APPLICATIONS NOTE

Leading Automotive Engine Manufacturer Utilizes MTII's Precision Capacitance Sensors to Verify State-of-the-Art Oil Pan Design

Introduction

Automotive engineers continue to enhance designs in an effort to decrease weight, increase horsepower and improve efficiency. Many engine components have been eliminated or now serve several purposes in order to produce higher horsepower in a smaller, compact package. This requires components to be manufactured to tighter tolerances and forces manufacturers to perform additional testing and quality control checks. Take the oil pan, for instance.

For years the sole purpose of the oil pan was to act as a reservoir for the engine lubricant. Some modern engines now utilize the oil pan as a critical structural component. It is machined from rigid steel or an aluminum casting and designed to support the lower portion of the crankshaft bearings and rear main seal. This enhancement introduced several potential problem areas that must be studied.

Problem

As an engine goes through heating and cooling cycles it is essential that the engine block and oil pan expand and contract at nearly the same rate. If not, stresses can be introduced into the pan gasket, main seal and bearing races. This not only can cause oil leaks but also lead to premature bearing failures and unwanted noise and vibration.

Solution

GM engineers approached MTII looking for a way to monitor the relative motion between the block and the pan during thermal cycles to determine if excessive stresses were occurring. The Accumeasure 1515 capacitance system was selected, because of its high accuracy and multi-channel capabilities. A test was performed using 16 capacitance probes strategically mounted to an engine. Each probe had an operating range of 0.04" (1mm) with a resolution of better than 10 micro-inches (0.25 microns). Before starting the test, all amplifier outputs were set to zero volts. As the engine was started, and brought up to operating temperature, the output of each sensor was recorded for further analysis.

Results

It was found that the relative motion was well within the seal and bearing manufacturer's specification. Had movements of 0.01" (250 microns) or greater been encountered, the manufacturer would have had to consider redesigning the lower motor components.

MTI Instruments Inc. offered several styles and types of non-contact capacitance probes to measure in tight, hard to reach places. The passive probes offered excellent thermal stability and were capable of operating at temperatures in excess of 400°C. In addition to capacitance sensors MTI Instruments, Inc. also manufactures high precision laser and fiber-optic systems with resolutions to 0.04 micro-inch (1 nm) and frequency responses to 500 kHz. Contact MTII's experienced Application Engineers for solutions to your demanding measurement needs.

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