Fuel Rail and Injectors: Fuel Rail Leak Test and Verification of Injector Functionality

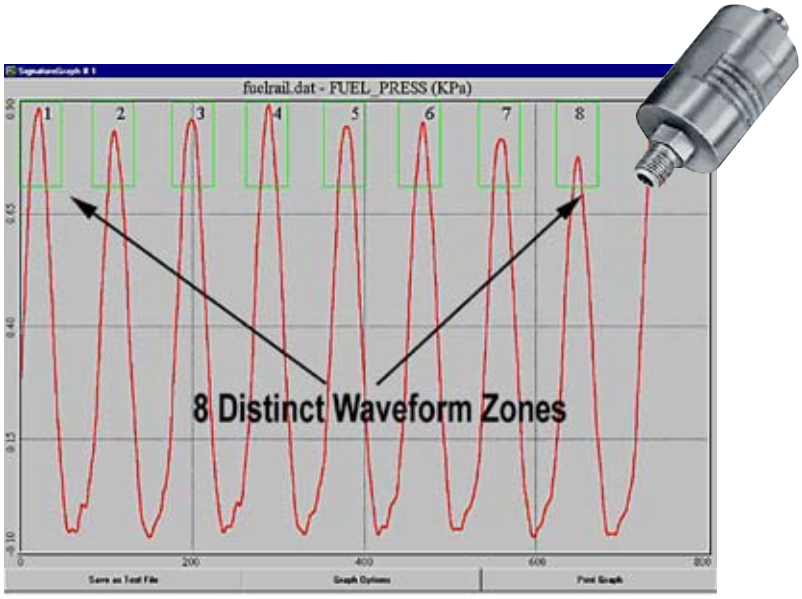
Overview:
An automobile engine manufacturer needed to test the integrity and operation of the fuel injectors during the production process. Sciemetric's Test and Analysis System and InspeXion® software provided a practical solution to the problem. The test is independent of the number of injectors that the engine uses, and it is done without disturbing the assembly since the test fixture is only attached to the fuel rail at the fuel inlet.

Highlights:
- Reliable 100% verification of all fuel injectors
- Single PASS/FAIL indication
- Two-part test indicates:
  - Fuel rail leaks
  - Missing injectors
  - Broken or sticky injectors
  - Debris
- Statistical analysis shows trends, aids design and quality improvement
- Eliminates teardowns after engine assembly

The inaccessibility of the injector nozzles and the method of assembly made it impractical to test each injector individually. At the same time, delaying the test until the engine could be run could result in costly tear-downs and production delays.

In the first part of the test, all injectors are turned off and the fuel rail is leak tested. Next, pressurized air is forced into the fuel rail through a "sonic" nozzle (which restricts the rate of air replenishment). A pressure sensor connected to the Test and Analysis System input detects changes in back pressure in the rail as each of the injectors is turned on and then off sequentially. The screen shot at left shows the pressure waveform for an engine with eight fuel injectors. For this test, the pressure sensor is connected in reverse so that the operating range of each injector appears at the top of the screen. Sciemetric's Signature Analysis techniques allow the waveform to be analyzed in specific windows so the functionality of each injector can be checked. By analyzing and comparing the shape of the pulses against known good pulses, defects such as debris, sticky, or broken injectors can be detected. More serious defects such as leaks and open or missing injectors are revealed in the first part of the test.

This is an excellent example of how Sciemetric's Advanced Signature Analysis can use a single sensor to verify an assembly having many separate functional components. The system provides reliable 100% line testing and a simple PASS/FAIL indication to the operator.



Pressure Waveform for an Engine with Eight Fuel Injectors

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