

■ Fuel Injector Insertion: Assembly Quality Verification Using Press Force Monitoring

Highlights:

- One Sciometric System monitors three insertion operations
- Immediate pass/fail indication
- System indicates:
 - O-ring missing or undersized
 - Injector misalignment
 - Pinched or rolled O-ring
 - Abrasive contamination in fuel rail cup

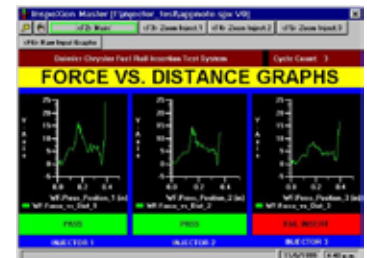
Sciometric's Test and Analysis System running InspecXion® operating software are the key components of a highly successful system that monitors the simultaneous insertion of three fuel injectors into a fuel rail. The Test and Analysis System tests for the security of the retaining clip, the presence and condition of the O-ring, fuel injector alignment, and possible abrasive contamination in the fuel-rail cup.

Each press head is coupled to the ram by a spring, and its position is monitored using an LVDT (Linear Variable Displacement Transformer). Load cells monitor the insertion force. A PLC (Programmable Logic Controller) controls the air cylinders. The system generates and displays a profile of insertion force versus time, determines the maximum force applied, and the total mechanical work done during insertion. If the total work done is too low, a missing O-ring is indicated. If it is too high, it indicates high friction in the press process, possibly from a pinched or rolled O-ring, or abrasive contamination in the fuel rail cup. The maximum press force is significant. If this is greater than a preset limit, it is likely that the injector is defective. A high starting force indicates that the fuel injector is misaligned, which could damage the O-ring. A low force when the press is in motion indicates that the O-ring is missing or undersized; if it is too high, the O-ring may be caught in the press.

After the fuel injector has been inserted and the retaining clip is in position, the system records the LVDT reading and the ram is withdrawn. The new LVDT reading is compared with the previous one. If the fuel injector is properly engaged, the press head remains in position. The spring allows the ram to be withdrawn and the LVDT reading does not change. If the clip is not engaged, the injector is withdrawn by 1/4 inch and the LVDT reading changes, which causes a failure to be indicated.



The Sciometric Test and Analysis System alerts the operator to the failure mode immediately and makes 100% inspection a reliable and practical reality. It conserves time and resources, eliminates manual inspection, and avoids costly tear-downs by preventing defective parts from reaching the next production stage. This is just one of Sciometric's intelligent solutions that raise quality, speed production and simplify manufacturing processes.



InspecXion Screen showing Force versus Distance Fuel Injector Insertion Graphs.



InspecXion Screen showing PASS/FAIL Messages Returned to Operator.



InspecXion Screen showing PASS/FAIL Signature Waveforms.