Cold Engine Testing: Mechanical Integrity and Fuel Systems Tests

SCIEMETRIC POWERTRAIN SOLUTIONS

Challenge

Engine manufacturers require a reliable and cost-effective end-of-line test to catch any defects missed during engine assembly. Hot testing, with its long cycle times and requirements for dedicated resources and facilities for stations, is expensive.

Solution

Sciemetric's Engine Cold Test system provides an economical and flexible alternative to hot testing. A cold test is performed when an electric motor is used to rotate the crankshaft with the engine "cold" (i.e., not running, so no gasoline or special ventilation are required) while the Sciemetric process signature software records and analyzes signatures and data from various sensors including torque, crankshaft angle and pressures. By comparing waveforms and their common characteristics with those of "good" engines, the system quickly identifies and pinpoints defects, rejecting abnormal or substandard engines.

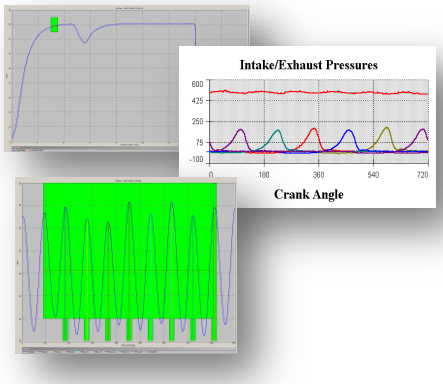
Cold Test System Checks

Sciemetric's Cold Test System finds issues introduced during the final engine assembly stages and includes high-speed tests, low speed tests and static tests with operator inspection. It detects low vacuum, bad oil pump, EGR valve functionality, incorrect engine timing, leaking fuel rail, damaged fuel injectors, knock sensors, missing/damaged gaskets. Here are some examples of the main tests:

MECHANICAL INTEGRITY AND FUEL SYSTEMS TEST KEY FEATURES

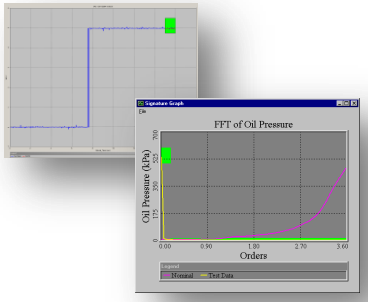
- Uses signature analysis for reliable, accurate verification
- All cold test data, including process signatures, are automatically stored in a central database for traceability by engine serial number
- Easy to use menus and full graphic displays
- Cost - effective

the science of quality



- *Mechanical*

The crankshaft is rotated at a fixed speed and process signatures collected and analyzed –upon the manifold – are crank torque, intake vacuum, exhaust pulses. The mechanical check finds defects such as low vacuum, missing or damaged gaskets, valve train defects or mechanical defects



- *Oil system*

To test the oil system, the crankshaft is rotated by an electric motor at a fixed speed. The signatures examined during this test include oil pressure vs. angle and the time and frequency domain analysis (FFT). The oil system test will identify missing or damaged gaskets and oil pumps not meeting specifications.

- *Fuel system*

To test the fuel system, the engine is rotated, a standard leak test – either pressure decay or flow – for the fuel rail is performed and the Electronic Engine Control (EEC) pulses injectors are examined. Signatures for the fuel rail and injector pressures are extracted to identify faulty components, leaks and wiring defects.

- *Ignition system*

To test the ignition system, the engine is rotated and clamps are place on the inductive sensors or information inferred from primary sensor readings. The system analyzes ignition pulses vs. crank angle and spark height (in volts) and width (time) signatures to find shorted spark plugs, swapped ignition wires, and faulty spark plugs that are not firing.

- *EGR valve*

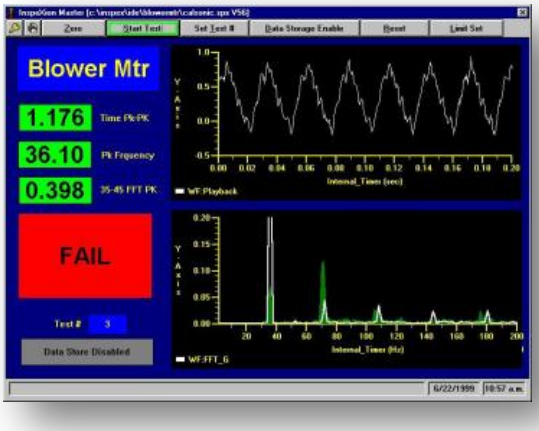
To test the ERG valve system, the engine is rotated and engine sensors are tested. The signature of the intake vacuum as the ERG valve is cycled is analyzed by the system to find EGR valve malfunction or misconnection of the EGR valve and missing and/or damaged gaskets.

- *Sensors*

The sensors test verifies the operation of engine sensors, electrical components and the wiring harness using voltage, current and resistance signatures. It will find oil pressure, oil temperature, coolant temperature, vacuum, Crank Position Sensor (CPS), CID(Cylinder Identification), MAP (Manifold Absolute Pressure) defects as well as faults within the wiring harness.

- *Vibration*

To test for unwanted vibration in the engine, the crankshaft is rotated by the electric motor at a fixed speed. The signatures examined during these tests are Accelerometer values and FFT (Fast Fourier Transformation) analysis. The defects that can be identified include compression problems, balance issues, valve train defects, gear or timing chain issues, missing bearings, other mechanical defects, and reversed sprockets.



A pioneer in signature analysis for manufacturing, Sciemetric has installations of cold test stands around the world. The process signature technology provides the most accurate defect detection.

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