This PWM valve hydraulic test system is one turnkey option. Source: InterTech

Hydraulic Testing Today

Learn more about turnkey hydraulic testing systems.

By Jacques Hoffmann

When your production focus is vehicular manufacturing—automotive, diesel or off road—there is no shortage of challenges when it comes to hydraulic testing.

Quite often one is dealing with a high production rate requirement usually in excess of 150 parts per hour. Conversely, individual part test time must be completed in a matter of seconds.

Blink-of-an-eye production rates ensure that traceability is a fundamental necessity and, combined with a programmable marking system, remain a manufacturer’s most important quality control ally. But ensuring that you have such systems in place is another challenge.

Overlaying these issues is the reality that today you are likely manufacturing for global markets. So for example, while durability and reliability are always issues, they are even more so when a given part you are testing in-line has to be as reliable in Quebec as it is in Qatar.

In-line Hydraulic Test Cell

Clearly, manufacturers who rely on an automated, up to date turnkey system for hydraulic testing are sleeping better this evening. So what do these systems look like? And what are the key features and benefits justifying the investment you will make in a turnkey system? Let’s consider a few applications that explore these questions.

The first functional test stand automatically tests, marks and sorts hydraulic solenoid valves. Of course, the hallmark of a forward thinking turnkey system is flexibility, so this modular design accommodates future product configuration changes.

In operation, the solenoid valves are automatically transferred from the test station to the marking station where programmable marking automatically identifies each part for traceability.

Then on to the unload station for classification based on test results; in this case there are three accept bins and one reject bin. Rejects are automatically unloaded into a separate bin with discharge verification to eliminate the possibility of shipping defective product. Test data is stored by serial number to document the supplier’s quality assurance program for a series of Six Sigma moments a QC manager would have to admire.

For maintainability, ready access to all
Valves are calibrated, tested, marked and sorted using power steering fluid as the test medium. Source: InterTech

What goes into this high-speed system? At its heart is modular instrumentation for flexibility and ease of maintenance. Test parameters are programmed to meet industry requirements, automatically selected, and sequentially performed. Dial transfer of parts, automated handling and sequencing of tests minimizes cycle time.

Through a fail-safe protocol, only accepted parts are marked, while automatic unloading and sorting prevents rejects from continuing down the production line. Reliability, which is always an issue, is ensured by repeatable positioning, a barrel cam indexer and interlocked motions. As in the prior example, tests may be easily modified

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### Relief Valve Hydraulic Functional Test Stand

This turnkey system is built for speed—automatically testing, marking and sorting a family of valves at 152 pph. Temperature control of the test fluid was critical for accurate testing, and to meet automotive industry requirements for test R&R. So a closed loop system was designed to maintain consistent fixture temperature (100 °F ± 3 °F).

The instrumentation performs eight tests:
- unseat (1,600 psig) and reseat (1,400 psig) at minimum flow
- pressure at maximum flow
- low pressure integrity test at 20 psig
- high pressure leakage at 2,000 psig max
- low pressure at 100 psig max
- internal seat leakage of 900 psig
- O-ring check at 6 psig (air test)

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A liquid air over oil intensifier is used to bring the 0.5 liter rail volume up to test pressure.

A test stand should be designed with ease of operation in the forefront. So the intensifier drive air regulator is brought to the front of the machine for easier operator adjustment.

A pressure relief valve is provided on the drive air regulator to ensure the maximum hydraulic pressure is not exceeded, and a small hydraulic pump is required to replenish the rail volume in between tests. A small air to oil cooler is incorporated to keep hydraulic fluid temperature at factory ambient temperature 72 to 104 F.

Finally, the fixture must work under extremely high pressure and measure flow force on valve stem lifts in increments of 0.005 millimeters. In this particular scenario, it consists of the following steps:

- Implement a Piezo-electric load cell to reduce the compressive distance to 1 micron/1.05kN.
- Accurately measures the fixture and valve stem compression and provide 10 valve lift stops in 5 micron increments.
- Position the valve preload spring above the solenoid so that it will not influence the test system.
- Program the data acquisition computer for the Piezo electric load cell.
- Provide data collection points for all sensors with adjustable target time and averaging width.

In the final analysis, hydraulic testing is always challenging. But with a well thought-out plan for a turnkey system, thorough preparation, clear design and testing requirements, you can reach the high product quality standards that your company aspires to achieve.  

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