

Review of IVB Engine Workshop | MINUTES

REVISION DATE: 7/2/2018 12:37:00 PM

Relevant Test:	Sequence IVB
Note Taker:	Chris Mileti
Meeting Date:	04-17-2018
Comments:	This meeting was held to review the notes collected by Joe Gleason and Matt Halley during the 01-17-2018 Sequence IVB engine build workshop. This workshop was hosted by Intertek in San Antonio, TX.

1. DISCUSSION:

1.1. Background:

- 1.1.1. A Sequence IVB engine build workshop was hosted by Intertek on 01-17-2018.
- 1.1.2. The Lubrizol attendees were Joe Gleason and Matt Halley.
- 1.1.3. Intertek provided some supporting documentation during this meeting (i.e. agenda, work instructions, Toyota build manual illustrations).
 - 1.1.3.1. **Link to supporting documents:** [Engine Build Workshop 01-17-2018\Hand Outs from Engine Build Workshop 01-17-2018.pdf](#)
- 1.1.4. These minutes are a summary of the notes collected by Gleason and Halley.

1.2. Timing Chain and Sprockets:

- 1.2.1. The Intertek engine builders wrap the timing chain around each sprocket when measuring the sprocket diameter.
- 1.2.2. Intertek has had significant problems with timing chain wear (especially with low viscosity oils).
 - 1.2.2.1. In fact, they have had timing chains elongate to a point where they jump teeth.

1.2.3. Tensioner:

- 1.2.3.1. Intertek installs a new timing chain tensioner at regular intervals.
- 1.2.3.2. This is needed because the 2NR-FE does not use a ratcheting tensioner.

1.2.4. Securing Timing Chain During Camshaft Removal:

- 1.2.4.1. Intertek uses a wooden wedge to hold the timing chain in place when the camshafts are removed at the end-of-test.
- 1.2.4.2. The engine is equipped with a retaining ledge to keep the chain on the crankshaft when it is not under tension.
- 1.2.4.3. Intertek uses a trailer hitch pin to secure the timing chain to the left-side of the block (using an open bolt hole) when the camshafts are removed.

1.3. Intake and Exhaust Valves:

- 1.3.1. Intertek recommends inspecting valve tips for wear or deformation after each test.
- 1.3.2. Over time, carbon can accumulate on the valves.
 - 1.3.2.1. This carbon can influence clearance measurements.

1.3.3. Compression and Leakdown:

- 1.3.3.1. Compression and leakdown tests should be done while the engine is still warm.
- 1.3.3.2. Carbon deposits can also influence compression and leakdown measurements.

- 1.3.3.3. It is useful to tap on each valve stem with a rubber mallet to dislodge any carbon prior to performing these tests.

1.4. Camshafts and Camshaft Stanchions:

- 1.4.1. Intertek uses Plastigauge to measure camshaft clearances.

- 1.4.1.1. They use pre-cut sections of Plastigauge material.

- 1.4.2. Do not use impact guns on the cylinder head.

1.4.3. Batch-D:

- 1.4.3.1. OHT wants to deplete its inventory of Batch-C camshafts before it starts using Batch-D camshafts for candidate testing.

- 1.4.3.2. The base circle of Batch-D camshafts is slightly smaller than on previous batches.

- 1.4.3.2.1. As a result, the labs may need to change their strategy for selecting lifter grades.

1.4.4. Camshaft Lobe Failures:

- 1.4.4.1. The center main is usually the first main bearing to exhibit wear when a camshaft lobe failure occurs.

- 1.4.4.2. Anomalies in oil pressure occur in conjunction with camshaft lobe failures.

- 1.4.4.2.1. The oil pressure usually drops during most of the test cycle.

- 1.4.4.2.2. However, the oil pressure may increase during the Stage 2 → 1 transition.

- 1.4.4.3. All bearings in the engine should be replaced after a lobe failure.

- 1.4.4.3.1. Toyota has not yet supplied main and connecting rod bearing clearance specifications.

- 1.4.4.3.2. Intertek has a supply of these bearings that can be supplied to the other labs as needed.

1.4.5. Sprockets:

- 1.4.5.1. Torque the sprocket bolts when the camshaft is not installed in the cylinder head.

- 1.4.5.1.1. This will reduce the likelihood of damaging sprocket bolts.

- 1.4.5.1.2. The torque is 56Nm.

- 1.4.5.2. Intertek recommends using a decommissioned cylinder head to hold the camshaft in place when installing the sprockets.

- 1.4.5.2.1. This method does not require two mechanics (i.e. one to hold the camshaft and one to torque the bolts).

- 1.4.5.3. A "crow's foot" is needed to tighten the bolt on the exhaust sprocket.

- 1.4.5.4. Intertek marks their intake sprocket by engraving it with one line, and they mark their exhaust sprocket by engraving it with two lines.

1.4.6. Valve Seals:

- 1.4.6.1. Intake and exhaust valve seals are not the same.

- 1.4.6.2. Intertek has valve seal part numbers that are available at Toyota dealerships.

- 1.4.7. When disassembling an engine, it is best to loosen the front camshaft end-cap first.

1.5. Bucket Lifters:

- 1.5.1. The engine builder should confirm that each bucket lifter spins freely in its bore before the camshaft is installed.

1.5.2. Button/Shim:

- 1.5.2.1. These lifters have a small button or shim on their underside that rests against the valve stem.

- 1.5.2.2. Intertek has seen irregular wear on this button/shim.

1.6. Best Practices and Documentation:

- 1.6.1. The serial number from engines supplied by OHT must be recorded in the test report.

- 1.6.2. Intertek tries to remove the test kit within 2-3 hours of the end-of-test.
 - 1.6.2.1. This helps reduce corrosion and rusting.
- 1.6.3. Combustion air should be disconnected from the stand whenever the engine is not running.
- 1.6.4. Intertek measures the width of bolts to determine when they should be replaced (due to elongation).
- 1.6.5. It is a good practice to close the manual fuel shut-off valve when the engine is shut down.
 - 1.6.5.1. This reduces the risk of fuel dripping into the cylinder.
- 1.6.6. Intertek uses the fuel rail and intake manifold from each new engine.
- 1.6.7. Intertek uses a camshaft pulley holder supplied by Matco Tools.
 - 1.6.7.1. Part Number: MST 9680
- 1.6.8. Extended Period of Unscheduled Downtime (Intertek):**
 - 1.6.8.1. Corrosion and rusting can be a problem during extended periods of downtime.
 - 1.6.8.2. In these situations, Intertek will remove a 6-8oz purge sample from the engine, remove the valve cover, and pour the purge oil over the camshafts.
 - 1.6.8.3. This will wash most of the acidic emulsion off the camshafts.

1.7. Front Cover:

- 1.7.1. It was recommended to remove the oil pump from the stock front cover of every new engine.
 - 1.7.1.1. This new oil pump can then be installed on the OHT (test-specific) front cover.
 - 1.7.1.2. Intertek uses this new pump for the duration of the cylinder head.

1.8. Cleaning Recommended by Intertek:

1.8.1. Cylinder Head:

- 1.8.1.1. Cylinder heads are not disassembled prior to cleaning.
- 1.8.1.2. The assembled head is first rinsed with Stoddard and then placed in an ultrasonic cleaner.

1.8.2. Engine Block:

- 1.8.2.1. The engine block is not cleaned in a sonic cleaner.
- 1.8.2.2. The piston oilers are removed and flushed with Stoddard.

1.8.3. Crankshaft:

- 1.8.3.1. The crankshaft is sprayed with Stoddard, and then coated with a 50/50 mixture of Stoddard and EF-411.
- 1.8.3.2. The crankshaft is polished if needed.

1.8.4. Throttle Bodies:

- 1.8.4.1. Throttle bodies can fill with sludge and should be cleaned.

1.9. Surveillance Panel Task Force:

- 1.9.1. A Surveillance Panel Task Force will be formed to determine which test stand parts should be supplied by TEI and which could be purchased elsewhere.

1.10. Fuel Temperature:

- 1.10.1. Intertek has found that control of the fuel temperature could be problematic during shutdowns and restarts.
- 1.10.2. They found that running the fuel pump (while the engine is not running) can heat the fuel before start-up.

Action Items	Person responsible	Completion Date

Follow-up Notes/Updates	Initials	Date Added

Attendees	Organization	Contact Information
Gleason, J.		
Halley, M.		
Mileti, C.		