Overview

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.
Overview

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

Performance

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

Fully balanced

- Crankshaft, 2 primary balanceshfts and 2 second order balanceshfts have separate "bolt-on"masses tailored to the customerscomponent requirements.
- Balance system is gear driven behind the front cover.
- High speed deep groove ball bearings provide low and consistent friction for experimental control.
- Idle gear is easily accessed for 2nd order balance shaft de-activation, if required, without the need for a full engine strip.