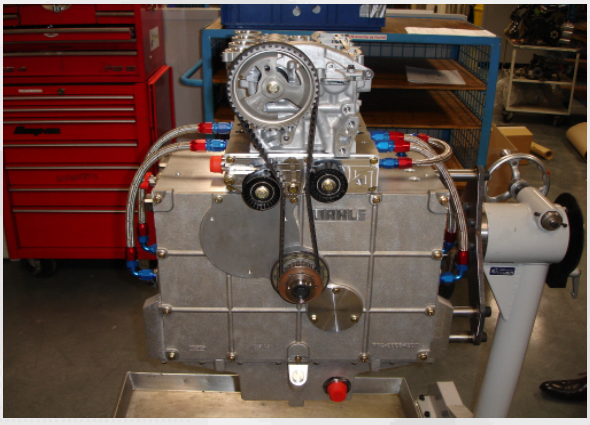
- Fully balanced for both first & second order vibrations
  - 8,500 rpm for normal applications
  - 5,000 rpm for optical applications
- Capability to run up to 13,000 rpm in special motorsport applications
- Capacity to run variety of cylinder heads & bore & stroke configurations:
  - Bore: 65 – 100mm
  - Stroke: 60 – 100mm
- Highly modular bottom end design for both thermodynamic & optical use
- Designed for ease of use:
  - Quick compression ratio changes
  - Quick piston changes (in optical mode)
  - Quick head changes
- DI-3 multi cylinder head mounted on high speed bottom end
- Balance shaft flexibility with bolt-on masses

Technical Specifications

- In-cylinder pressures up to 200bar possible depending on bore size & conrod design
- Main bearings carried over for all configurations
- Operates safely up to max cylinder pressure of 200 bar
- Cylinder head, piston, con-rod & big end bearings nominated by customer
- Con-rod can be analysed to predict max cylinder pressure for safe operation



>> Main bearing safety factors



>> DI-3 multi cylinder head mounted on high speed bottom

Fully Balanced Bottom End

- All major parts tailored to customer requirements
  - Crankshaft
  - Primary balance shafts x2
  - Second orer balance shafts x2
- Separate “bolt-on” masses for all shafts
- Balance system gear driven behind the front cover
- High speed deep groove ball bearings provide low and consistent friction for experimental control
- Idle gear easily accessed for second order balance shaft de-activation, if required, without the need for a full engine strip

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