Challenge

An engine defect can be introduced at any machining or assembly station yet many manufacturers rely on end-of-line tests, performed on a complete assembly, to catch problems. The sooner the defect is found, however, the less costly it is. When an engine is fully assembled it can be difficult to diagnose the root cause of a failure and requires greater time and effort to make the necessary repairs.

Solution

In-process testing (or IPT) is a more practical approach that finds and contains defects where and when they occur. In IPT, process monitors are installed at the assembly operations that are critical to quality to determine whether the operation and assembly were completed according to specification.

Sciemetric offers an Engine IPT solution that uses Signature Analysis to monitor across engine assembly operations. The systems measure properties such as force, distance, torque, compression, leak rates, vibration, vacuum, etc. and the signature analysis software 'learns' the signature of a good part and uses that information to create a set of limits that are applied to subsequent parts. The software provides a single, user-friendly interface across all of the test stands.

In the complete Engine IPT approach, data from each test system is stored in a central database where a record of all IPT information is maintained. Only the Sciemetric system enables storage of the data contained in the process signatures. This information can be used to easily generate yield and trend reports with full drill down to the individual part level using simple Windows®-based tools. It can also be used for quick identification of the root cause of issues affecting quality. The data provides the visibility required to enact change to improve yield.

ENGINE IPT KEY FEATURES

- Uses signature analysis for most accurate verification

- Tests engines at every build level to ensure components have been properly installed

- Provides detailed graphical displays and numerical results to test engineers

- Complete traceability: data, including signatures, are automatically stored in a central database and cross-referenced by engine serial number

- Direct communication between the test software and the motion controller

- Aborts testing as soon as a defect is identified to reduce cycle time and prevent damaging components
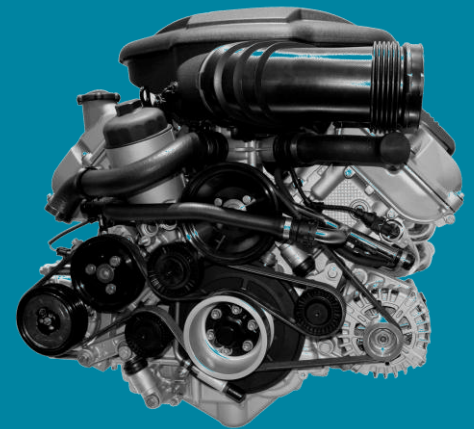
the science
of quality

Results

When manufacturers apply an IPT methodology on their production lines, they are able to increase quality and customer satisfaction while reducing costs because they understand what is happening on the line and are better equipped to be proactive at addressing issues.

A long-time user of Sciemetric's Engine IPT, Ford is able to show continuous improvements, and a leadership position, in engine quality.

Examples of Sciemetric Engine IPT Applications

Fitting with the philosophy that one should integrate process verification and testing into the assembly lines as much as practical, Sciemetric's solutions work across the engine line. Here are just a few examples.

Total Engine-Related Problems
Passenger Cars
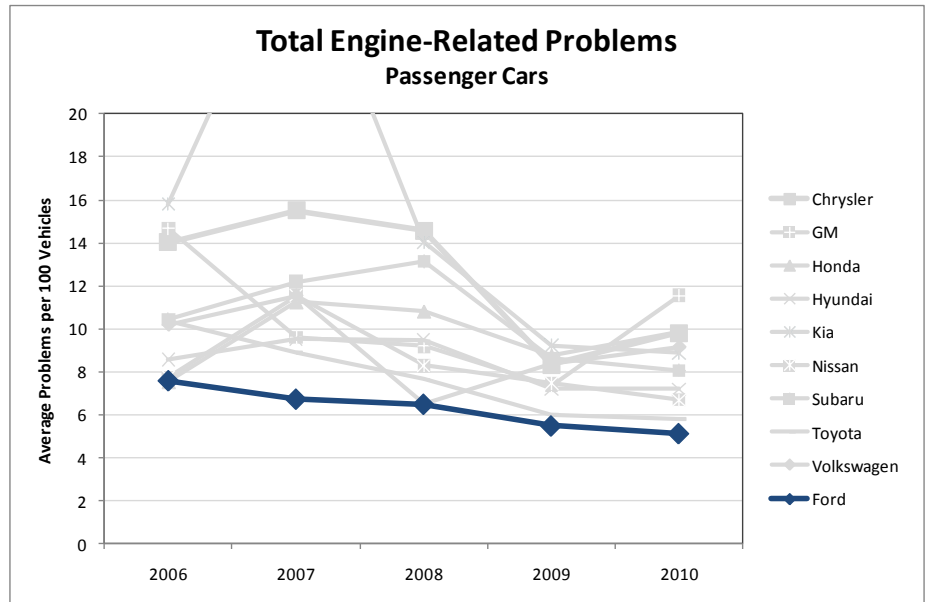
Analysis by Sciemetric based on JD Power Initial Customer Satisfaction survey data, by engine concerns.

Short Block

Sciemetric's Engine IPT system finds defects introduced at the short block stage of the assembly process.

Crank Torque to Turn Test

Examines breakaway torque, running torque and rear and front cup plug verification. Detects defects such as contaminated main bearings, debris, incorrect fit, insufficient lubrication, or nicked or bent cranks.

Short Block Verification

This test includes breakaway torque peak threshold, running torque average and peak threshold, missing bearing detection and rear seal verification. Finds problems such as missing con rod bearings, missing main bearings, incorrect fit, debris, reversed caps, blocked oil passages and bore lubrication.
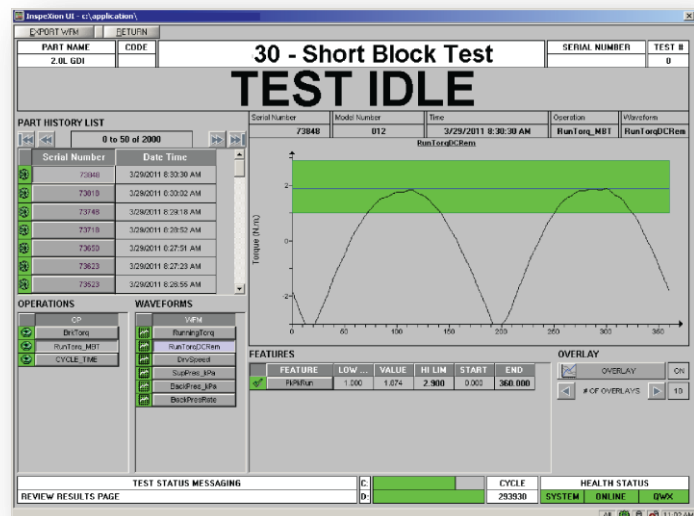
Long Block

Sciemetric's Engine IPT system finds defects introduced at the long block stage of the assembly process.

Oil Cavity and Coolant Cavity Leak Test Systems

The leak test systems look for missing or leaking components, casting porosity, misassembled components, improper run-down torques.

Long Block Verification

The tests include cylinder compression and running torque average and peak threshold to find defects such as low compression, misassembled timing chains, head installation problems, incorrect engine timing and soft lash adjusters.
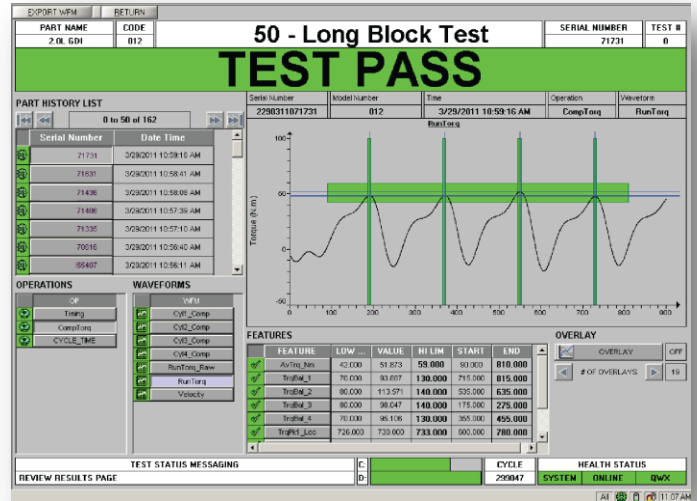
Cold Test System

This module in the Engine IPT suite finds issues introduced during the final engine assembly stages and includes high-speed tests, low speed tests and static tests with operator inspection. The Cold Test System detects low vacuum, bad oil pump, EGR valve functionality, incorrect engine timing, leaking fuel rail, damaged fuel injectors, knock sensors, missing/damaged gaskets. It includes tests such as:

- Torque
- Vacuum
- Oil system
- Fuel system
- Ignition system
- EGR valve
- Sensors
- Vibration
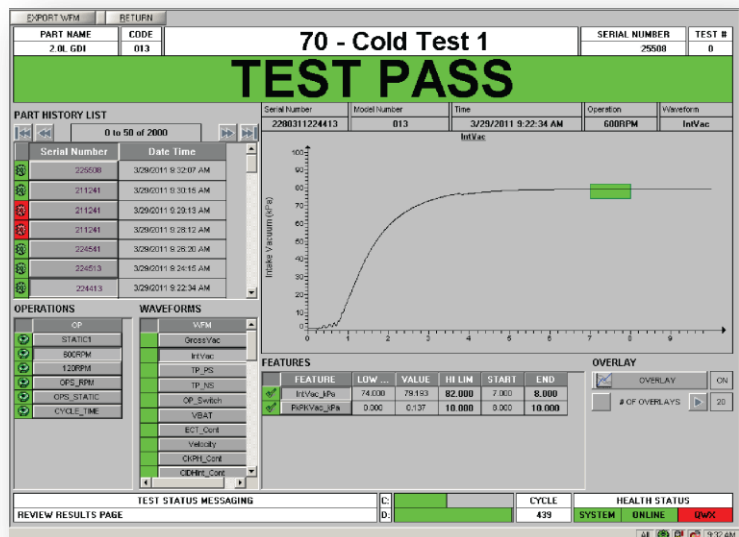
SCIEMETRIC POWERTRAIN

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