Sequence IV Surveillance Panel | MINUTES

REVISION DATE: 5/17/2018 7:58:00 AM

Relevant Test:	Sequence IVB
Note Taker:	Chris Mileti
Meeting Date:	04-26-2018
Comments:	The purpose of this meeting was to discuss the recent LTMS motion and its negative votes.

1. OPENING DISCUSSION:

1.1. Comments from The Surveillance Panel Chairman:

1.1.1. An e-Ballot was issued early in April so that the Surveillance Panel could vote on the proposed Sequence IVB LTMS system.
1.1.2. The motion ballot passed with (2) negative votes and one waiving vote with comments.
1.1.3. The rules regarding LTMS require that all negative votes be resolved before the ballot can be finalized.

1.2. Review of 1st Negative Vote:

1.2.1. The TMC cast the first negative vote.
1.2.2. They recommended diligence when analyzing an anomalous result in LTMS.
1.2.2.1. Is the anomalous result truly an anomaly, or is the severity of the test stand changing?
1.2.3. Toyota stated that TMC's concern is reasonable.

1.3. Review of 2nd Negative Vote:

1.3.1. Exxon cast the second negative vote.
1.3.2. Exxon is concerned that iron has not been monitored [as a pass/fail parameter] throughout test development.
1.3.2.1. It is also unclear how chemistry will influence iron.
1.3.3. Exxon would like to see the Surveillance Panel collect more data during the Tech Demo period.
1.3.3.1. The iron parameter could be revisited once this data is available for review.

1.3.4. Comments from Intertek:

1.3.4.1. They agree with Exxon that additional work needs to be done, and it is likely that the iron parameter will need some type of adjustment.
1.3.4.2. This adjustment may be like the phosphorous retention adjustment used for the Sequence III.
1.3.4.3. They also noted that iron needs to be in the initial LTMS document if it is going to be a pass/fail parameter for this test.

1.3.5. Comments from Exxon:

1.3.5.1. <u>They recommended that the Surveillance Panel closely monitor the following parameters during the Tech Demo:</u>
1.3.5.1.1. Engine hours
1.3.5.1.2. Oil consumption

1.3.5.1.3. Frequency of camshaft lobe failures and the iron content during the first flushes after the engine is rebuilt.

1.3.6. Comments from Southwest:

1.3.6.1. They share Exxon's concerns and agree that iron needs to be closely monitored during the Tech Demo period.

1.3.6.2. It is premature to hold the labs accountable to an iron limit in LTMS when this parameter is not fully understood.

1.4. Camshaft Lobe Failures:

1.4.1. Question from Infineum:

1.4.1.1. Is there a formal procedure for dealing with camshaft lobe failures?

1.4.1.2. <u>Response from Intertek:</u>

1.4.1.2.1. The IVB procedure specifies (5) separate flushes between tests.

1.4.1.2.2. The first is an oil pan flush with EF-411, and the remaining four are "fired" engine flushes with the candidate oil.

1.4.1.2.3. Intertek performs flush effectiveness calculations using the flush oil analysis data.

1.4.1.2.4. If a lobe failure occurs, Intertek disassembles and cleans the engine.

1.4.1.2.4.1. They replace the main and connecting rod bearings if necessary.

1.4.1.2.4.2. They then reassemble the engine and run a 50HR break-in and aging cycle.

1.4.2. Comments from Afton:

1.4.2.1. The procedure [on the TMC website] states that an engine is to be removed from service if a lobe failure occurs.

1.4.2.2. This issue needs to be clarified because it appears that not all the labs are following this.

1.4.3. Comments from Lubrizol:

1.4.3.1. Lubrizol has experienced about (4) camshaft lobe failures over the last two years.

1.4.3.2. They follow the procedure and decommissions the "lobe failure" engine instead of rebuilding it.

1.4.4. Comments from Exxon:

1.4.4.1. Exxon recently experienced a camshaft lobe failure with its high wear oil.

1.4.4.2. They cleaned and flushed the engine.

1.4.4.3. They are running a repeat test with the "lobe failure" engine to evaluate the effectiveness of their cleaning/flushing procedure to remove wear debris.

1.4.5. Comments from Intertek:

1.4.5.1. They conducted flush effectiveness studies after previous camshaft lobe failures.

1.4.5.2. These studies focused on cleaning the valve deck and oil pan.

1.4.5.3. The new OHT oil pan (which was introduced after the Intertek studies) eliminated most of the concern regarding camshaft wear debris settling in the bottom of the engine.

1.4.5.3.1. The new oil pan has a very low oil retention volume when the drain plug is removed.

1.4.5.3.2. The new oil pan also allowed for an "oil pan only" flush to be added to the procedure.

1.4.5.3.3. Intertek is confident that the new design and flush is removing any iron that settles in the pan.

1.4.5.4. The problem of debris damaging the main and connecting rod bearings still has not been resolved.

1.4.5.4.1. Some lobe failures result in bearing damage while other lobe failures do not.

1.4.6. Comments from Infineum:

1.4.6.1. The Industry should probably decommission all "lobe failure" engines until this issue can be formally addressed in the procedure.

1.4.7. Comments from Southwest:

1.4.7.1. Southwest has not experienced any camshaft lobe failures since the large oil charge was introduced last year.

1.4.7.2. Before the larger oil charge was used, they would rebuild "lobe failure" engines using a procedure that is identical to the one used by Intertek.

1.5. Camshaft Lobe Failure Cleaning and Rebuild Discussion:

1.5.1. Bearing Replacement Strategy:

1.5.1.1. The plan is to eventually have OHT stockpile bearings and piston rings.

1.5.1.2. This hardware can be used to rebuild engines after camshaft lobe failures.

1.5.1.3. OHT currently has a small quantity of these parts.

1.5.1.3.1. But they need more clarity on future usage to manage their inventory accordingly.

1.5.2. Bearing Grades:

1.5.2.1. There are several different bearing grades available for the Toyota engine.

1.5.2.2. In the past, Intertek has supplied Southwest and Lubrizol with different bearing grades that they could use for engine rebuilds.

1.5.3. Cleaning:

1.5.3.1. Intertek uses an ultrasonic cleaner to clean fully assembled Toyota cylinder heads.

1.5.3.1.1. It is the same machine that is used to clean IIIH and GMOD hardware.

1.5.3.1.2. The results are very good.

1.5.4. Intertek and Southwest agreed that there is no apparent downside [in performance] to rebuilding an engine after a camshaft lobe failure.

1.6. Formation of Sub-Groups – Discussion Part 1:

1.6.1. Buscher noted there are several outstanding action items (such as the issue of camshaft lobe failures) that the Surveillance Panel needs to address.

1.6.2. He suggested forming two sub-groups to address these action items.

1.6.2.1. The 1st sub-group would focus on action items that relate to improving test precision.

1.6.2.2. The 2nd sub-group would focus on action items that relate to the procedure.

1.6.3. Sub-Group Membership:

1.6.3.1. Five Sequence IVB labs

1.6.3.2. Toyota

1.6.3.3. TMC

1.6.3.4. TEI

1.6.3.5. OHT

1.6.4. The first agenda item for both sub-groups should be camshaft lobe failures.

1.7. Engine Longevity and Impact on Severity:

1.7.1. Comments from Intertek:

1.7.1.1. Most of the iron [during normal tests] appears to be coming from the cylinder bores and piston rings.

1.7.1.2. They recently made a fixture to hold a 2NR-FE engine block on their PDI machine.

1.7.1.2.1. They plan to use this fixture to generate wear profile data inside of each bore.

1.7.1.2.2. The measurements will be taken at 90° intervals.

1.7.1.2.3. They will issue a report to the Surveillance Panel once these measurements are collected and analyzed.

1.7.2. Engine Specifications:

1.7.2.1. Toyota plans to provide Intertek with specifications for key aspects of the 2NR-FE engine (bore finishes, bearing clearances, etc.).

1.7.2.2. These specifications will be used to develop a procedure for reconditioning 2NR-FE engines.

1.7.3. Maximum Number of Runs:

1.7.3.1. Intertek has not been able to get (12) runs out of an engine yet.

1.7.3.1.1. They did, however, have two engines make it to 9-runs.

1.7.3.2. With one of their recent engines, Intertek decided to change the cylinder head at 4-runs instead of the typical 6-runs.

1.7.3.2.1. This engine experienced a camshaft lobe failure on its 7th test, and they decided not to rebuild it.

1.7.4. Comments from Lubrizol:

1.7.4.1. All the discussions thus far during this conference call support the assertion that iron is not a fully vetted parameter.

1.7.4.2. In fact, these discussions support an engine-based LTMS system instead of a stand-based system.

1.7.5. Comments from Afton:

1.7.5.1. Lubrizol brings up an interesting point.

1.7.5.2. The Surveillance Panel needs to better understand iron before it is used as a pass/fail parameter.

1.7.5.3. Did Intertek change an engine during the Precision Matrix? If so, what happened to the severity of the stand?

1.7.5.3.1. *Response from Intertek:*

1.7.5.3.1.1. They did have to remove a 3rd run engine from IAR102 due to a lobe failure.

1.7.5.3.1.2. They had a "mild" result with REO1012 on the first engine, and a "severe" result with REO300 on the second engine.

1.7.5.3.1.3. It is difficult to draw any conclusions from this data.

1.7.5.4. This Surveillance Panel needs to lock down a standard procedure for acceptable engine life and dealing with camshaft lobe failures.

1.7.5.5. Future Sequence IVB customers need to know when their candidate test follows a previous test that had a lobe failure or unusually high iron.

1.7.5.6. They are open to running a reference test with every new engine if needed.

2. LUBRIZOL PRESENTATION:

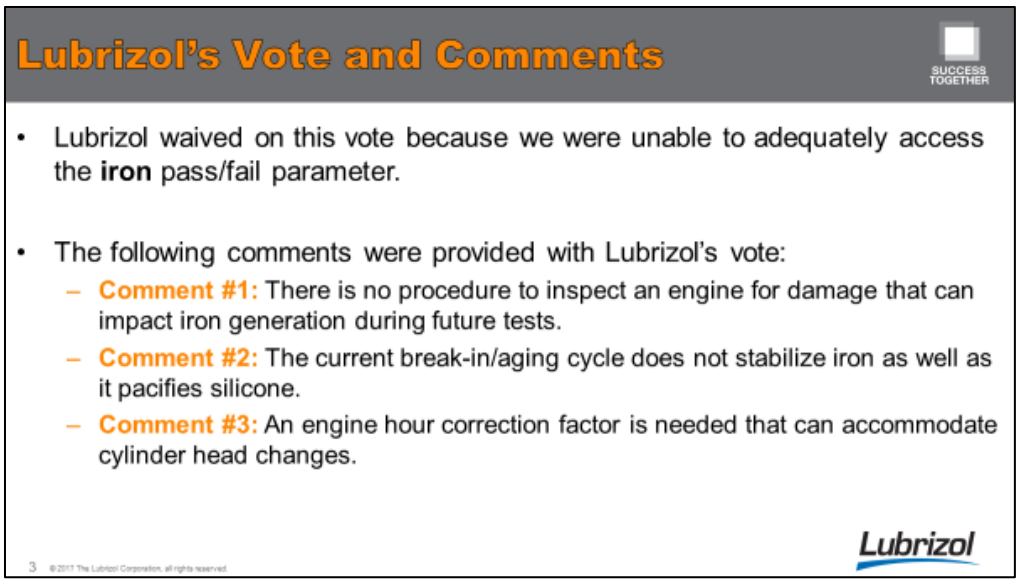
2.1. Background:

2.1.1. During the original e-Ballot, Lubrizol waived on the vote but did submit comments.

2.1.2. This presentation explains each of the comments that were submitted.

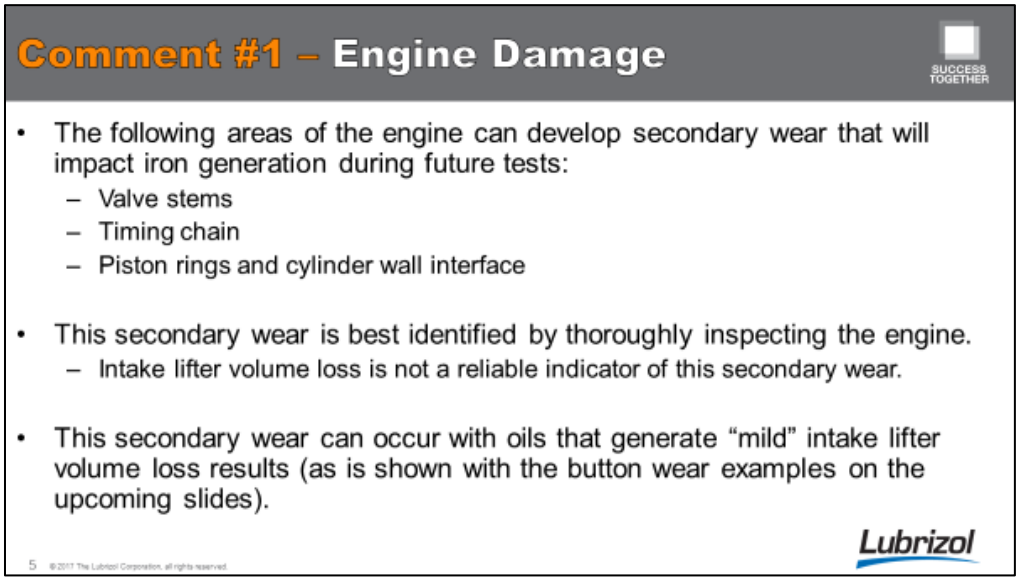
2.1.3. File name: "***Lubrizol Comments on IVB LTMS Vote.pptx***"

2.2. Slide #3:



2.2.1. This slide summarizes the comments that Lubrizol issued with its e-Ballot response.

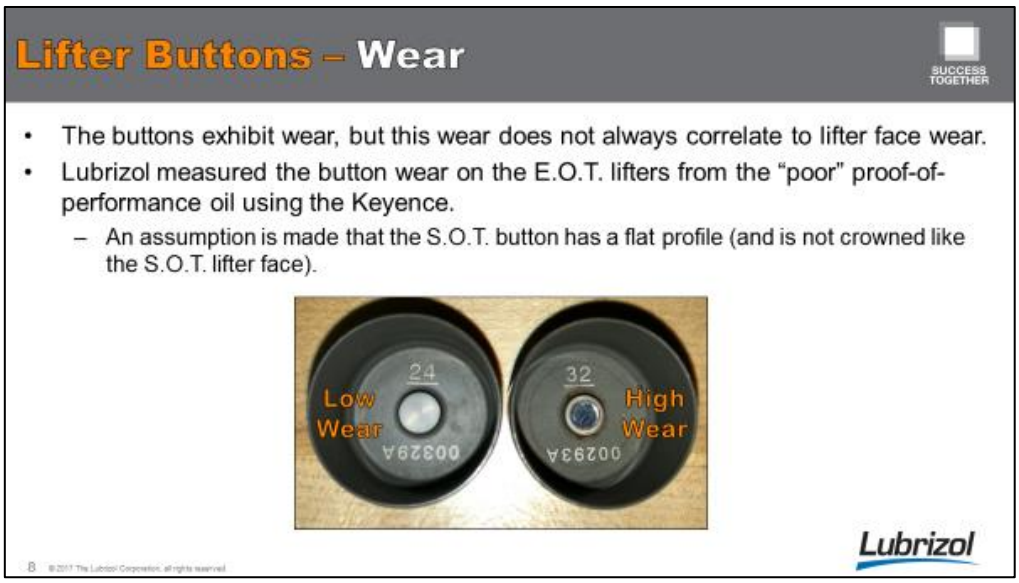
2.3. Slide #5:



2.3.1. There is compelling evidence that an engine can become damaged, or develop excessive wear, from an oil that does not necessarily generate failing ALVI measurements.

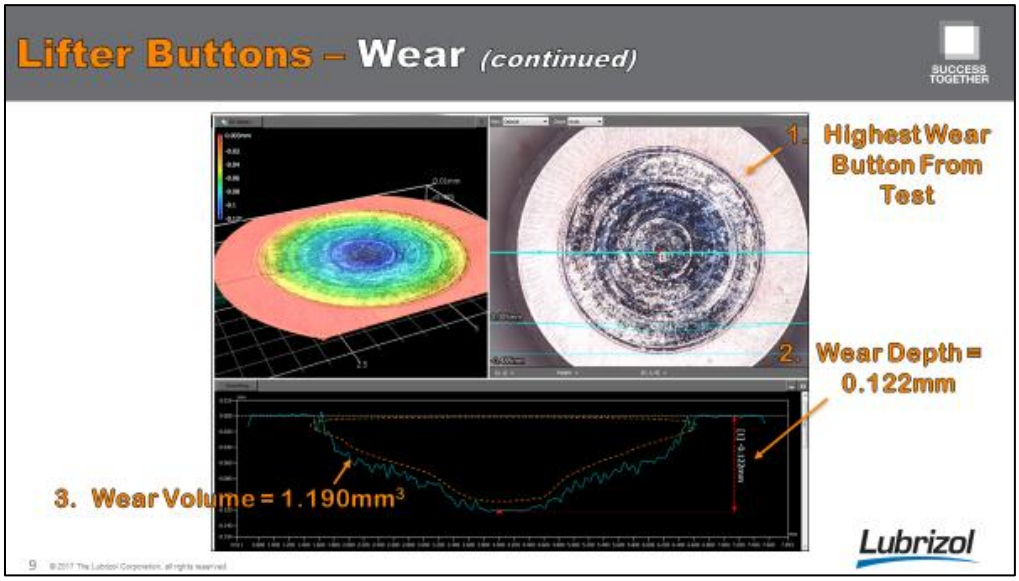
2.3.2. This damage and/or excessive wear can impact the iron level of subsequent tests.

2.4. Slide #8:



2.4.1. This slide shows the underside buttons of two lifters that are from the same test kit.
2.4.2. One of these buttons has almost no wear, and the other button has excessive wear.

2.5. Slide #9:

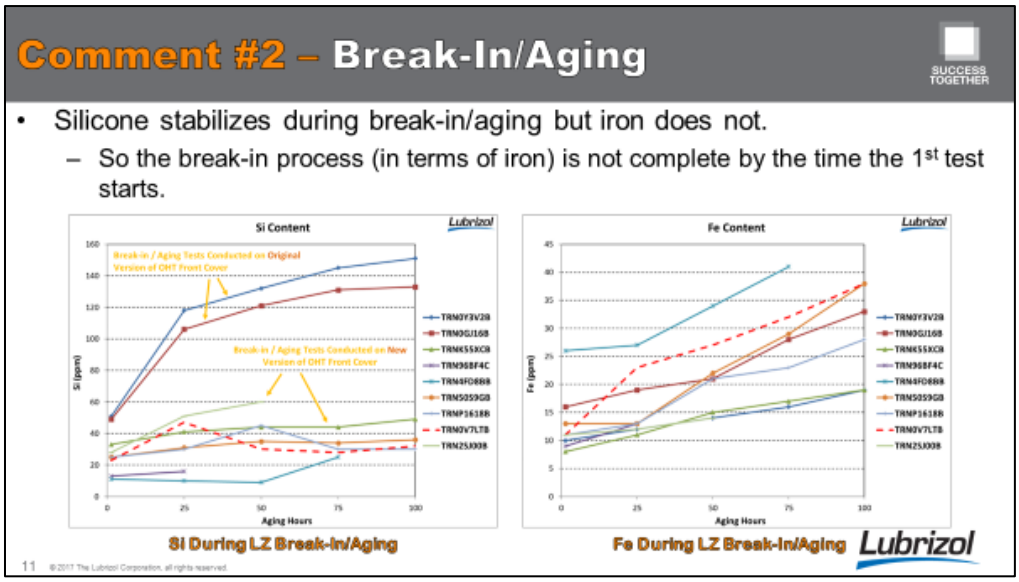


2.5.1. The excessively worn button had a wear volume that was almost as high as the wear volume from the lifter's upper surface (that is in contact with the camshaft).

2.6. Slide #10:

2.6.1. Lubrizol is confident that excessive button wear is the result of deformed valve stems.
2.6.2. Valves are only replaced when the cylinder head is changed.
2.6.3. As a result, valve stem deformation can significantly increase the iron generation of future candidate tests.

2.7. Slide #11:



2.7.1. The current IVB aging cycle stabilizes silicone (left chart) but not iron (right chart).
2.7.2. The graph on the left shows the drastic reduction in silicone that Lubrizol encountered after switching to the latest version of the OHT front cover (that uses a rope gasket).
2.7.3. Lubrizol's silicone level may be lower than that of the other labs because it uses the same stock rocker arm cover for all its break-in/aging cycles.

2.8. Further Discussion about IVB Break-In and Aging Cycle:

2.8.1. The procedure uses REO1006-2 as the break-in oil.
2.8.2. Fred Gerhart (Southwest):
2.8.2.1. Gerhart based the IVB break-in cycle on the break-in cycle used for the Sequence IVA.

2.8.2.2. He did reduce the torque set-points to account for the smaller size of the Toyota engine.

2.8.3. The break-in cycle progressively moves to ever increasing temperatures and torques.

2.8.4. Aging Cycle:

2.8.4.1. The aging cycle is currently run at steady-state conditions.

2.8.4.2. The duration of the aging cycle was recently reduced from 100HRS to 50HRS.

2.8.4.3. Several of the Surveillance Panel members suggested cycling the engine during aging.

2.8.4.3.1. This would presumably help the iron concentration stabilize within 50HRS.

2.8.5. Candidate Testing:

2.8.5.1. There was a broad agreement among the Surveillance Panel members that there will not be enough upcoming reference tests to generate the data needed for a thorough statistical analysis of iron.

2.8.5.2. Some members suggested looking at iron from candidate tests.

2.8.5.3. Comments from Toyota:

2.8.5.3.1. Is there a procedure to gather candidate data without compromising confidentiality?

2.8.5.3.2. They asked if the TMC could comment on this.

2.8.5.4. TMC Response:

2.8.5.4.1. Any request to use candidate data for statistical analysis would need to come from the Surveillance Panel.

2.8.5.4.2. This type of request is not unprecedented; a similar request was made for phosphorous data during Sequence IIIGB development.

2.8.5.4.3. The data will need to be coded to maintain confidentiality.

2.8.5.5. Comments from Intertek:

2.8.5.5.1. Buscher supports this proposal as the Chairman of the Surveillance Panel.

2.8.5.5.2. He suggested that the Surveillance Panel compile a list of parameters to be captured from these candidate tests (iron, AVLI, oil consumption, engine hours, etc.).

2.8.5.6. Comments from Afton:

2.8.5.6.1. The HD Surveillance Panels sometimes take a similar approach with candidate data.

2.8.5.6.2. However, it is important to keep in mind that the test sponsors own the candidate data and not the test labs.

2.8.5.6.3. Afton supports this idea even though its implementation may be difficult.

2.9. Formation of Sub-Groups – Discussion Part 2:

2.9.1. Afton and Lubrizol both suggested scheduling weekly meetings for the Surveillance Panel or its proposed sub-groups.

2.9.1.1. This is the only way to make steady progress on the issues that were discussed during this meeting.

2.9.1.2. Both companies also recommended maintaining a formal list of action items.

2.9.2. Intertek again suggested forming one sub-group to focus on procedural issues and one sub-group to focus on precision/operational issues.

2.9.2.1. Each sub-group could meet weekly.

2.9.3. Lubrizol offered to maintain the action item list and meeting minutes for each sub-group.

2.9.4. Intertek offered to lead the Precision and Operation Sub-Group.

2.9.5. Southwest offered to lead the Procedure Sub-Group.

2.10. How Should the Surveillance Panel Move Forward with the LTMS e-Ballot?

2.10.1. Buscher wants the Surveillance Panel to figure out how it can move past the negatives and comments from the 1st LTMS e-Ballot.
2.10.1.1. He wants a resolution to this issue so that labs can calibrate their stands and discussions can begin regarding ACC registration.
2.10.2. He proposed moving forward with just AVLI as a pass/fail parameter.
2.10.2.1. Iron could then be revisited later.

2.10.3. Comments from Toyota:

2.10.3.1. They incorporated a margin of error into their proposal to make iron a pass/fail parameter.
2.10.3.1.1. For example, the proposed AVLI limit is 2.5mm^3.
2.10.3.1.2. Recent results indicate that an AVLI measurement of 2.5mm^3 correlates to an E.O.T. iron of 300ppm.
2.10.3.1.3. Toyota increased their proposed E.O.T. iron limit from 300ppm to 400ppm to incorporate a margin of error.
2.10.3.2. This margin of error essentially makes iron a secondary pass/fail parameter.

2.10.4. Follow-Up Comments from Intertek:

2.10.4.1. Buscher developed his proposal further by offering to drop iron and its severity adjustment from LTMS.
2.10.4.2. Iron would then not be charted.

2.10.5. Comments from TMC:

2.10.5.1. They said that Buscher's proposal would address their negative vote.
2.10.5.2. They could not confirm if there is a precedent to adding a pass/fail parameter (i.e. iron) to a test after the Tech Demo period.
2.10.5.2.1. They would have to do research to see if there is a rule against this.
2.10.6. Afton, Lubrizol, Toyota, Infineum and Oronite were all comfortable with Buscher's proposal.

2.10.7. Follow-Up Comments from Intertek:

2.10.7.1. There appears to be broad support among the Surveillance Panel members to drop iron from LTMS and revisit it later.
2.10.7.2. Exxon, TMC and Lubrizol also confirmed that this proposal would address their negative votes and comments.
2.10.7.3. The TMC and Intertek noted that this proposal would require a 2-week waiting period.
2.10.7.4. Intertek will have its statistician issue a revised LTMS document (without iron).
2.10.8. The TMC and Afton requested that the Surveillance Panel hold a new vote for the LTMS system.
2.10.9. The TMC suggested that the Surveillance Panel handle the LTMS system and the data dictionary as separate items.

2.11. 2nd Vote on Proposed LTMS System:

2.11.1. Intertek made the motion, and the motion was seconded by Toyota.
2.11.2. ***Motion:*** "*Sequence IV surveillance panel accepts the Sequence IVB LTMS, as documented in the previous slides of this presentation (IVB LTMS Motion 20180426.pptx). Effective 5/10/18 (two weeks after the vote on this motion) to be applied to all Precision Matrix 2 and later reference tests. The ASTM TMC will grant calibration status where applicable, based on the agreed on LTMS, with calibration intervals effective based on reference test EOT dates.*"
2.11.3. The motion passed unanimously with no waives (16-0-0).

2.11.4. Closing Comments from Toyota:

2.11.4.1. The pass/fail proposals discussed during this meeting are not final.
2.11.4.2. They could change after the Tech Demo period.

Action Items	Person responsible	Completion Date

Follow-up Notes/Updates	Initials	Date Added

Attendees	Organization	Contact Information

Sequence IV Surveillance Panel

Conference Call
April 26, 2018
8:30 a.m. - 11:30 p.m.

AGENDA

1. Chairman comments
2. Discuss comments and resolve negatives on Sequence IVB LTMS eBallot
3. Sequence IVB open discussion
4. Motion and action item review
5. Next meeting
6. Adjourn

MEMBERSHIP
SEQUENCE IV SURVEILLANCE PANEL

April 26, 2018

NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
Bowden, Jason Y	OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 Phone No.: 440-354-7007 Fax No.: 440-354-7080 Email: jhbowden@ohtech.com	✓
Buscher III, William Y	Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238 Phone No.: 210-647-9489 or 210-240-8990 cell Fax No.: 210-684-6074 Email: william.buscher@intertek.com	✓
Buscher, Jr., William	Buscher Consulting Services P.O. Box 112 Hopewell Jct., NY 12533 Phone No.: 914-897-8069 Fax No.: 914-897-8069 Email: buschwa@aol.com	
Grundza, Rich Y	ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 Phone No.: 412-365-1031 Fax No.: 412-365-1047 Email: reg@astmtmc.cmu.edu	✓
Hopp, Meryn Y	GM Powertrain Mail Code 483-730-322 823 Joslyn Rd. Pontiac, MI 48340-2920 Phone No.: 228-318-7303 Fax No.: Email: Meryn.hopp@gm.com	✓
Hosseini, Mahboobeh ROBERT VOTING Y	Chevron Oronite Company LLC 100 Chevron Way, 71-7548 P.O. Box 1627 Richmond, CA 94802-0627 Phone No.: 510-242-3462 Fax No.: Email: Mahboob.Hosseini@chevron.com	
Hsu, Jeffery Y	Shell Global Solutions 3333 Highway 6 South Houston, TX 77082 Phone No.: 281-544-8619 Fax No.: 281-544-8150 Email: j.hsu@shell.com	✓
Kowalski, Teri Y	Toyota Motor North America, Inc. 1555 Woodridge Ann Arbor, MI 48105 Phone No.: 734- 995-4032 or 734-355-8082 cell Fax No.: 734- 995-9049 Email: teri.kowalski@tema.toyota.com	✓

MEMBERSHIP
SEQUENCE IV SURVEILLANCE PANEL

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NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
Lanctot, Dan Y	Test Engineering, Inc. 12718 Cimarron Path San Antonio, TX 78249 Phone No.: Fax No.: Email: DLanctot@tei-net.com	
Linden, Jim Y	Total 673 Campus Road Rochester Hills, MI 48309 Phone No.: 248-321-5343 Fax No.: Email: lindenjim@jlindenconsulting.com	
Mileti, Chris Y	Lubrizol Corporation 29400 Lakeland Blvd. Wickliffe, OH 44092 Phone No.: 440-347-2521 Fax No.: 440-347-4096 Email: christopher.mileti@Lubrizol.com	
Overaker, Mark PROXY VOTING Y	Haltermann Solutions 15635 Jacintoport Blvd. Houston, TX 77345 Phone No.: 832-376-2202 Fax No.: Email: mhoveraker@jhaltermann.com	
Pecinovsky, Katerina Y	Afton Chemical Corporation 500 Spring Street P.O. Box 2158 Richmond, VA 23217-2158 Phone No.: 804-788- Fax No.: 804-788- Email: Katerina.Pecinovsky@AftonChemical.com	
Proctor, Robert	Honda R&D Americas, Inc. Phone No.: 937-309-9321 Fax No.: Email: rproctor@oh.hra.com	
Rais, Khaled Y	Southwest Research Institute 6220 Culebra Road P.O. Drawer 28510 San Antonio, TX 78228-0510 Phone No.: 210-522-3842 Fax No.: 210-684-7523 Email: khaled.rais@swri.org	
Rieth, Ryan Y	Infineum USA L.P. 1900 E. Linden Avenue Linden, NJ 07036-0536 Phone No.: 908-474-7377 Fax No.: 908-474-3637 Email: Ryan.Rieth@Infineum.com	

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SEQUENCE IV SURVEILLANCE PANEL

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NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
Romano, Ron Y	Ford Motor Company 1800 Fairlane Drive Allen Park, MI 48101 Phone No.: 313-845-4068 Fax No.: 313-323-8042 Email: rromano@ford.com	✓
Sagawa, Takumaru	Nissan Motor Co., Ltd. 560-2, Okatsukoku, Atsugi city Kanagawa 243-0192 Phone No.: 046-270-1515 Fax No.: 046-270-1585 Email: t-sagawa@mail.nissan.co.jp	
Salvensen, Cliff Y	ExxonMobil Research & Engineering Co. 600 Billingsport Road P.O. Box 480 Paulsboro, NJ 08066-0480 Phone No.: 856-224-2954 Fax No.: Email: clifford.r.salvesen@exxonmobil.com	✓
Savant, Amol	Valvoline 22nd & Front Streets Ashland, KY 41114 Phone No. Fax No.: Email: ACSavant@valvoline.com	
Tang, Haiying	Chrysler Group LLC 800 Chrysler Drive Auburn Hills, MI Phone No.: Fax No.: Email: haiying.tang@fcagroup.com	
Tarry, Preston	BP 1500 Valley Road Wayne, NJ 07470 Phone No.: Fax No.: Email: Preston.Tarry@bp.com	
	Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	

NON-MEMBER MAILING LIST
SEQUENCE IV SURVEILLANCE PANEL

April 26, 2018

NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
Adams, Mark	Tribology Testing Labs Phone No.: 989-980-4418 Fax No.: Email: mark@tribologytesting.com	
Affinito, Ricardo	Chevron Oronite Company LLC Phone No.: Fax No.: Email: Ricardo.Affinito@chevron.com	
Altman, Ed	Afton Chemical Corporation 500 Spring Street P.O. Box 2158 Richmond, VA 23217-2158 Phone No.: 804-788-5279 Fax No.: 804-788-6358 Email: ed.altman@aftonchemical.com	
Bean, Nathan	Valvoline Phone No.: Fax No.: Email:	
Boese, Doyle	Infineum USA L.P. 1900 E. Linden Avenue Linden, NJ 07036-0536 Phone No.: 908-474-3176 Fax No.: 908-474-3637 Email: doyle.boese@infineum.com	
Bowden, Dwight	OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 Phone No.: 440-354-7007 Fax No.: 440-354-7080 Email: dhbowden@ohtech.com	
Bowden, Matt	OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 Phone No.: 440-354-7007 Fax No.: 440-354-7080 Email: mbowden@ohtech.com	✓
Brys, Jerome	Lubrizol Corporation 29400 Lakeland Blvd. Wickliffe, OH 44092 Phone No.: 440-347-2631 / 440-943-1200 Fax No.: 440-943-9013 Email: jabs@lubrizol.com	

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NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
Campbell, Bob	Afton Chemical Corporation 500 Spring Street P.O. Box 2158 Richmond, VA 23217-2158 Phone No.: 804-788- Fax No.: 804-788-6358 Email: bob.campbell@aftonchemical.com	✓
Castanien, Chris	Neste Phone No.: Fax No.: Email: Chris.Castanien@nesteoil.com	
Clark, Sid	Southwest Research Institute 50481 Peggy Lane Chesterfield, MI 48047 Phone No.: 586-873-1255 Email: sidney.clark@swri.org	
Clark, Jeff	ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 Phone No.: 412-365-1032 Fax No.: 412-365-1047 Email: jac@astmtmc.cmu.edu	
Coker, Carlton	Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238-1993 Phone No.: 210-647-9473 or 210-643-1817 cell Fax No.: 210-523-4607 Email: carlton.coker@intertek.com	
Collins, Chet	Southwest Research Institute 6220 Culebra Road P.O. Drawer 28510 San Antonio, TX 78228-0510 Phone No.: 210-522- Fax No.: Email: chet.collins@swri.org	
Dvorak, Todd	Afton Chemical Corporation 500 Spring Street P.O. Box 2158 Richmond, VA 23217-2158 Phone No.: 804-788- Fax No.: 804-788-6358 Email: todd.dvorak@aftonchemical.com	
Farnsworth, Gordon	Infineum USA L.P. 1900 E. Linden Avenue Linden, NJ 07036-0536 Phone No.: 570-934-2776 Fax No.: 908-474-3637 Email: gordon.farnsworth@infineum.com	

NON-MEMBER MAILING LIST
SEQUENCE IV SURVEILLANCE PANEL

April 26, 2018

NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
Haumann, Karin	Shell Global Solutions Phone No.: 281-544-6986 Fax No.: Email: Karin.Haumann@shell.com	
Hirano, Satoshi	Toyota Phone No.: Fax No.: Email: satoshi_hirano_aa@mail.toyota.co.jp	
Knight, Clayton	Test Engineering, Inc. 12718 Cimarron Path San Antonio, TX 78249 Phone No.: 210-862-5987 cell Fax No.: 210-690-1959 Email: cknight@tei-net.com	
Kostan, Travis	Southwest Research Institute 6220 Culebra Road P.O. Drawer 28510 San Antonio, TX 78228-0510 Phone No.: 210-522-2407 Fax No.: 210-684-7523 Email: travis.kostan@swri.org	
Lang, Patrick	Southwest Research Institute 6220 Culebra Road P.O. Drawer 28510 San Antonio, TX 78228-0510 Phone No.: 210-522-2820 or 210-240-9461 cell Fax No.: 210-684-7523 Email: patrick.lang@swri.org	
Leverett, Charlie	Infineum Phone No.: 210-414-5445 Fax No.: Email: charlie.leverett@yahoo.com	
Lochte, Michael	Southwest Research Institute 6220 Culebra Road P.O. Drawer 28510 San Antonio, TX 78228-0510 Phone No.: 210-522-5430 Fax No.: 210-684-7523 Email: michael.lochte@swri.org	
Lopez, Al	ntertek Automotive Research 5404 Bandera Road San Antonio, TX 78238-1993 Phone No.: 210-647-9465 or 210-862-7935 cell Fax No.: 210-523-4607 Email: al.lopez@intertek.com	

NON-MEMBER MAILING LIST
SEQUENCE IV SURVEILLANCE PANEL

April 26, 2018

NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
Martinez, Jo	Chevron Oronite Company LLC 100 Chevron Way, 71-7548 P.O. Box 1627 Richmond, CA 94802-0627 Phone No.: 510-242-5563 Fax No.: 510-242-1930 Email: jomartinez@chevron.com	
Matasic, James	Lubrizol Corporation 29400 Lakeland Blvd. Wickliffe, OH 44092 Phone No.: 440-347-2487 Fax No.: Email: James.Matasic@Lubrizol.com	
McMillan, Mike	5019 Deer Creek Cir N Washington, MI 48094 Phone No.: 586-677-9198 Fax No.: Email: mmcmillan123@comcast.net	
Meier, Adam	ExxonMobil Phone No.: Fax No.: Email: adam.r.meier@exxonmobil.com	
O'Malley, Kevin	Lubrizol Corporation 29400 Lakeland Blvd. Wickliffe, OH 44092 Phone No.: 440-347-4141 Fax No.: Email: Kevin.OMalley@lubrizol.com	
Pastor, Jofran	Infineum Phone No.: Fax No.: Email: jofran.pastor@infineum.com	
Porter, Christian	Afton Chemical Corporation 500 Spring Street P.O. Box 2158 Richmond, VA 23217-2158 Phone No.: 804-788-5837 Fax No.: 804-788-6358 Email: christian.porter@aftonchemical.com	
Ritchie, Andrew	Infineum USA L.P. 1900 E. Linden Avenue Linden, NJ 07036-0536 Phone No.: 908-474-2097 Fax No.: 908-474-3637 Email: andrew.ritchie@infineum.com	

NON-MEMBER MAILING LIST
SEQUENCE IV SURVEILLANCE PANEL

April 26, 2018

NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
Smolenski, Don	Evonik Phone No.: Fax No.: Email:	
Stockwell, Robert	Chevron Oronite Company LLC Phone No.: Fax No.: Email: Robert.Stockwell@chevron.com	✓
Sutherland, Mark	Test Engineering, Inc. 12718 Cimarron Path San Antonio, TX 78249 Phone No.: 210-867-8357 Fax No.: 210-690-1959 Email: msutherland@tei-net.com	
Taylor, Chris	VP Racing Fuels Phone No.: 210-710-4627 Fax No.: Email: chris.taylor@vpracing-fuels.com	
Thompson, Hap	ASTM Facilitator Phone No.: 904-287-9596 Fax No.: Email: Hapjthom@aol.com	✓
Tumati, Prasad	Haltermann Phone No.: Fax No.: Email: ptumati@jhaltermann.com	✓
ANGELA WILLIS	GM Phone No.: Fax No.: Email:	
SCOTT LINDHOLM	SHELL Phone No.: Fax No.: Email:	

NON-MEMBER MAILING LIST
SEQUENCE IV SURVEILLANCE PANEL

April 26, 2018

NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
JOSH FREDERICK	VALVOLINE Phone No.: Fax No.: Email:	
DARRYL PURIFICATI	PETRO CANADA Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	

Mileti, Christopher

From: Rich Grundza <reg@astmtmc.cmu.edu>
Sent: Tuesday, April 3, 2018 12:15 PM
To: Bill Buscher Intertek; NON-LZ LOPEZ AL; NON-LZ LANG PATRICK; 'Clark, Sidney L.'; Satoshi Hirano; Teri Kowalski; Jim Linden; 't-sagawa@mail.nissan.co.jp'; 'stephen.fields@nissan-usa.com'; 'Romano, Ron (R.)'; Tang Haiying (FCA) (haiying.tang@fcagroup.com); Jeff Betz; 'Mark Sutherland'; 'Dan Lanctot'; 'dhbowden@ohtech.com'; 'Jason Bowden (jhbowden@OHTech.com)'; 'Matthew Bowden'; Frank Farber; Jeff Clark; 'Rieth, Ryan'; 'Ritchie, Andrew'; 'Farnsworth, Gordon'; 'Ed.Altman@aftonchemical.com'; 'Bob.Campbell@aftonchemical.com'; Brys, Jerome; Timothy L Caudill; 'Scott.Lindholm@shell.com'; 'Jeff Hsu'; 'Hapjthom@aol.com'; 'BuschWA@aol.com'; 'Mike McMillan'; 'Chris Castanien (Chris.Castanien@nesteoil.com)'; Amol Savant; OMalley, Kevin; 'ray.seiz@infineum.com'; NON-LZ CHADWICK MARTIN; todd.dvorak@aftonchemical.com; Martinez, Jo G. (jogm); 'Doyle Boese'; 'Affinito, Ricardo E'; NON-LZ LOCHTE MIKE; 'Stockwell, Robert T'; Mileti, Christopher; Meryn.hopp@gm.com; NON-LZ GLASER JOHN; Mourhatch, Ramoun; Kostan, Travis G.; Rais, Khaled; Karin.Haumann@shell.com; Mark Adams; Salvesen, Clifford R; Matasic, James; Hosseini, Seyedeh Mahboobeh; Tarry, Preston; Pecinovsky, Katerina; Charlie; Thom Smith; Calcut, Brent; Carlton Coker Intertek; Collins, Chet A.; arthur.t.andrews@exxonmobil.com; Overaker, Mark; ptumati@jhaltermann.com; Meier, Adam Robert; Bob Proctor (rproctor@oh.hra.com); angela.p.willis@gm.com; jrfrederick@valvoline.com; darryl.purificati@petrocanadalsp.com
Subject: RE: Sequence IV Surveillance Panel eBallot - Accept Sequence IVB LTMS TMC Vote

The TMC votes negative on the proposed LTMS for the following reason.
When adjusting for apparatus bias, one tenet is that the process is stable. The current severity adjustment proposed for FEWMEOT does not include a measure, such as Ei, to verify process stability.
Even though this is considered a secondary parameter, a precision check needs to be included to ensure that the severity adjustment is appropriate.

Best regards;

Richard E. Grundza
Senior Project Engineer
ASTM Test Monitoring Center
6555 Penn Avenue
Pittsburgh, PA 15206
412-365-1031
412-848-8840 (cell)

From: Bill Buscher Intertek [mailto:william.buscher@intertek.com]
Sent: Friday, March 30, 2018 12:27 PM
To: Alfonso Lopez Intertek; 'Lang, Patrick M.'; 'Clark, Sidney L.'; 'SATOSHI HIRANO'; Teri Kowalski (TEMA TTC); 'lindenjim@jlindenconsulting.com'; 't-sagawa@mail.nissan.co.jp'; 'stephen.fields@nissan-usa.com'; 'Romano, Ron (R.)'; Tang Haiying (FCA) (haiying.tang@fcagroup.com); Jeff Betz; 'Mark Sutherland'; 'Dan Lanctot'; 'dhbowden@ohtech.com'; 'Jason Bowden (jhbowden@OHTech.com)'; 'Matthew Bowden'; Frank Farber; Jeff Clark; Rich Grundza; 'Rieth, Ryan';

'Ritchie, Andrew'; 'Farnsworth, Gordon'; 'Ed.Altman@aftonchemical.com'; 'Bob.Campbell@aftonchemical.com'; 'Brys, Jerome'; tlcaudill@valvoline.com; 'Scott.Lindholm@shell.com'; 'Jeff Hsu'; 'Hapjthom@aol.com'; 'BuschWA@aol.com'; 'Mike McMillan'; 'Chris Castanien (Chris.Castanien@nesteoil.com)'; Amol Savant; 'Kevin.OMalley@lubrizol.com'; 'ray.seiz@infineum.com'; Martin Chadwick Intertek; 'Dvorak, Todd'; Martinez, Jo G. (jogm); 'Doyle Boese'; 'Affinito, Ricardo E'; 'Lochte, Michael D.'; 'Stockwell, Robert T'; 'Mileti, Christopher'; Meryn.hopp@gm.com; John Glaser Intertek; Mourhatch, Ramoun; Kostan, Travis G.; Rais, Khaled; Karin.Haumann@shell.com; Mark Adams; Salvesen, Clifford R; James Matasic; Hosseini, Seyedeh Mahboobeh; Tarry, Preston; Pecinovsky, Katerina; Charlie; Thom Smith (TRSmith@Valvoline.com); Calcut, Brent; Carlton Coker Intertek; Collins, Chet A.; arthur.t.andrews@exxonmobil.com; Overaker, Mark; ptumati@jhaltermann.com; Meier, Adam Robert; Bob Proctor (rproctor@oh.hra.com); angela.p.willis@gm.com; jrfrederick@valvoline.com; darryl.purificati@petrocanadalsp.com
Subject: Sequence IV Surveillance Panel eBallot - Accept Sequence IVB LTMS

Sequence IV Surveillance Panel,

A Sequence IV surveillance panel eBallot is attached for you to review and approve. This eBallot pertains to approving the Sequence IVB LTMS. A copy of the Sequence IV surveillance panel voting membership list is attached. If you will be voting as proxy for your company's voting member, please indicate so on your response. Details are included below.

Sequence IV Surveillance Panel eBallot - Accept Sequence IVB LTMS

The Sequence IV surveillance panel met on March 28, 2018 to review the proposed "**Sequence IVB LTMS**". After the review the surveillance panel requested the chair to issue an eBallot with a **finalized LTMS for acceptance for use for the Sequence IVB**.

The motion is:

Motion:	Sequence IV surveillance panel accepts the Sequence IVB LTMS, as documented in the previous slides of this presentation (IVB LTMS eBallot 20180329.pptx). Effective 4/18/18 (two weeks after the close of this eBallot) to be applied to all Precision Matrix 2 and later reference tests. The ASTM TMC will grant calibration status where applicable, based on the agreed on LTMS, with calibration intervals effective based on reference test EOT dates.
Motion by:	Bill Buscher, Intertek
Seconded by:	Teri Kowalski, Toyota

All Sequence IV surveillance panel voting members are asked to **Vote on the Sequence IV Surveillance Panel** motion "**Accept Sequence IVB LTMS**" by replying to this email. Please respond with a positive, negative or abstain/waive vote. Comments are optional.

A PDF file including the motion and supporting documentation, is attached to this email.

This eBallot will close on Wednesday April 4, 2018.

Any questions, please contact the Sequence IV surveillance panel chair.

Regards,

William A. Buscher III
Chairman, Sequence IV Surveillance Panel
Office: 210-647-9489
Cell: 210-240-8990
Email: william.buscher@intertek.com

Total Quality. Assured.

Mileti, Christopher

From: Salvesen, Clifford R <clifford.r.salvesen@exxonmobil.com>
Sent: Wednesday, April 4, 2018 9:05 AM
To: Bill Buscher Intertek
Cc: Meier, Adam R
Subject: IVB Ballot Vote - ExxonMobil

ExxonMobil votes negative on the proposed LTMS ballet, with comments:

AVLI is a fairly well understood parameter and we support an LTMS based on intake volume. EOT Iron measurement is a recently considered test parameter, and there are some items (engine wear/life, carryover from test-to-test, others) that are still not fully understood. Including it in the IVB LTMS is premature. If further technical investigation supports EOT Fe inclusion at a later date, it can be added to the LTMS at that time using existing administrative procedures. We do support adding the EOT Fe as a report-only item for data collection, with no target or limit on test validity.

Kind Regards,

Clifford Salvesen
Engineering Associate
Lubricants Technology

ExxonMobil Research and Engineering Company
600 Billingsport Rd.
Paulsboro, NJ 08066
Office: (856) 224-2954
Email: clifford.r.salvesen@exxonmobil.com

IVB FEWMEOT LTMS Suggestions

Martin Chadwick

04/19/2018

Background

- The initial proposed IVB LTMS has severity adjustments only with no acceptance limits for FEWMEOT. This motion passed with two negatives (13/2/3).
- LTMS Section 1.E. specifies a unanimous agreement or determination that the minority votes are non-persuasive when negatives are present.

E. Surveillance Panel Guidelines for Revisions to the LTMS

1. The final authority for specifying the test-specific requirements of the LTMS resides with the surveillance panels of Subcommittee D02.B0.
2. Surveillance panels shall strive for unanimous approval of any revision to the LTMS.
3. Except in the case of an urgent target update, surveillance panel chairmen shall allow at least two weeks for review and possible panel discussion prior to the effective date of an LTMS revision.
4. To ensure the value of the two-week review, it is expected that each surveillance panel member will be responsible for representing their organization's technical position.
5. In those instances when the panel vote on a proposed LTMS revision is not unanimous, all minority voters shall be given sufficient opportunity to present the technical basis for their votes.
6. The surveillance panel shall make every effort to resolve minority voter concerns in order for there to be a consensus on the proposed LTMS revision. In the event unanimity cannot be achieved, a minority vote can be ruled non-persuasive by majority vote.

Negative Votes

- The TMC votes negative
  - When adjusting for apparatus bias, one tenet is that the process is stable. The current severity adjustment proposed for FEWMEOT does not include a measure, such as Ei, to verify process stability.
  - Even though this is considered a secondary parameter, a precision check needs to be included to ensure that the severity adjustment is appropriate.
- ExxonMobil votes negative
  - AVLI is a fairly well understood parameter and we support an LTMS based on intake volume. EOT Iron measurement is a recently considered test parameter, and there are some items (engine wear/life, carryover from test-to-test, others) that are still not fully understood. Including it in the IVB LTMS is premature. If further technical investigation supports EOT Fe inclusion at a later date, it can be added to the LTMS at that time using existing administrative procedures. We do support adding the EOT Fe as a report-only item for data collection, with no target or limit on test validity.

Path Forward

- Two primary paths forward exist.
  - Rule the negatives non-persuasive and continue with the system as voted on.
  - Eliminate the severity adjustment for FEWMEOT and report only until more data is available.

- This presentation intends to focus on a compromise path between these two positions as the majority vote supports having severity adjustments and there are good reasons to ensure candidates are not adjusted by the SA that results if an unusual or "flyer" result is obtained. This is also a concern that has not been addressed with the recently adopted LTMS changes and deserves some discussion.

Exploring Compromise Options

- The original IVB LTMS discussion included a summary of FEWMEOT with the "default" LTMS limits applied. All 28 reference tests reviewed were in the acceptance bands. However concerns about the future behavior of the parameter and the significant correlation with AVLI indicate some LTMS changes could be implemented that reduce the risk of additional referencing due to false alarms while still protecting against inappropriate SA's.

1. ei and/or Zi limits can be expanded.
2. Level 1 and Level 2 ei Limits can be removed.

- Other, more complex, solutions are possible but these two changes take advantage of the revised LTMS calculations and changes like this were recommended during the original design process of the current calculations.

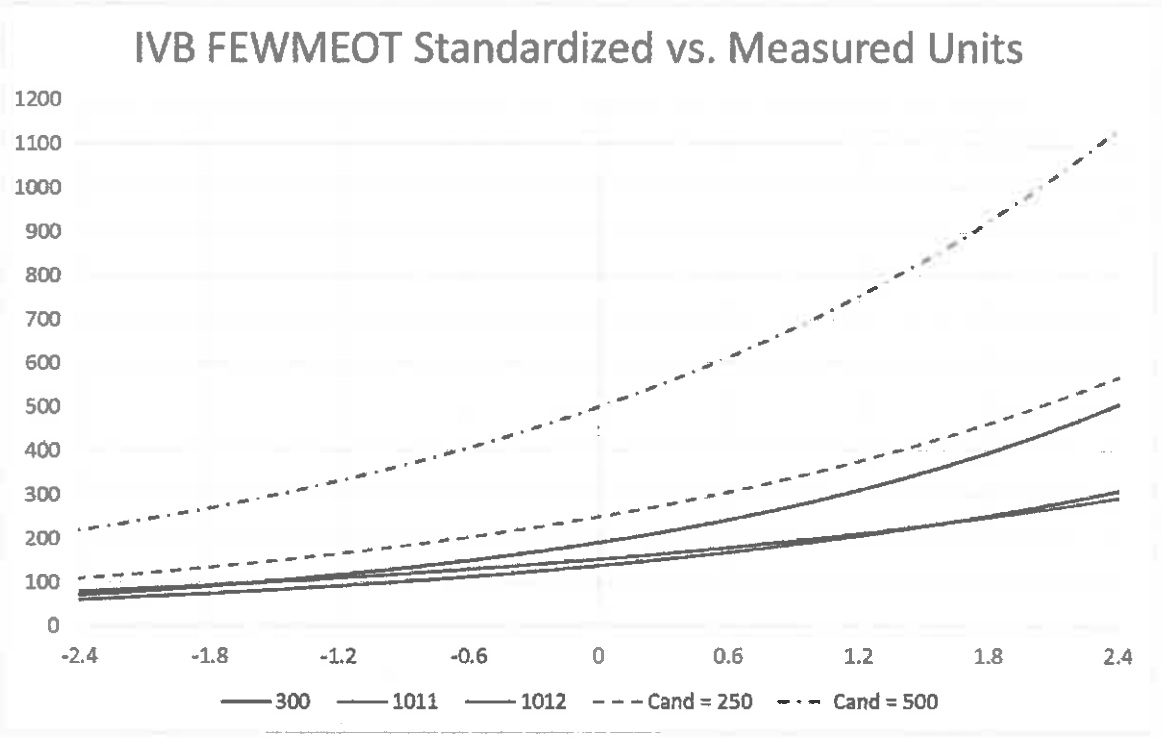
New ei Limits

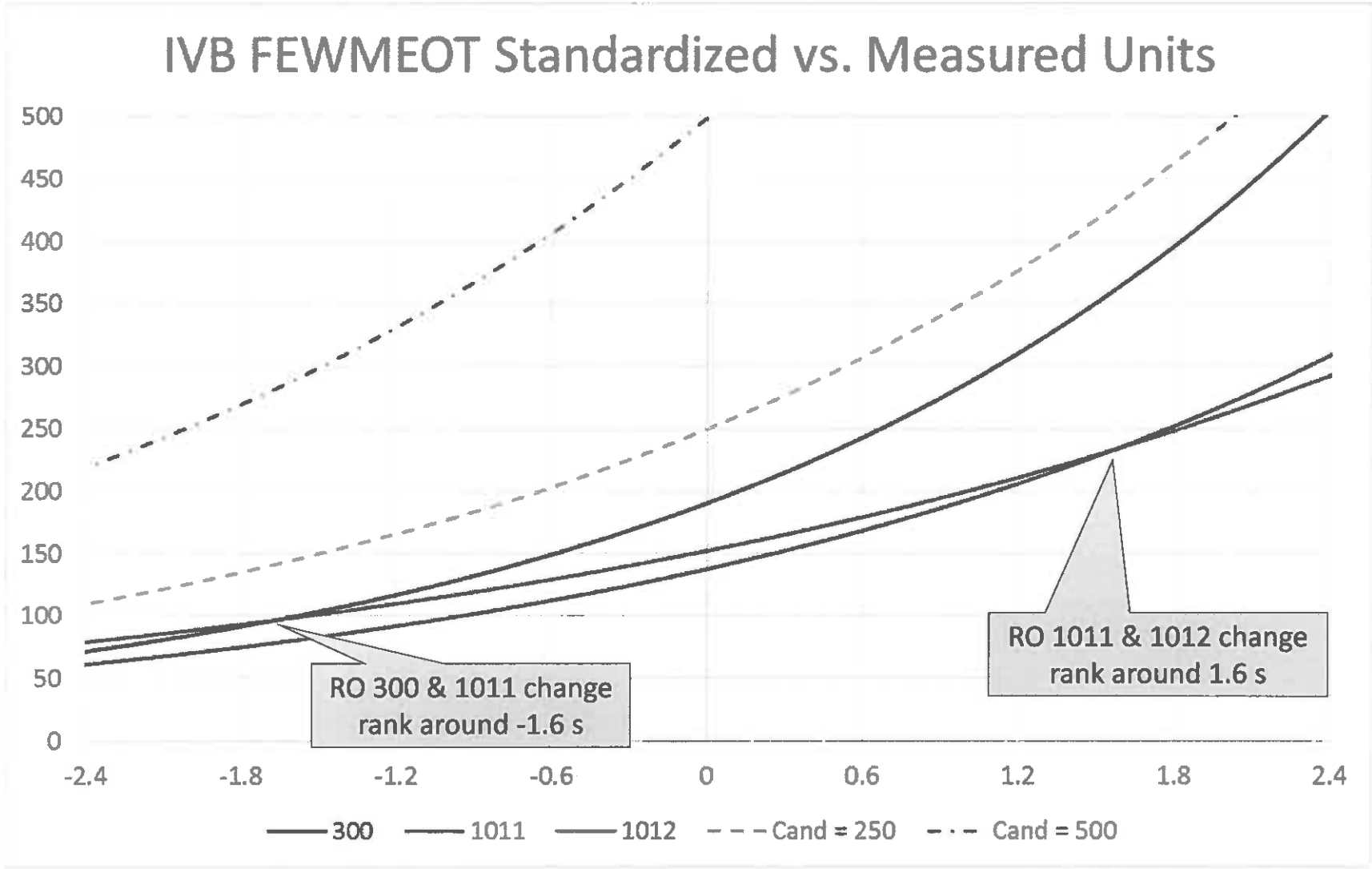
- The current "default" ei limits represent confidence interval approximations when comparing a result to an EWMA calculated with a lambda of 0.2. We can use that approach to create expanded limits for FEWMEOT.

Limit Description	Current "default" ei Limits	Selected Z		Limit for Lambda = 0.2	Suggested IVB FEWMEOT Limits	Limit for Lambda = 0.3
Two Sided 99%		z(0.995)	2.576	2.715	level 3	2.794
One Sided 99%		z(0.990)	2.326	2.452	level 2	2.523
Two Sided 95%	level 3	z(0.975)	1.960	2.066	level 1	2.126
One Sided 95%	level 2	z(0.950)	1.645	1.734		1.784
One Sided 90%	level 1	z(0.900)	1.282	1.351		1.390

Evaluate Zi Limits

- A review of the behavior of reference oils and severity adjustments at severity extremes indicates that Zi limits wider than +/-1.8 are not advisable. This also supports the need to implement both ei and Zi limits as the FEWMEOT behavior at severity extremes is not understood.

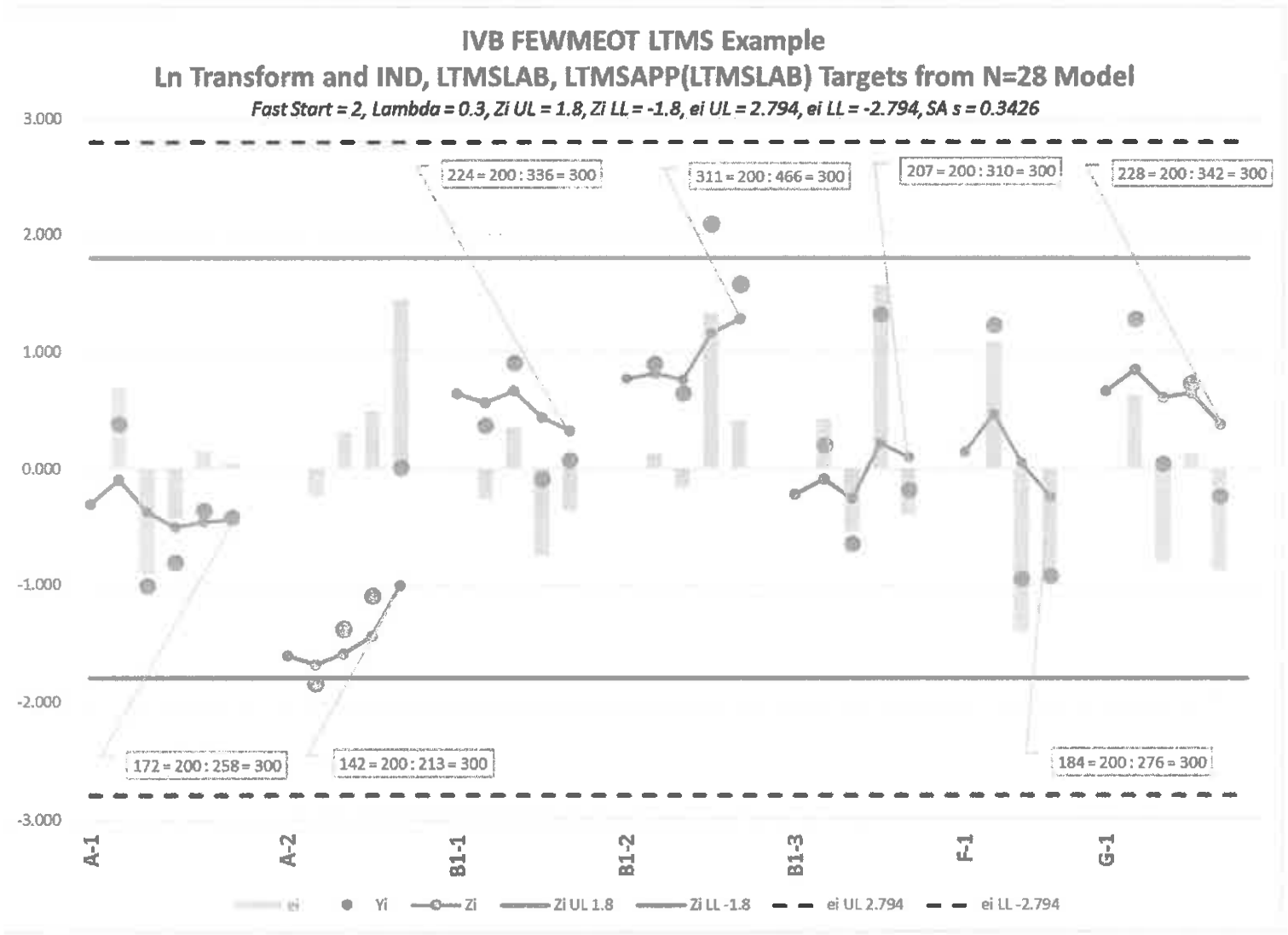


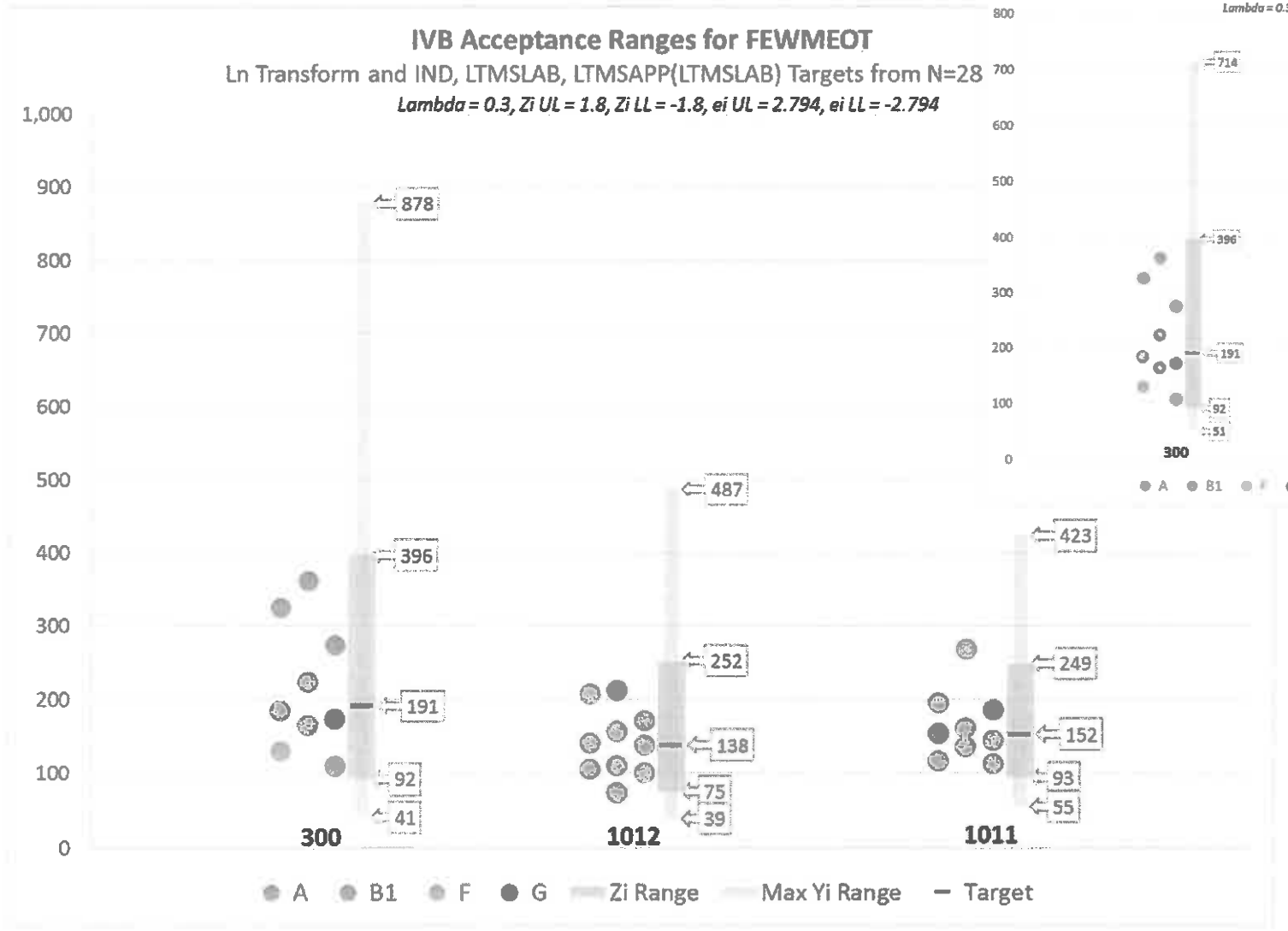

IVB FEWMEOT Standardized vs. Measured Units
500
450
400
350
300
250
200
150
100
50
0
-2.4
-1.8
-1.2
-0.6
0
0.6
1.2
1.8
2.4
RO 300 & 1011 change rank around -1.6 s
RO 1011 & 1012 change rank around 1.6 s
300
1011
1012
Cand = 250
Cand = 500

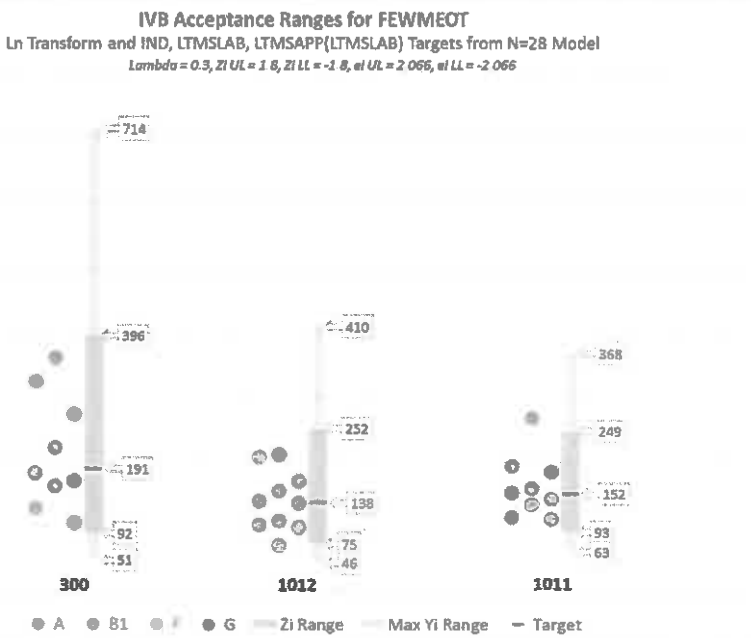
Recommendation

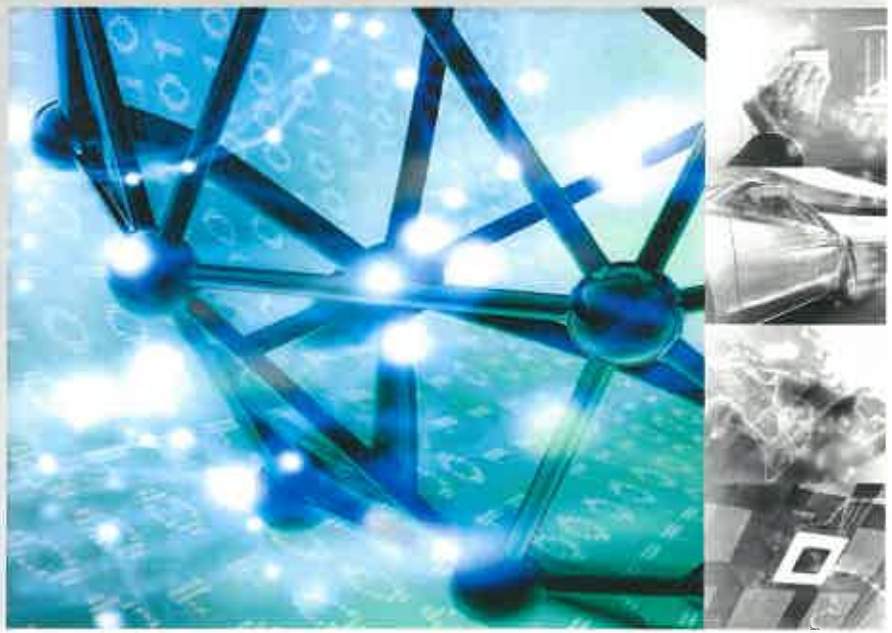
- Adopt ei and Zi limits for FEWMEOT reference acceptance with the Excessive Influence calculation using the limits below.
  - ei Level 3 = +/-2.794
  - ei Level 2 = +/-2.523 (optional)
  - ei Level 1 = +/-2.126 (optional)
  - Zi Level 1 = 0.000, continuous SA's
  - Zi Level 2 = +/-1.800

This recommendation was briefly discussed in the Stats Group but no consensus position was developed. The Stats Group will need some additional direction from the SP if a consensus position is desired.


IVB FEWMEOT LTMS Example
Ln Transform and IND, LTMSLAB, LTMSAPP(LTMSLAB) Targets from N=28 Model
Fast Start = 2, Lambda = 0.3, Zi UL = 1.8, Zi LL = -1.8, ei UL = 2.794, ei LL = -2.794, SA s = 0.3426
3.000
2.000
1.000
0.000
-1.000
-2.000
-3.000
224 = 200 : 336 = 300
311 = 200 : 466 = 300
207 = 200 : 310 = 300
228 = 200 : 342 = 300
172 = 200 : 258 = 300
142 = 200 : 213 = 300
184 = 200 : 276 = 300
A-1
A-2
B1-1
B1-2
B1-3
F-1
G-1
ei
Yi
Zi
Zi UL 1.8
Zi LL -1.8
ei UL 2.794
ei LL -2.794


IVB Acceptance Ranges for FEWMEOT
Ln Transform and IND, LTMSLAB, LTMSAPP(LTMSLAB) Targets from N=28
Lambda = 0.3, Zi UL = 1.8, Zi LL = -1.8, ei UL = 2.794, ei LL = -2.794
1,000
900
800
700
600
500
400
300
200
100
0
878
396
191
92
41
487
252
138
75
39
423
249
152
93
55
300
1012
1011
A
B1
F
G
Zi Range
Max Yi Range
Target


IVB Acceptance Ranges for FEWMEOT
Ln Transform and IND, LTMSLAB, LTMSAPP(LTMSLAB) Targets from N=28 Model
Lambda = 0.3, Zi UL = 1.8, Zi LL = -1.8, ei UL = 2.066, ei LL = -2.066
800
700
600
500
400
300
200
100
0
714
396
191
92
51
410
252
138
75
46
368
249
152
93
63
300
1012
1011
A
B1
F
G
Zi Range
Max Yi Range
Target



Follow-Up to Lubrizol's Comments

Sequence IVB LTMS Vote

CHTM, 04-24-2018

Lubrizol

Background on Ballot

SUCCESS TOGETHER

- The following Sequence IV Surveillance Panel e-ballot was issued on 03-30-2018 regarding the proposed LTMS system for the Sequence IVB test:

Motion:	Sequence IV surveillance panel accepts the Sequence IVB LTMS, as documented in the previous slides of this presentation (IVB LTMS eBallot 20180329.pptx). Effective 4/18/18 (two weeks after the close of this eBallot) to be applied to all Precision Matrix 2 and later reference tests. The ASTM TMC will grant calibration status where applicable, based on the agreed on LTMS, with calibration intervals effective based on reference test EOT dates.
Motion by:	Bill Buscher, Intertek
Seconded by:	Teri Kowalski, Toyota

- This e-ballot was closed on 04-04-2018.

Lubrizol

Lubrizol's Vote and Comments

SUCCESS TOGETHER

- Lubrizol waived on this vote because we were unable to adequately access the **iron** pass/fail parameter.

- The following comments were provided with Lubrizol's vote:
  - **Comment #1:** There is no procedure to inspect an engine for damage that can impact iron generation during future tests.
  - **Comment #2:** The current break-in/aging cycle does not stabilize iron as well as it pacifies silicone.
  - **Comment #3:** An engine hour correction factor is needed that can accommodate cylinder head changes.

Lubrizol

Lubrizol

Comment #1 – Engine Damage

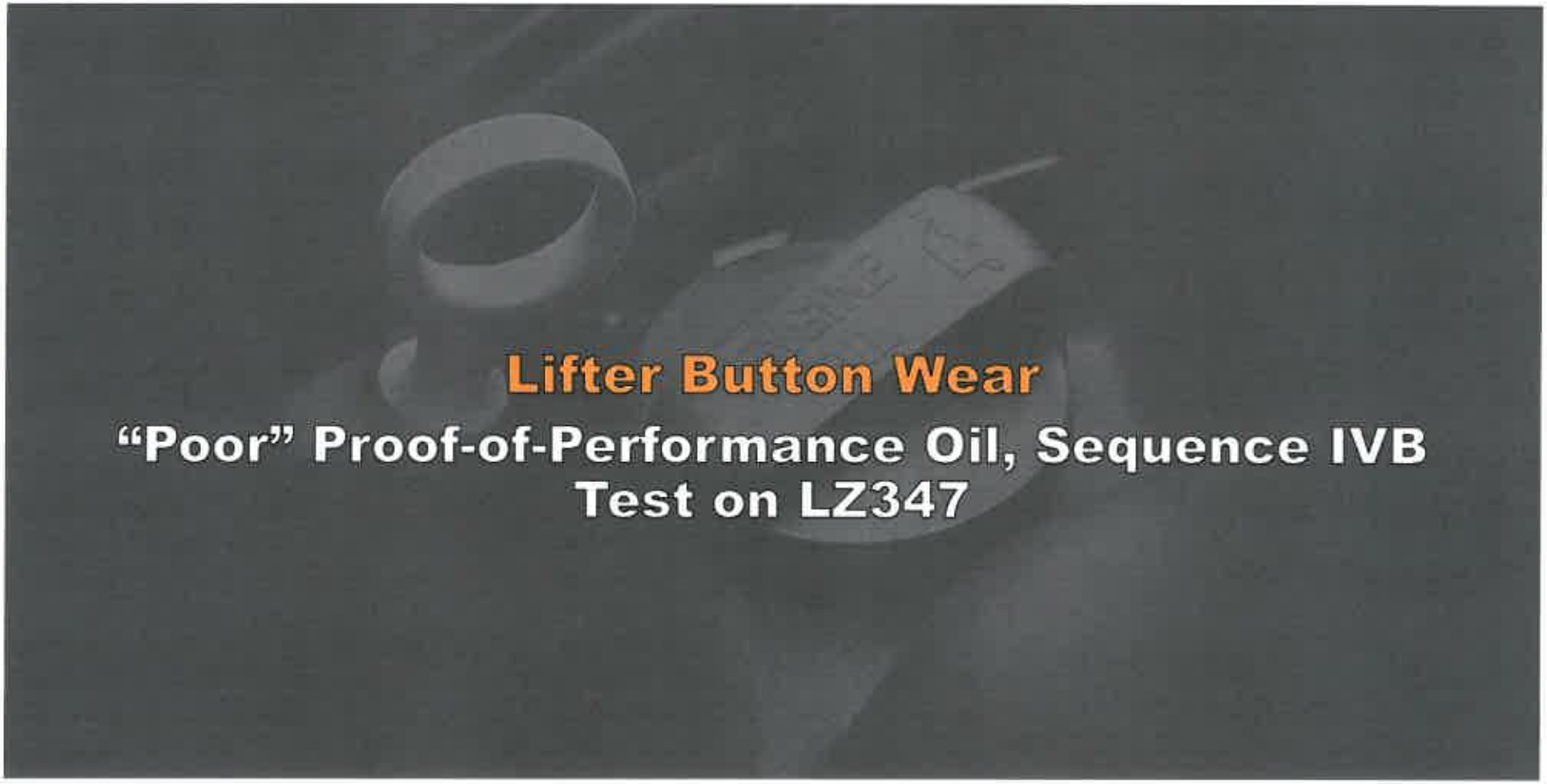
SUCCESS TOGETHER

- The following areas of the engine can develop secondary wear that will impact iron generation during future tests:
  - Valve stems
  - Timing chain
  - Piston rings and cylinder wall interface

- This secondary wear is best identified by thoroughly inspecting the engine.
  - Intake lifter volume loss is not a reliable indicator of this secondary wear.

- This secondary wear can occur with oils that generate "mild" intake lifter volume loss results (as is shown with the button wear examples on the upcoming slides).

Lubrizol



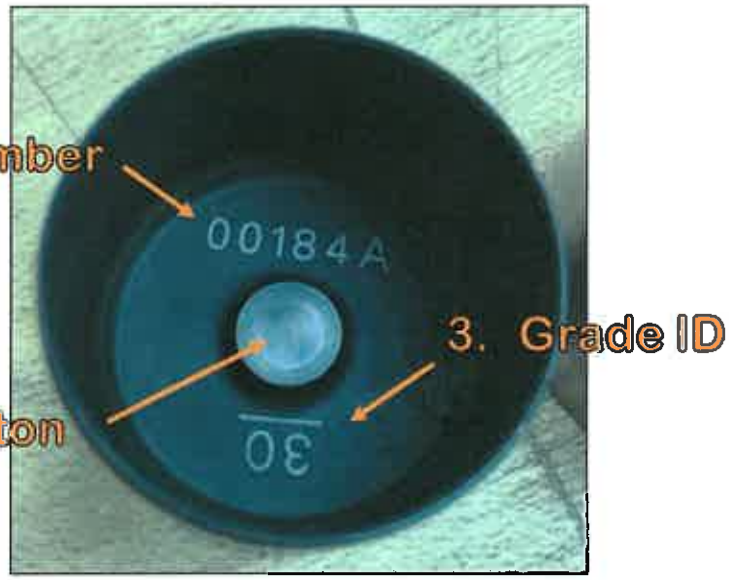
Lifter Button Wear

"Poor" Proof-of-Performance Oil, Sequence IVB Test on LZ347

Lifter Buttons – Background

SUCCESS TOGETHER

- The lifter-to-lobe clearance on the 2NR-FE engine is not adjusted – it is shimmed.
- Each lifter has a small button located in the center of its underside.
- Different lifter grades are available (each grade has a different button height).
- Lifter grades are selected to achieve the appropriate lifter-to-lobe clearance.



Lubrizol

Lifter Buttons – Wear

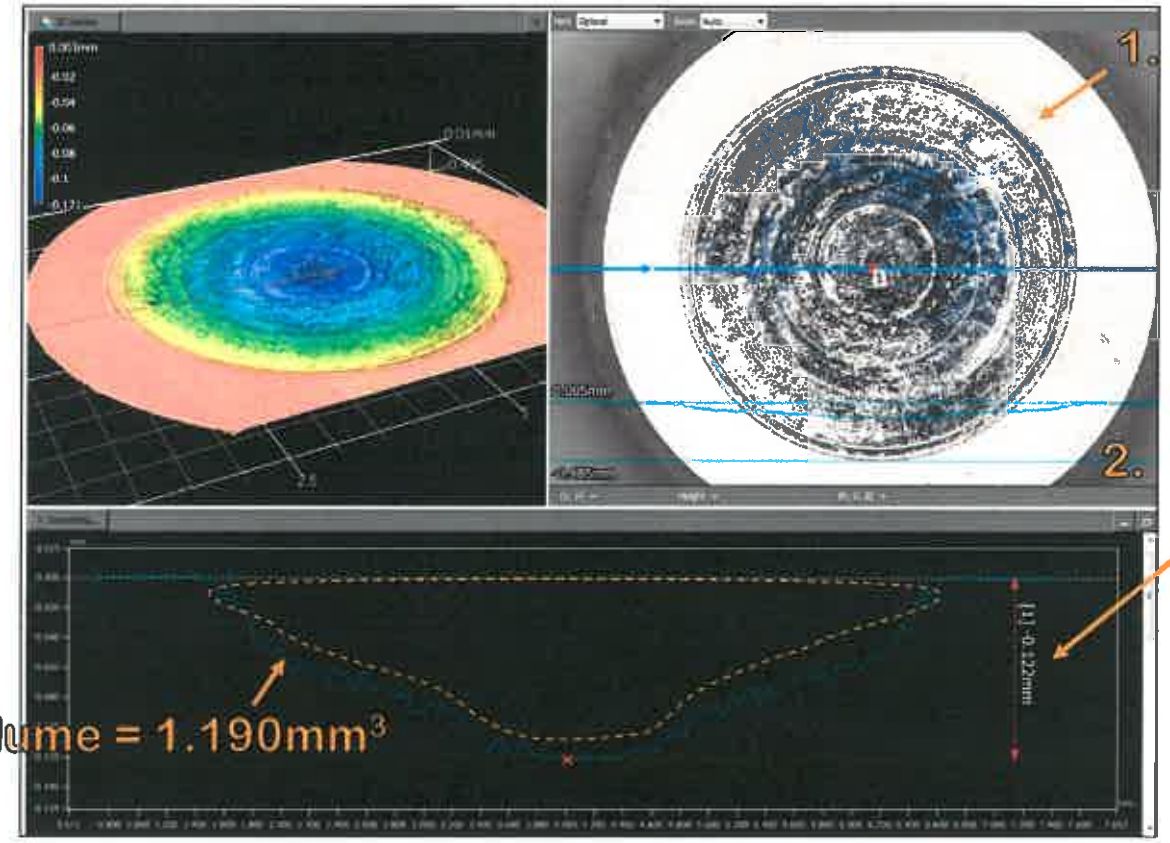
SUCCESS TOGETHER

- The buttons exhibit wear, but this wear does not always correlate to lifter face wear.
- Lubrizol measured the button wear on the E.O.T. lifters from the "poor" proof-of-performance oil using the Keyence.
  - An assumption is made that the S.O.T. button has a flat profile (and is not crowned like the S.O.T. lifter face).

Lubrizol

Lifter Buttons – Wear *(continued)*

SUCCESS TOGETHER



Highest Wear Button From Test

Wear Depth = 0.122mm

3. Wear Volume = 1.190mm^3

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Lifter Buttons – Wear *(continued)*

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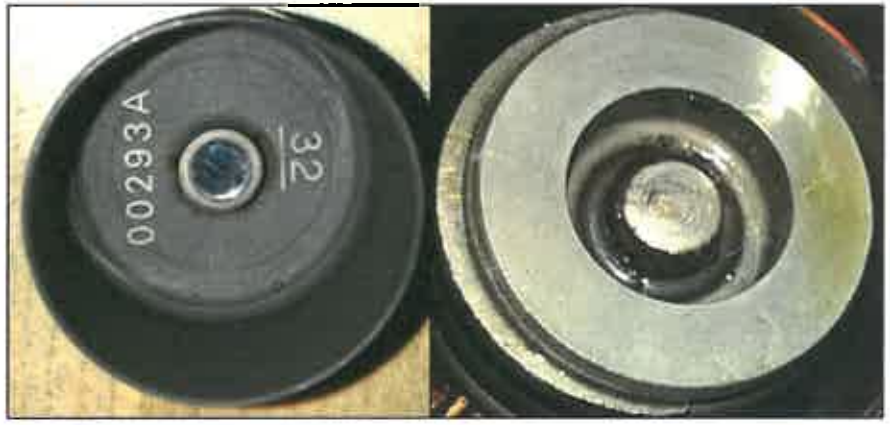
- For this test kit, lifter positions that had the most valve stem deformation also seemed to exhibit the most button wear.

Lifter and Associated Valve Tip

Minimal Button Wear

No Valve Tip Deformation

Lifter and Associated Valve Tip



Heavy Button Wear

Heavy Valve Tip Deformation

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Comment #2 – Break-In/Aging

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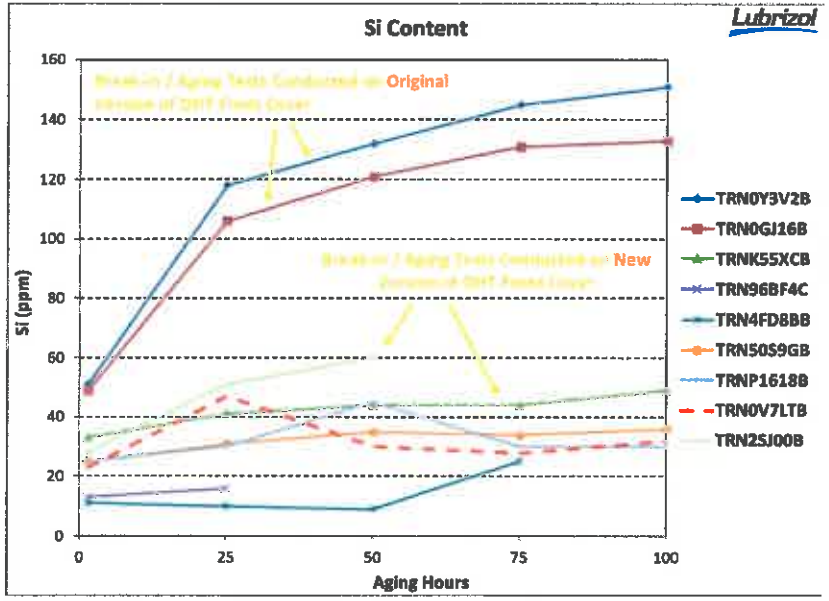
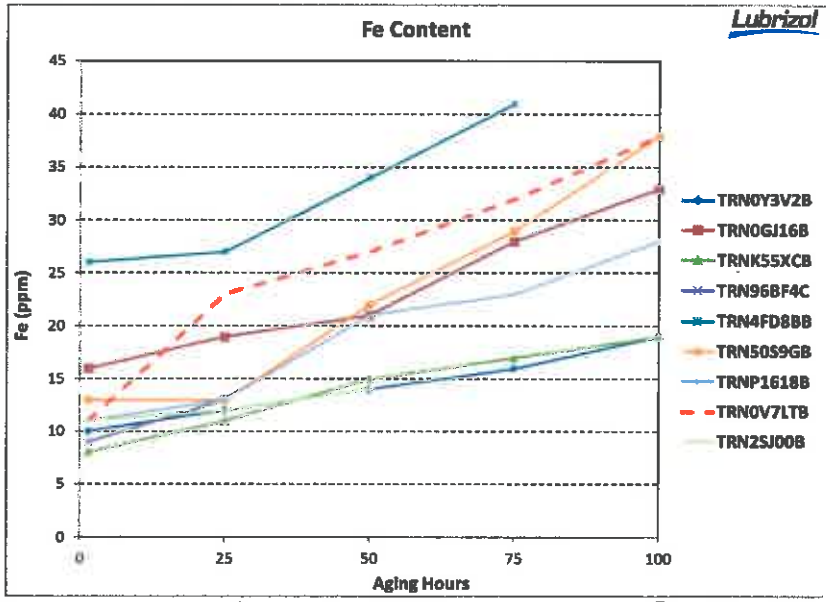
- Silicone stabilizes during break-in/aging but iron does not.
  - So the break-in process (in terms of iron) is not complete by the time the 1st test starts.



Si During LZ Break-In/Aging



Fe During LZ Break-In/Aging

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Comment #3 – Engine Hour Correction

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- During a recent statistical analysis, it was noted that there may be an engine hours effect.
- In order to explore this possibility further, the statisticians need data for engines that have completed up to (12) runs.
- The statisticians will also need data that shows the impact of cylinder head changes on iron generation.

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Additional Comment – Stand Calibration

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- Under the proposed LTMS system, it may be possible for a stand to obtain an iron result in excess of 800ppm and still be calibrated for candidate testing.
  - A severity adjustment is available to partially compensate for this.
- However, from a practical standpoint, iron levels around 800ppm are a strong indication that the engine has experienced excessive wear.
- Should an engine such as this be allowed to continue candidate testing?
  - The proposed LTMS system has no mechanism to deal with this issue.

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Revision Log

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Revision	Initials	Date	Description
0	CHTM	04-24-2018	Initial presentation released.

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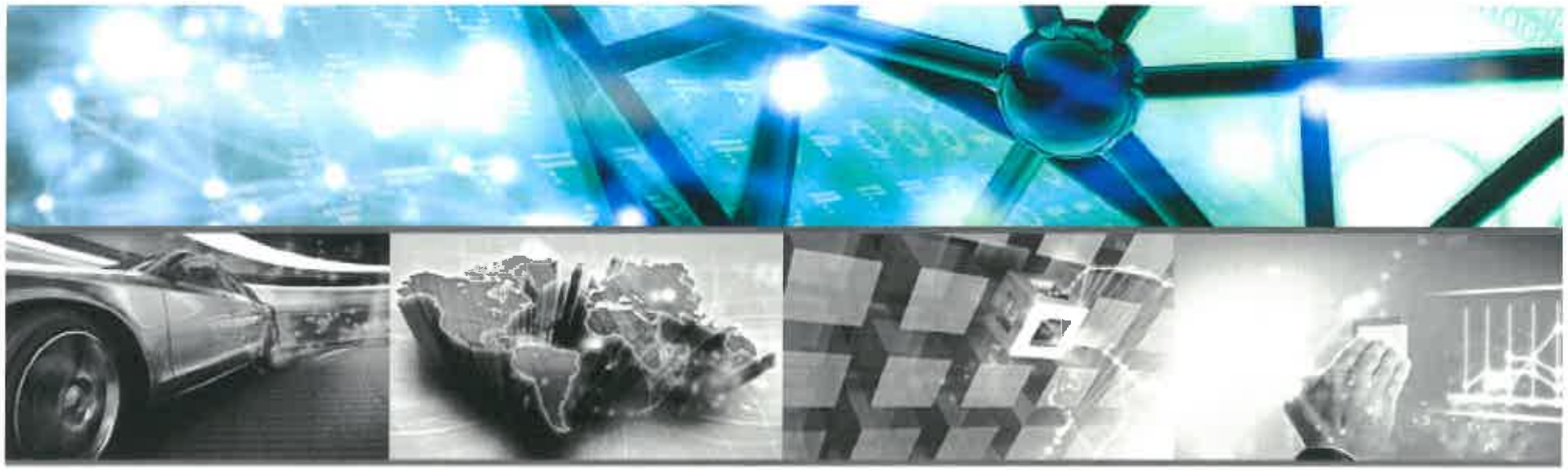

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