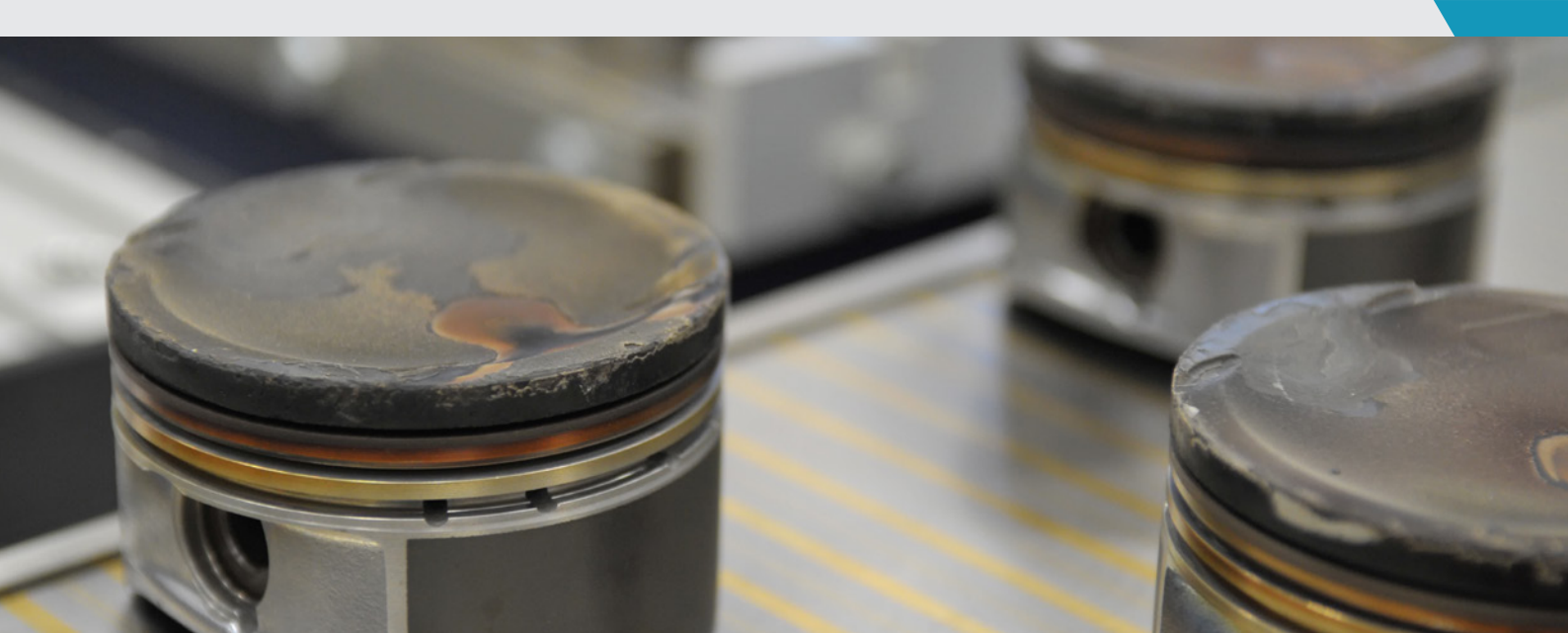


QUINDOS WEAR EXPANDS THE PALLET OF WEAR MEASUREMENT TO ITS FULL POTENTIAL

ISP Salzbergen GmbH & Co. KG



The testing institute

By Harald Richter

The internationally operating ISP testing institute has been able to reduce the high-accuracy wear measurement procedure for engine components from two full days to just a few hours. These enormous time savings are based on high-accuracy Leitz CMM measuring technology and of the QUINDOS Wear software module, an innovation in wear measurement developed jointly with Hexagon PTS.

When an auto manufacturer's performance tests and consumption measurements are running like a well-oiled machine, it's precisely because they are using the right kind of lubricant, motor oil. Maximum engine output, optimum fuel economy and environmental compatibility can only be combined if frictional losses in the drive train are reduced to a minimum.

Here, we measure in μm

In combustion engines, a good 40 percent of frictional losses occur between the “friction partners,” i.e. the pistons, piston rings and cylinder bores. In modern motorcars, these components are manufactured with extreme precision. Micro-structured 3D functional surfaces and extremely precise fitting accuracy optimise the tribological system, reduce energy consumption and form the basis for running comfort and reliability. The focus of engineers is an ideal interplay between the key components of the drive train, such as camshafts, bearing shells and timing chains, with as little wear as possible.

The oil industry is working toward the same end, as they know you can't win the race unless you are able to offer auto makers the best lubricant formula as a motor oil OEM. Consequently, oil producers are putting considerable effort into validating their products. Analyses of highly stressed components using complex, realistic engine wear tests have to be implemented properly.

34 engine test rigs for wear measurement

Nearly every well-known oil supplier relies on the outstanding expertise of ISP Salzbergen GmbH & Co. KG in Lower Saxony.

ISP is one of the world's leading independent institutions for engine testing, vehicle testing and laboratory analyses in the field of fuel and lubrication development. With their head office in Salzbergen near Rheine, Germany and another location in Grand-Couronne, France, ISP are an internationally recognised development partner to the chemical, oil, motorcar and supplier industries.

Using state-of-the-art engine test rigs, all-wheel-drive roller test rigs and exhaust roller dynamometer test rigs, the experts at ISP test the technologies of tomorrow. They have the support of the team at the in-house chemical-physical laboratory in their execution of comprehensive analyses of fuels in accordance with international standards.

Twenty dynamic, fully air-conditioned test rigs just for engine wear testing alone are available in Salzbergen. Redundantly designed infrastructure, the latest



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measuring technology and state-of-the-art automation systems provide the engineers with ideal conditions for targeted testing of fuels, lubricants and engine components.

As Martin Heuking, a component evaluation specialist at ISP explained, this is no easy task: "A wear evaluation can only be carried out on an engine component if its actual condition after having driven the vehicle for certain distances, for example 50,000, 100,000 or 250,000 kilometres, can be compared directly to that of a new engine."

Defining reference values and carrying out non-destructive testing

This means that two crucial requirements must be met.

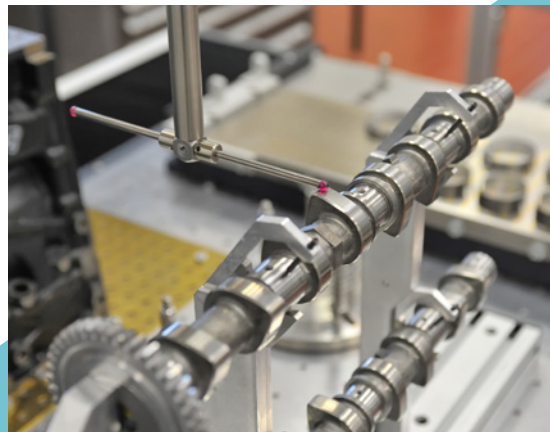
First, wear testing must be non-destructive, as the engine parts have to be available for further testing as an assembled unit after measurement.

Second, the reference measurement values of the original component are required as the reference values for the wear measurements. According to Martin Heuking, this is where it gets tricky: "CAD data from car manufacturers, if we get any at all, doesn't help us, as it only represents the structural condition as intended. Our reference has to be the unused engine part physically on hand. This means that we have to generate the respective data set for our measurement reference

ourselves based on the actual engine to be examined in each case.

Both this measurement of the un-worn component and subsequent wear measurements of cylinder bores, pistons, piston rings, camshafts and bearing shells were becoming increasingly more difficult. On the one hand, ISP's test volume was growing rapidly. On the other, auto makers' production was becoming more and more precise with tighter tolerances. "Here, we measure in μm ," remarked Martin Heuking.

The hand-held measuring instruments used in the ISP component evaluation measuring room were increasingly reaching their accuracy limits. At the same time, two of the coordinate measuring devices being used were causing time constraints. Martin Heuking relayed his thoughts on the precarious situation at the time: "Set-up and measurement program creation were just too slow and laborious."



ISP's requirement profile for increasing efficiency in wear measurement, i.e. fast measurement, a flexible measuring program and pallet clamping, turned many suppliers away. Ultimately, the package developed jointly by Hexagon and ISP fulfilled all the performance criteria. The specially designed pallet guarantees measurement of all the important engine parts in a cycle, including during the unmanned night shift.



A realignment of measurement expertise

In late 2008, the list of demands for a basic realignment of ISP measurement expertise lay in wear measurement. It comprised five essential requirements:

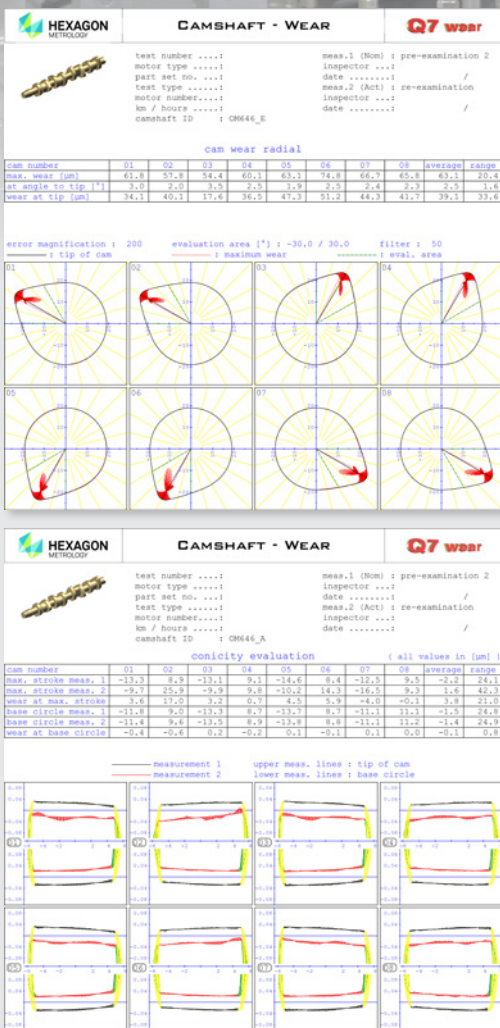
- The use of a high-precision 3D coordinate measuring machine in the Leitz Reference class, the Leitz Reference HP (high precision). As a replacement for the two measuring machines previously being used, it would not only be more accurate, but it would also allow considerably greater part throughput.
- The development of a measuring program with ideal operator guidance from part alignment to measurement to evaluation.
- Graphical display of the measurement results for wear mapping on the component as a replacement for the purely numerical evaluation previously used.
- Increased efficiency by reducing the set-up, measuring and evaluation times.
- Integration of pallet measurement as a new feature of wear measurement: a single pallet for all the individual components of an engine to be tested.

„It was clear to us that we would need a development partner to achieve this ambitious goal,” recalled Michael Schulz, who heads up engine and vehicle testing at ISP Salzbergen. “We met with negative responses everywhere except Hexagon Metrology PTS, though. The problem of combining fast measurement, a flexible measuring program and pallet clamping didn’t seem like it had a solution.”

A successful development partnership

It was a different story with Hexagon Metrology PTS, which ISP saw as capable of setting them up and preparing them in the best possible way, precisely in this respect. Firstly, they would be getting a scanning CMM Reference HP from Leitz with a measuring LSP 3D scanning system for tackling complex measuring tasks. This offers both fast single-point probing for all typical measuring tasks and high-speed scanning for form and profile measurements.

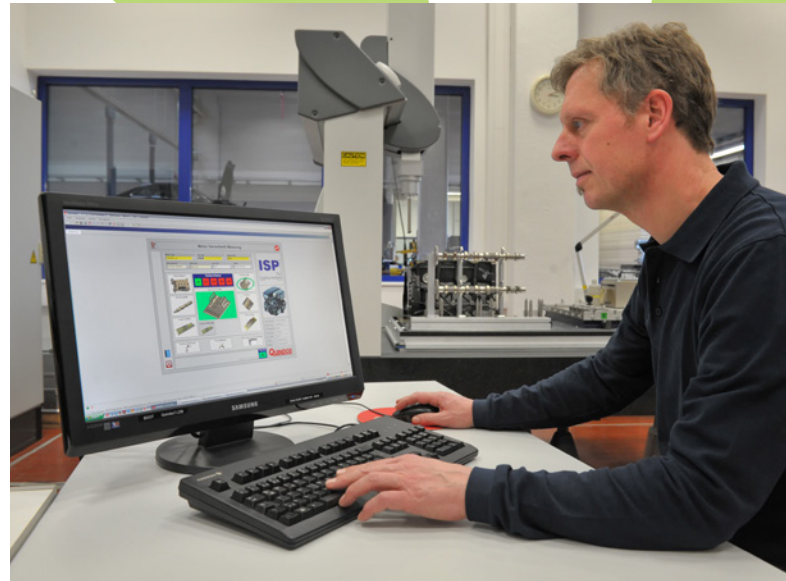
Secondly, they would have the QUINDOS software at their disposal, which is the key to efficiency for dimensional coordinate measuring technology. “QUINDOS” flexible architecture is made for handling extremely specific user wishes like this,” remarked software engineer and ISP adviser Albert Geßler in praise of Hexagon Metrology PTS. “QUINDOS is a continually growing software system capable of



The new Leitz Reference HP coordinate measuring machine stands for maximum precision and maximum efficiency. It's an investment which matches the core values of the ISP company.

Wear report for camshaft evaluation with graphical output (top: radial wear evaluation, bottom: conicity)

“ A firm guarantee for progress with consistency



The QUINDOS Wear option in use. An intuitive user interface for wear measurement of the various engine components.

confronting new challenges and providing solutions to them, time and again.” Put concisely, it’s a firm guarantee for progress with consistency.

In ISP’s case, a completely new, highly specialised module was created: QUINDOS Wear, the software tool for engine component wear measurement.

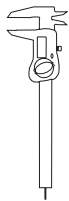
The result: A single package which meets all the requirements

ISP and Hexagon Metrology PTS worked for over a year in an incredibly productive development partnership to get QUINDOS Wear and all the desired performance features launched in Salzbergen:

- Unlimited pallet measurement capabilities for engine components, including cylinders, pistons, piston rings, camshafts, bearing shells and timing chains.
- Output of results in tabular and graphical form.
- Automatic saving of measurement results in PDF and Excel files.
- Automatic measurement data storage based on specific characteristics, such as “engine type,” “test type,” “parts kit number” etc.

„What used to take us two whole days, between set-up, measurement and evaluation, we can now accomplish with QUINDOS Wear and the new measuring machine in four to six hours, maximum. This is positively sensational,” said ISP component evaluator Martin Heuking happily.

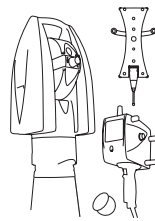
And what’s more, programmers of individual power train solutions have given QUINDOS Wear capabilities which put ISP miles ahead of the industry, namely the measurement of timing chains. “We don’t just measure changes in length. Anyone can do that. We measure the wear on the bearing of each chain link down to the μ . Only a very few can do that, with the help of QUINDOS Wear,” said Michael Schulz enthusiastically about this totally new “colour on the pallet of wear measurement.”



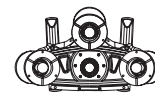
PRECISION MEASURING INSTRUMENTS



PORTABLE MEASURING ARMS



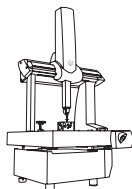
LASER TRACKERS & STATIONS



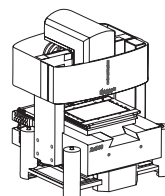
WHITE LIGHT SCANNERS



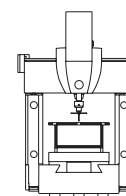
SENSORS



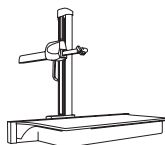
BRIDGE CMMs



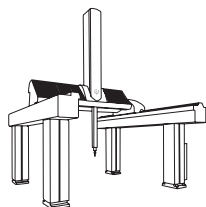
MULTISENSOR & OPTICAL SYSTEMS



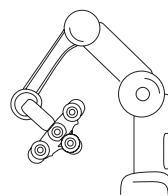
ULTRA HIGH ACCURACY CMMs



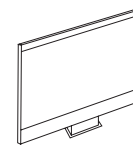
HORIZONTAL ARM CMMs



GANTRY CMMs



AUTOMATED APPLICATIONS



SOFTWARE SOLUTIONS



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