www.vibrationfree.co.uk

Utilizing Crankcase Deflection Analysis for Improved Crankshaft Design & Engine Performance

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Professional MotorSport WORLD EXPO 2007

Improving Crankshaft Design

- Improved Crankshaft Counter-weighting
- Reduced Main Bearing Loads
- Reduced Stress & Fatigue
- Optimising Reliability & Performance

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Introducing

- Vibration Free
- Dynamic Table Balancing
- Crankshaft Deflection Analyser
- Spin Rig Balance Arbour

Professional MotorSport WORLD EXPO 2007

Peking to Paris 1907 Itala

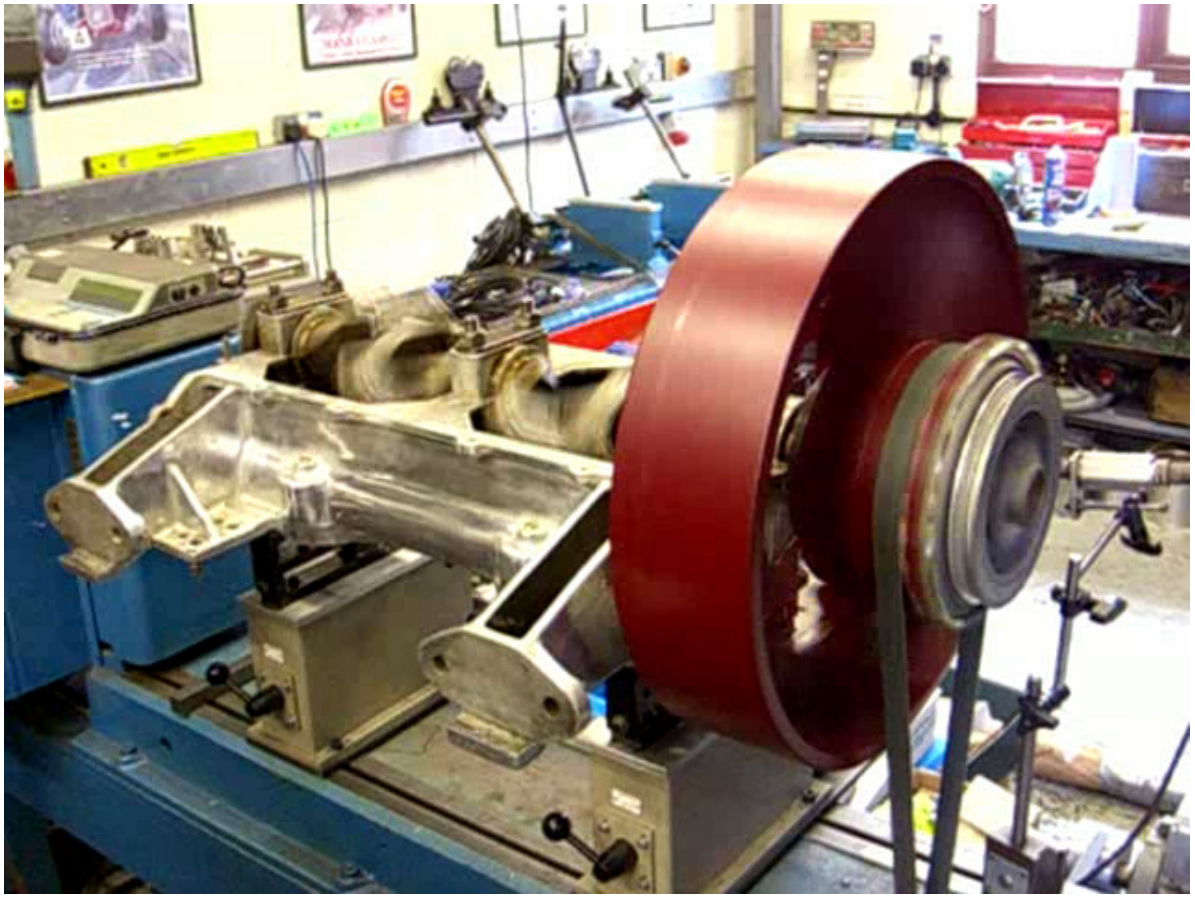
Dynamic Table Balancing

- Unique service for “awkward” rotor assemblies e.g. V8 Engines

- Used for balancing or understanding state of balance

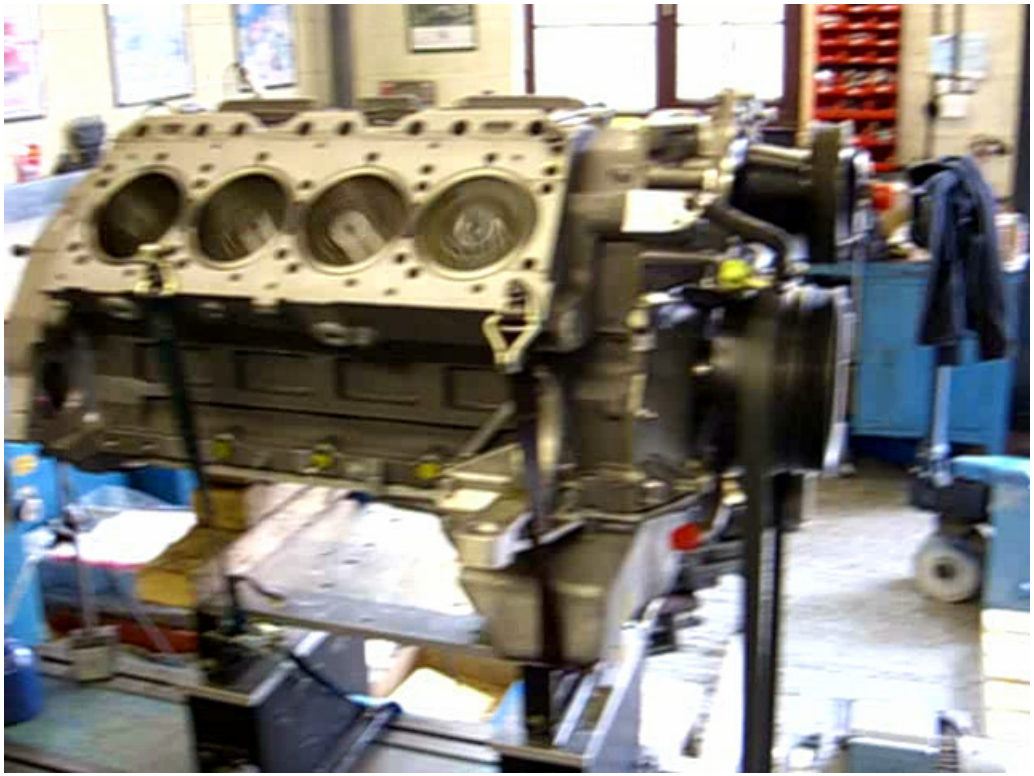
  e.g. crankshaft counterweight accuracy

Itala Engine on Dynamic Table

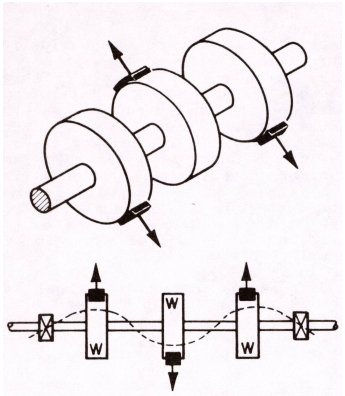


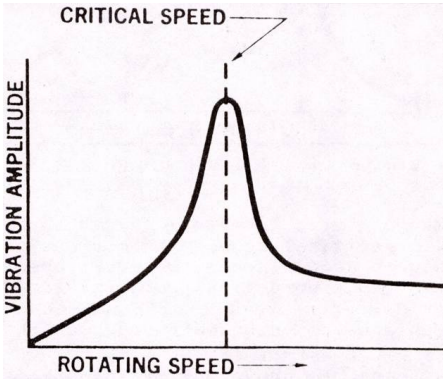
Bugatti Engine on Dynamic table

Bentley Arnage on Dynamic Table



Quick Refresh on Balancing

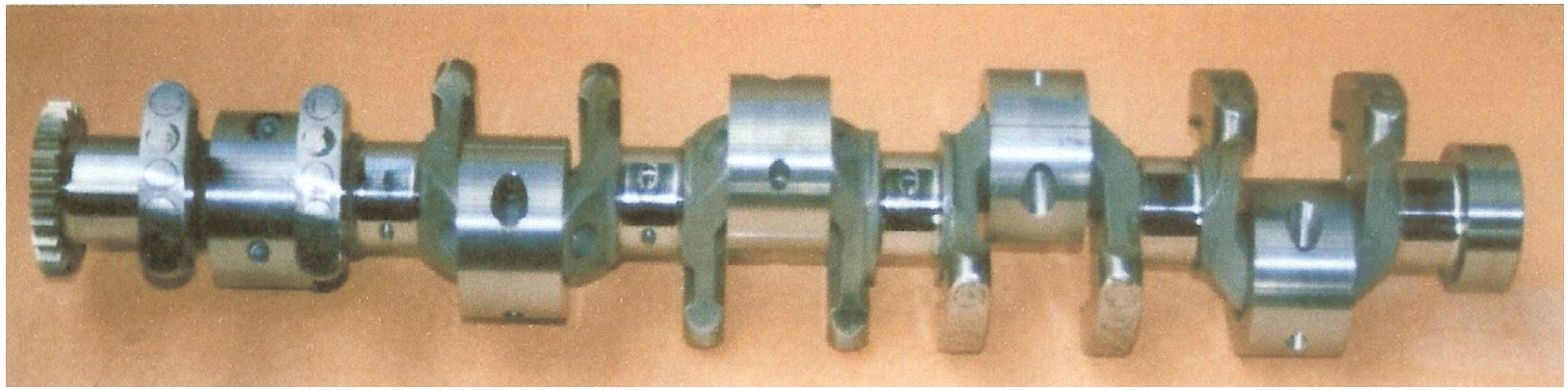




- Rigid Rotors operate < 70% critical speed
- Flexible Rotors operate > 70% critical speed
- Differences being levels of rotor stiffness

Flexible Crankshafts

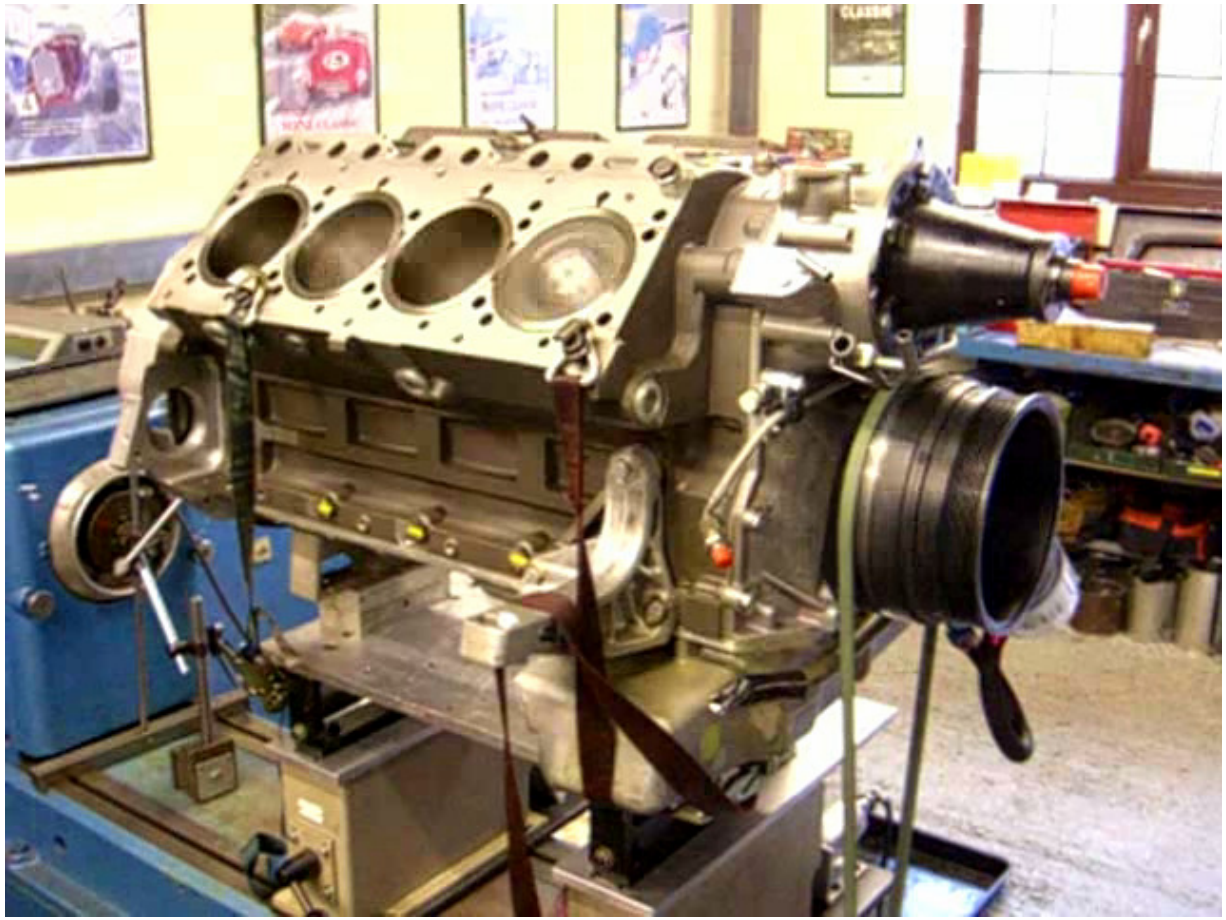
- Traditionally treated as rigid i.e. don't flex
- Bending loads reduced by fully counter-weighting crankshaft
- Lately, increased rpm & power loads combined with light construction are promoting flexing



V8 Bentley Engine Development

- Assembly balance condition
- Improve counterweight accuracy
- Focus on crankshaft design to improve refinement, capability & reliability
- Dyno tests for vibration analysis
- Spin rig tests to test crankcase capability

V8 Bentley Arnage Development



Crankcase / Crankshaft Deflection Analyser

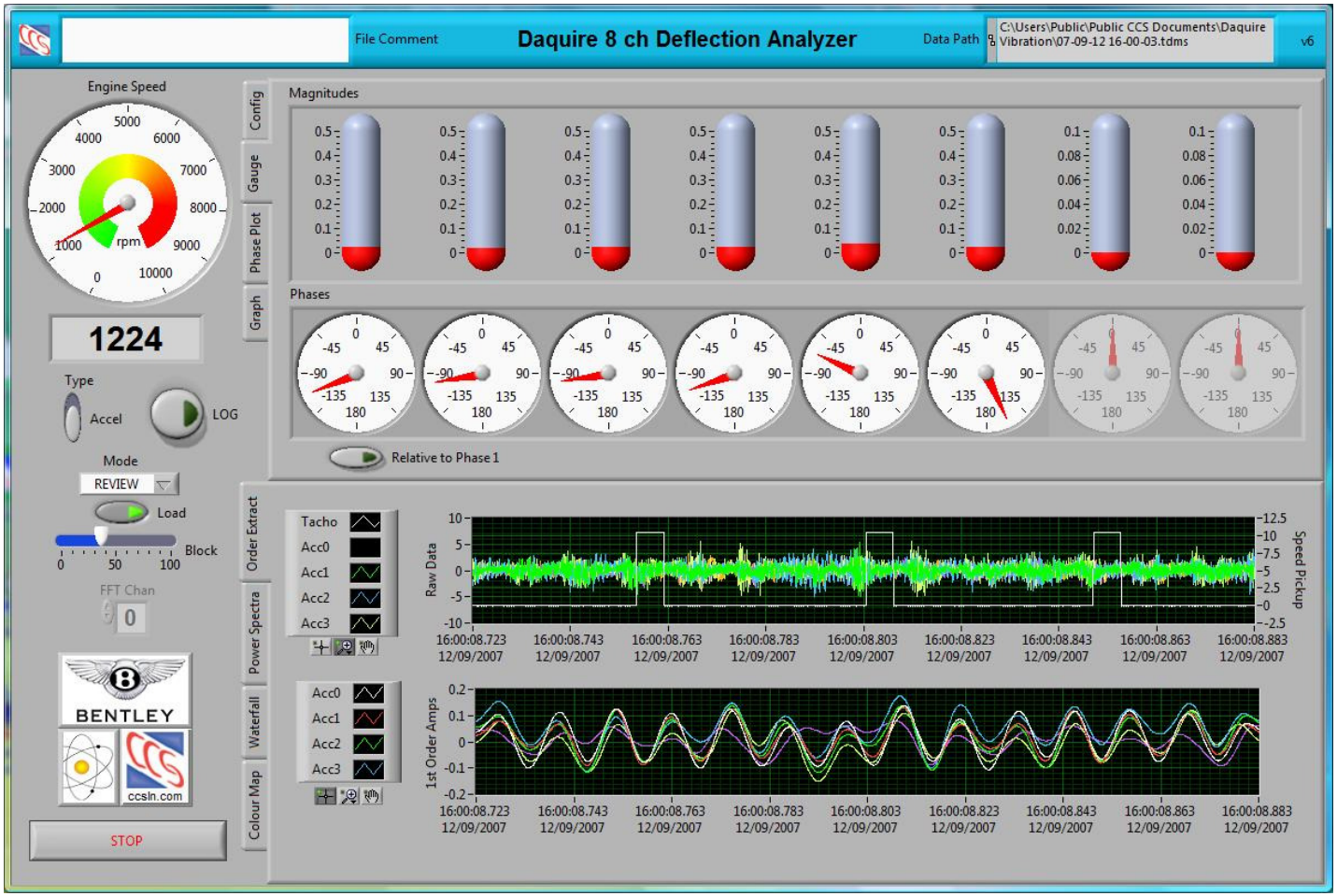
- Allows easy recording & understanding of crankcase deflection during single dyno runs
- Eight vibration inputs
- One tacho input
- High speed data capture through intermediate signal conditioning
- Remote PC instrumentation

Engine Analysis on Dyno

High Temperature Transducers

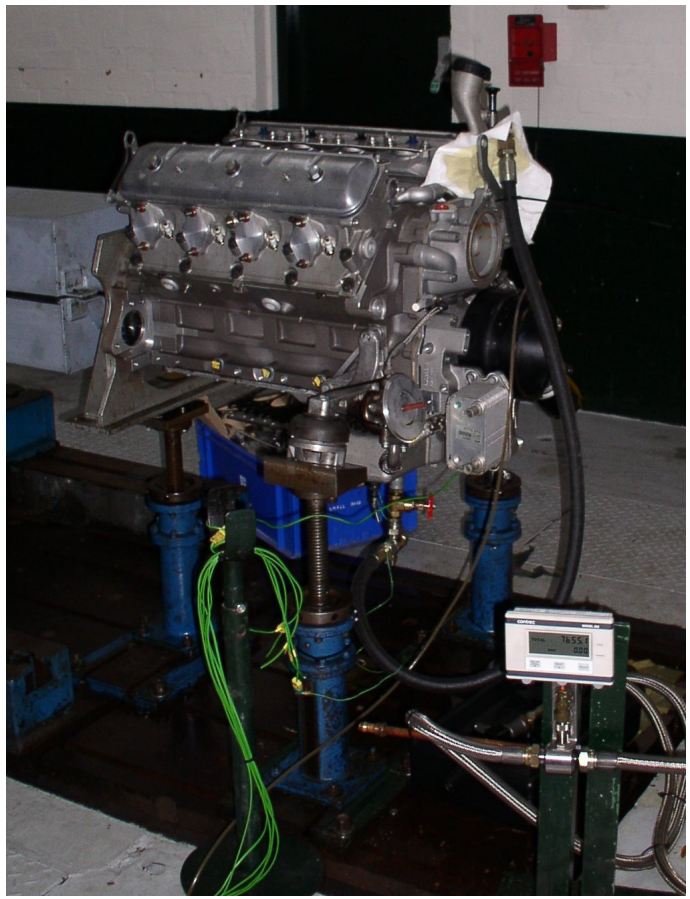
- Crankcase measurements up to 250 C

Deflection Analyser display

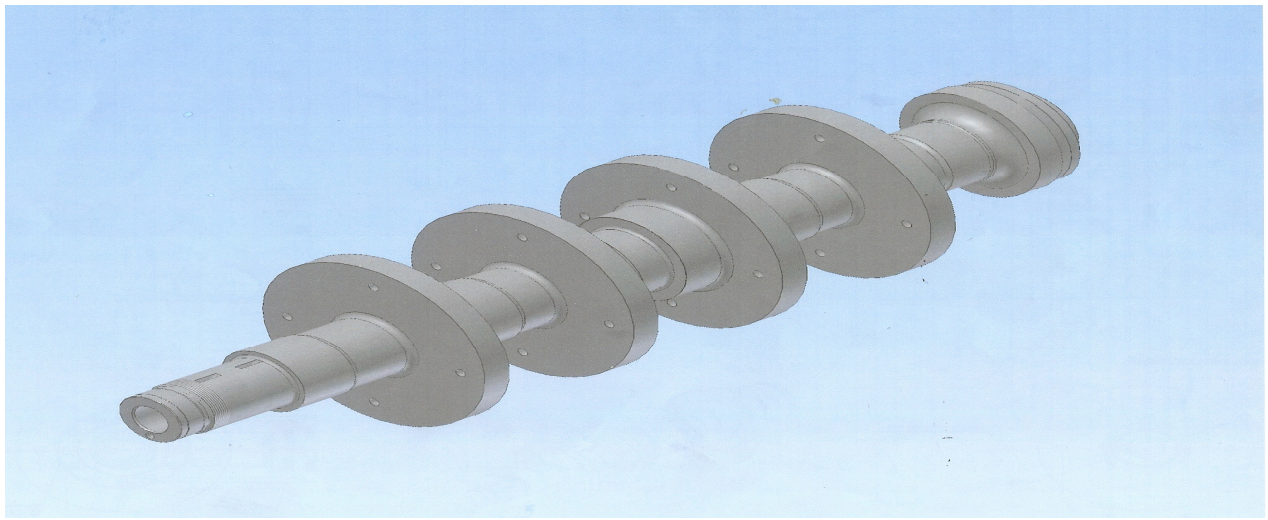


Deflection Analyser

- Understand production engines capability
- Gauge response and potential on prototypes
- Challenge new crankshafts in existing crankcases
- Challenge new crankcases with existing crankshafts
- Challenge modelled predictions



Spin Rig Balance Mandrel



- Challenge block response to a range of dynamic cyclic loads

Summary

- Vibration is great indicator of mechanical condition
- Dynamic motion is indicative of forces present and their respective directions
- Crankshaft designs are often compromised by weight constraints
- Models need empirical tests to qualify accuracy
- Understanding crankshaft & crankcase response limitations endorse & justify design changes
- High main bearing loads kill power, refinement and reliability
- Treat crankshafts as “flexible” rotors

Assisting future developments

- Improved crankshaft balance condition provides a reliable basis for future engine performance increases
- Lower vibration produces less crankshaft and crankcase stress
- Less stress provides greater development
- Improved refinement of the engine
- Better quality product