

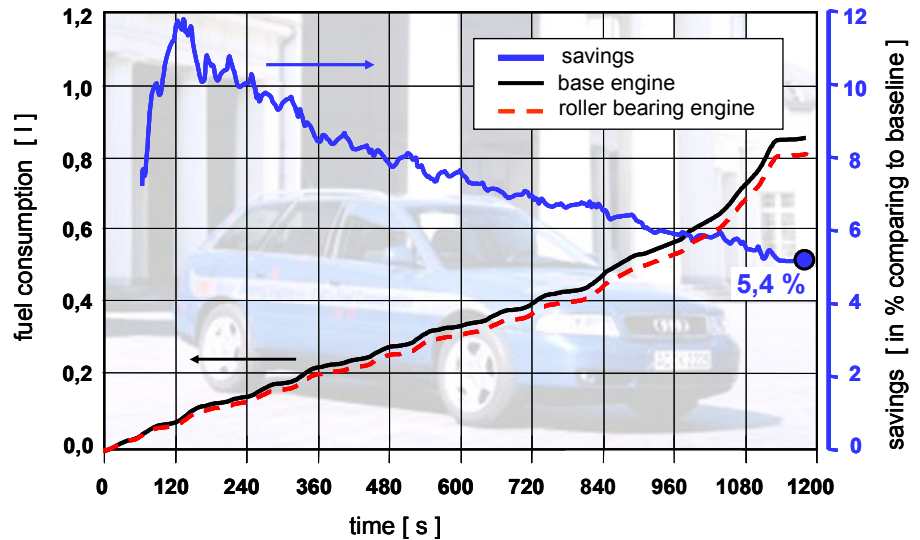
Roller-Bearings in Combustion Engines – an Effective Way for Fuel Saving

The fuel consumption of an internal combustion engine is significantly driven by the engine friction. Main and conrod bearings contribute - beside the piston-liner contact – substantially to friction losses. Thus, the replacement of the plain bearings by roller-bearings provides the opportunity to clearly reduce the fuel consumption. FEV has verified this potential and the general feasibility of a roller-bearing crank train in an inter-

nal combustion engine.

From a given 1,6 L 4-cylinder plain bearing engine changed to roller bearings a proved 5,4% (NEDC) improvement of the fuel consumption resulted from reduced friction.

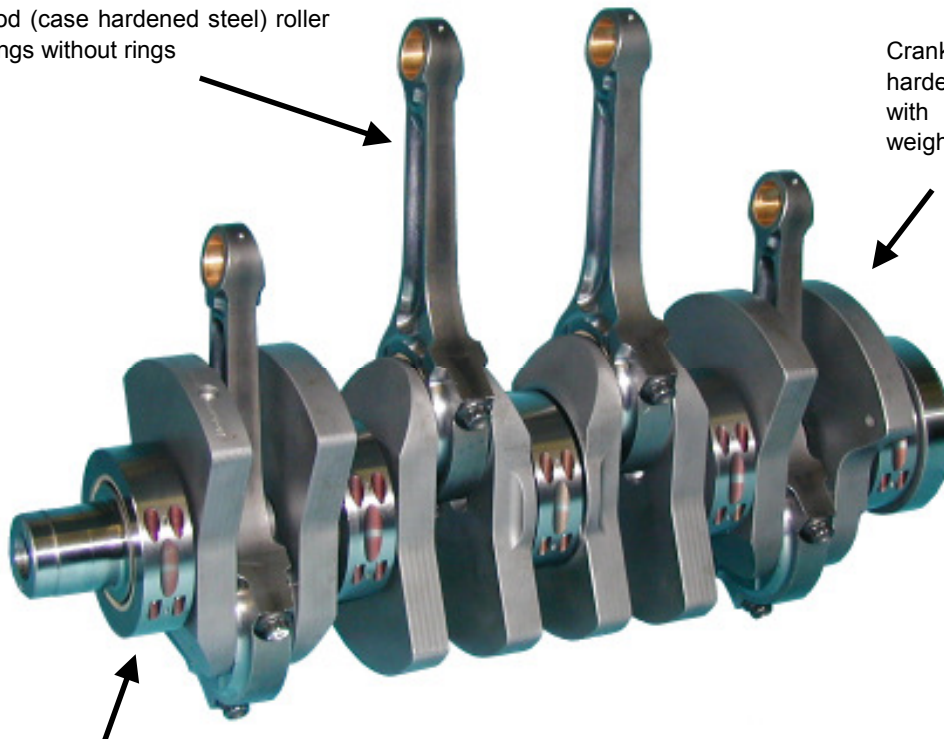
By means of subsequent calculation



Fuel consumption reduction in NEDC with roller-bearing engine

Conrod (case hardened steel) roller bearings without rings

Crank shaft (case hardened steel) with 8 counter-weights



Thick-walled main bearing ring

Crank train of generation 2 test engine

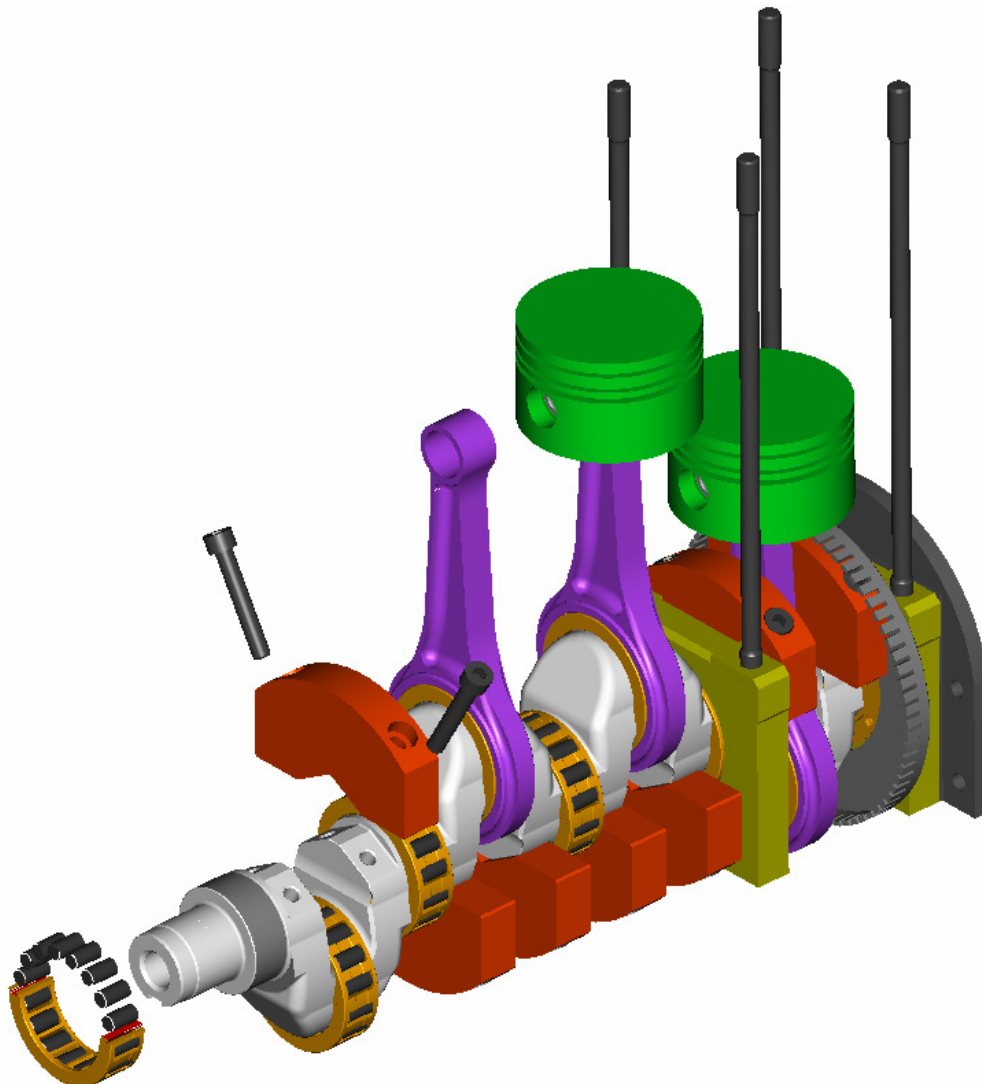
and simulation the basics for NVH and durability optimization were identified. Based on this knowledge, an advanced test engine was set up. The measurement with this generation 2 roller-bearing engine demonstrates a significant improvement in the NVH behavior.

In parallel to the investigation with the prototype generation 2 - which represents a compromise due to the demand of a quickly realized and feasible application - a complete new roller-bearing bottom-end concept was designed. This new design meets the main requirements of optimal roller bearings and furthermore, it takes into account the boundary conditions for

high-volume production.

The main attributes of this generation 3 roller-bearing crank train concept are the single-piece conrod and main-bearing pedestals, which are threaded on a single-piece crankshaft.

The payback of the 50 to 70 EUR for these roller-bearing concepts is quickly met from the gain in fuel consumption reduction.



Crank train of generation 3 test engine