Sequence IV Surveillance Panel | MINUTES

REVISION DATE: 10/16/2017 8:23:00 AM

Relevant Test:	Sequence IVB
Note Taker:	Chris Mileti
Meeting Date:	10-03-2017
Comments:	This face-to-face meeting was hosted by Intertek. The purpose of this meeting was to review the status of the 2nd prove-out matrix prior to the start of the 2nd Precision Matrix.

1. ACTION ITEM REVIEW:

1.1. Background:

1.1.1. Bill Buscher (Intertek) provided an agenda to the Surveillance Panel by email (10-02-2017 at 6:12PM EST) prior to the start of this meeting.

1.2. Approve Previous Meeting Minutes:

1.2.1. The minutes from the following meetings were unanimously approved:
- 1.2.1.1. June 6-8, 2017
- 1.2.1.2. July 12, 2017
- 1.2.1.3. July 19, 2017
- 1.2.1.4. July 26, 2017
- 1.2.1.5. August 8, 2017
- 1.2.1.6. September 21, 2017

1.2.2. The TMC noted that the meeting date listed on the document for the August 8th meeting may not be correct.
- 1.2.2.1. Chris Mileti will follow-up on this.

1.2.3. Supporting documents (i.e. presentations, attendance list, etc.) still need to be added to the minutes for some of the more recent meetings.
- 1.2.3.1. Chris Mileti and Bill Buscher will follow-up on this.

1.3. Revise Sequence IVB Data Dictionary:

1.3.1. This work is in progress.

1.3.2. The revised form will not include PDI area loss or lifter mass loss measurements.

1.3.3. The revised form will also reflect changes to the coolant temperature control strategy.
- 1.3.3.1. The coolant temperature is now controlled at the outlet of the engine instead of the inlet.

1.4. Statistical Analysis of PDI vs. Keyence Metrology Measurements:

1.4.1. The statisticians will analyze the PDI (area loss) and Keyence (volume loss) measurements collected during the 1st Precision Matrix.
- 1.4.1.1. The 1st Precision Matrix included (13) completed tests.

1.4.2. There was some discussion regarding whether a statistical analysis is necessary.
- 1.4.2.1. Lubrizol, Southwest and Intertek all agreed that they have seen an extremely strong correlation between the two sets of measurements.

1.4.2.2. Exxon recommended that the statistical analysis should still be performed so that the Surveillance Panel does its due diligence.

1.4.3. Exxon will need an OHT fixture and an upgrade to their comparator software before they can collect PDI measurements.

1.4.4. The Surveillance Panel agreed that a formal statistical review of the data is necessary.

1.4.4.1. Intertek will supply the statisticians with the necessary data.

1.4.4.2. The goal of this analysis will be for the statisticians to provide a recommendation as to whether the PDI measurements can be eliminated.

1.5. 10% Volume Acceptance When Inventorying a New Fuel Batch:

1.5.1. The Surveillance Panel has not yet decided on this issue.

1.5.2. Fortunately, there is still time before a decision must be made.

1.5.2.1. Haltermann's current inventory of KA24E fuel is expected to last for at least one more year.

1.6. OHT Action Items:

1.6.1. OHT is still working on the following action items:

1.6.1.1. Design and supply a clutch alignment tool.

1.6.1.2. Design and supply a wedge or other tool to secure the timing chain during camshaft/lifter changes.

1.6.1.3. Add "in" and "out" stamping to the current OHT coolant adaptor plates.

1.7. Procedure and Build Manual Review:

1.7.1. Intertek is working on an annex document that details the set-up of the external blowby system.

1.7.2. The procedure still needs instructions for dealing with a camshaft lobe failure.

1.7.3. Southwest confirmed that the latest version of the procedure is posted to the TMC website.

1.8. Set Quality Index Limits for the Coolant Temperature at Engine Outlet:

1.8.1. The statisticians will need to be provided with a data set to analyze.

1.8.2. The upper and lower limits will need to be established before the 1st row of the Precision Matrix is completed.

1.8.2.1. Ideally, these limits will be established before the next Surveillance Panel conference call.

1.8.3. SWRI agreed to lead the statistical analysis.

1.9. Investigate New Oil Sample Valve to Reduce Oil Foaming:

1.9.1. Lubrizol has replaced the stock sample valve on its Golden Stand with a commercially available valve from Swagelok.

1.9.2. Lubrizol will be collecting qualitative observations during its upcoming prove-out tests.

1.9.3. Lubrizol's technicians believe the new valve reduces foaming in the oil sample.

1.10. Oil Schedule and Run Order for Supplemental/Donated Test Results:

1.10.1. Exxon and Lubrizol have agreed to donate supplemental data for the prove-out and Precision Matrices.

1.10.1.1. Afton cannot commit to providing supplemental data until they finish a shakedown of their test stand.

1.11. OHT Oil Pans with Modified Pick-Up Tube:

1.11.1. The new OHT oil pans have a modified pick-up tube but do not utilize a displacement block.
1.11.2. OHT has supplied at least one of these new oil pans to each of the (5) laboratories.
1.11.3. OHT requested that all laboratories return their existing oil pans to them within the next two weeks.
1.11.3.1. These oil pans will be modified with the latest pick-up tube design.

1.12. Thermal Barrier Ceramic Coating for Oil Pans and Front Covers:

1.12.1. OHT has not yet focused on this action item.
1.12.2. Their primary focus over the last few weeks was to ensure that adequate hardware was available to run the upcoming prove-out and Precision Matrices.

1.13. New Action Items:

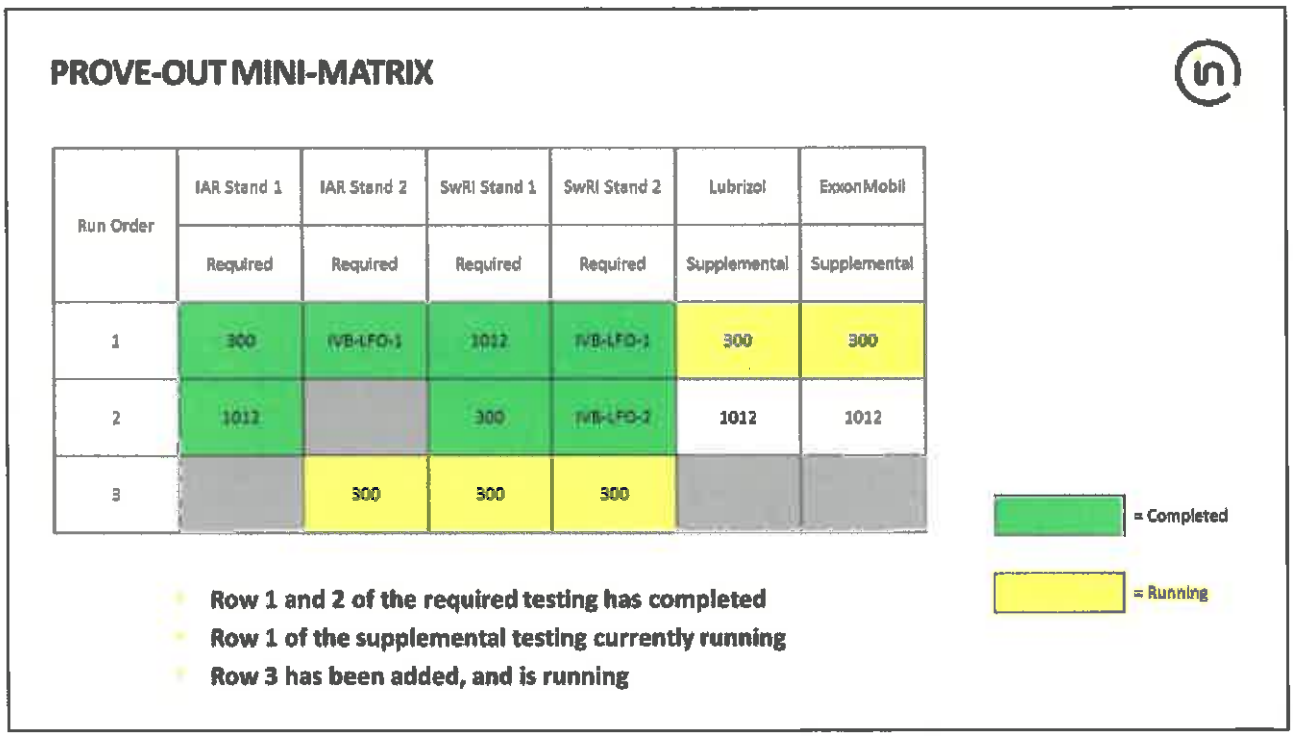
1.13.1. Intertek and Southwest will swap end-of-test oil drains so that they can compare oil analysis results.
1.13.2. Lab audits will be scheduled and conducted.
1.13.2.1. Most of this work has already been completed.

2. INTERTEK PRESENTATION:

2.1. Background:

2.1.1. ***File name:*** *"IVB Update to Surveillance Panel 20171003.pptx"*

2.2. Slide #2:



2.2.1. Row #1 and #2 have been completed at Intertek and Southwest.
2.2.2. Lubrizol and Exxon are currently running the first row of supplemental tests.
2.2.3. The prove-out matrix contains two high-event camshaft lobe failure oils (IVB-LFO-1 and IVB-LFO-2) in addition to the standard reference oils.

2.2.4. There have been no camshaft lobe failures since the test was redeveloped over the summer.

2.3. Slide #3:

PROVE-OUT MINI-MATRIX

Test Number	Lab	Test Purpose	Test Oil	Date Completed	Test Fuel Batch	Test Fuel Sulfur Content	Test Oil Charge	Intake Camshaft Batch	Intake Camshaft Chamfered	Oil Pan Pick-up Tube Modified	25-hR Interval Oil Sample Size	5-HR Interval Oil Samples	Oil Separator and Plumbing Insulation	Engine Coolant Flow Direction	Engine Coolant Temperature Control Point	Fe at EOT ppm	Intake Camshaft Lobe Failure	Intake Lifter Average Volume Loss mm³
355-D-24	IAR	Prove-out test for lower sulfur content fuel and larger initial oil charge.	ASTM REO 300	8/24/2017	EJ1721GP01	124 ppm	2600 g (≈ 3000 ml)	C	N	N	65 ml	Y	N	IN = Pipe OUT = Head	OUT, 52°C	180	None	1.65 *
352-D-60	IAR	Prove-out test for all post-precision matrix changes.	ASTM REO 300	9/8/2017	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	167	None	1.79 **
18-D-36	SwRI	Prove-out test for all post-precision matrix changes.	ASTM REO 300	9/22/2017	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	193	None	1.15 **
352-D-58	IAR	Prove-out test for lower sulfur content fuel and larger initial oil charge.	ASTM REO 1012	9/26/2017	EJ1721GP01	124 ppm	2600 g (≈ 3000 ml)	C	N	N	60 ml	Y	N	IN = Pipe OUT = Head	OUT, 52°C	153	None	1.19 *
18-D-35	SwRI	Prove-out test for all post-precision matrix changes.	ASTM REO 1012	9/15/2017	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	70	None	1.01 **
352-D-61	IAR	Prove-out test for all post-precision matrix changes.	ASTM REO 1012	9/22/2017	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	153	None	1.32 **
350-D-62	IAR	Prove-out test for lower sulfur content fuel and larger initial oil charge.	IVB-LFO-1	9/23/2017	EJ1721GP01	124 ppm	2600 g (≈ 3000 ml)	C	N	N	60 ml	Y	N	IN = Pipe OUT = Head	OUT, 52°C	340	None	N/A
355-D-35	IAR	Prove-out test for all post-precision matrix changes.	IVB-LFO-1	9/8/2017	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	234	None	N/A
20-D-52	SwRI	Prove-out test for all post-precision matrix changes.	IVB-LFO-1		FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	116	None	N/A
20-D-53	SwRI	Prove-out test for all post-precision matrix changes.	IVB-LFO-2		FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	130	None	N/A

*** Volume loss measurements performed using the old Keyence software, the old settings and Talc Powder.**

**** Volume loss measurements performed using the new Keyence software, the new settings and Talc Powder.**

2.3.1. REO300 is the "poor" reference oil.

2.3.2. Intertek has completed two tests with REO300.

2.3.2.1. The first test was completed without some of the latest test changes (such as the modified oil pan pick-up tube, G-2 Keyence software, blowby insulation and elimination of 5HR oil samples) and had an intake lifter volume loss of 1.65mm³.

2.3.2.2. The second test was completed with the latest test conditions and had an intake lifter volume loss of 1.79mm³.

2.3.3. Southwest completed one test with REO300 and the intake lifter volume loss was 1.15mm³.

2.3.4. The San Antonio labs have completed a total of three tests with REO1012:

2.3.4.1. Intertek, average intake lifter volume loss = 1.19mm³

2.3.4.2. Intertek, average intake lifter volume loss = 1.32mm³

2.3.4.3. Southwest, average intake lifter volume loss = 1.01mm³

2.3.5. There are growing concerns about whether there is enough discrimination between the two oils.

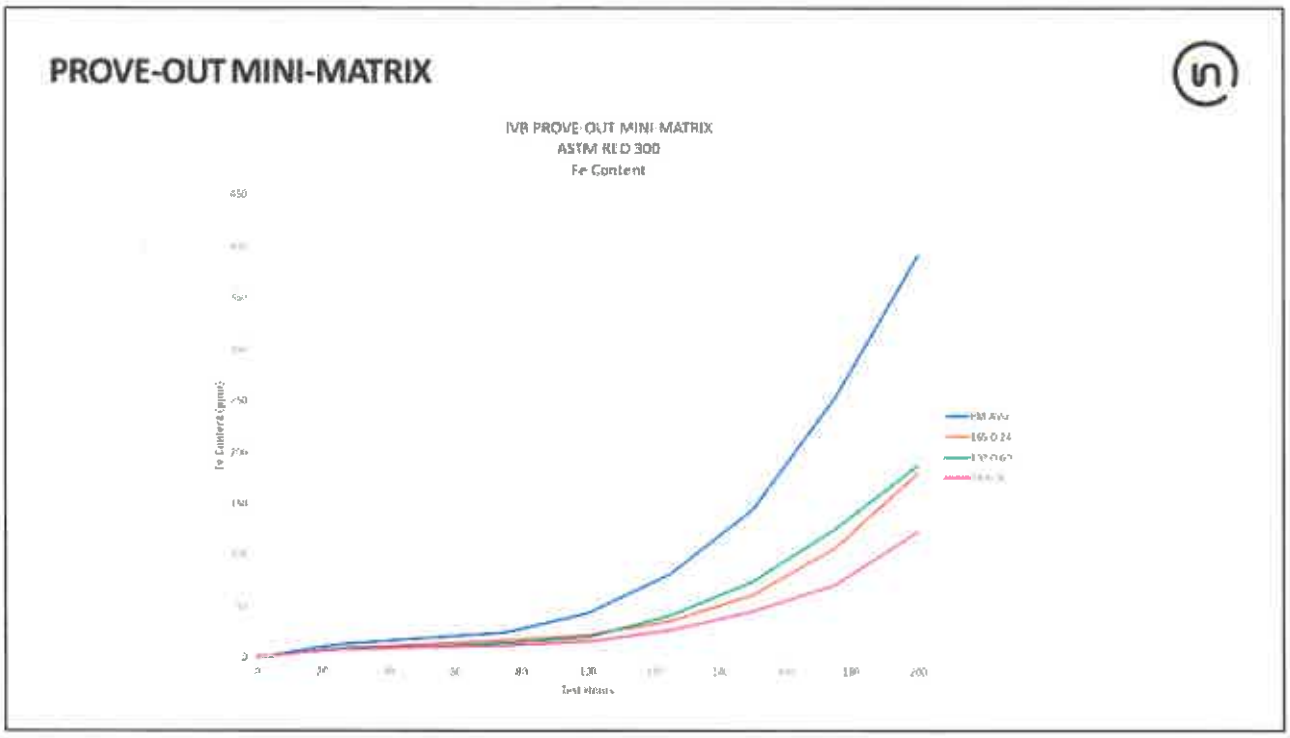
2.3.6. Additional test results with REO300:

2.3.6.1. Intertek is running one more REO300 test.

2.3.6.2. Southwest is running two more tests with REO300.

2.3.6.3. Lubrizol and Exxon are both running tests with REO300 (although they are both several days behind the San Antonio labs).

2.4. Slide #4:

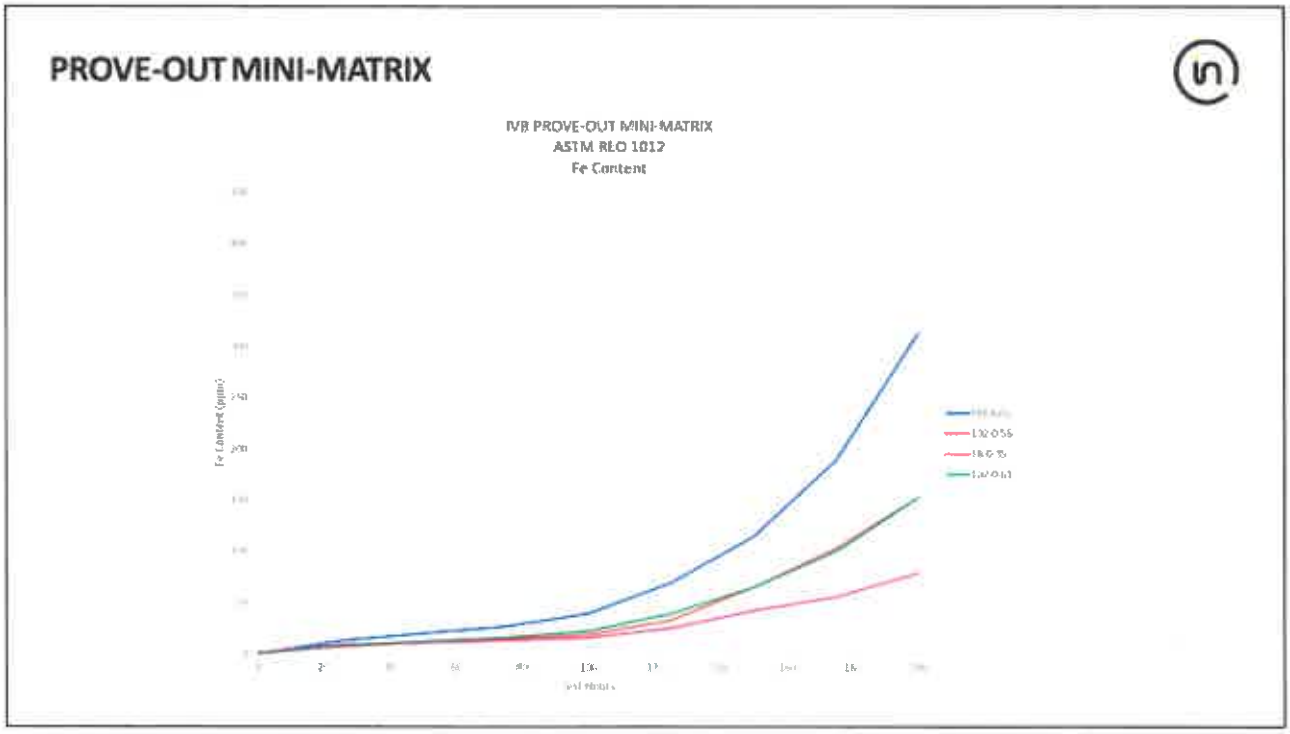


2.4.1. This slide shows the iron plots for REO300.

2.4.2. The recent changes to the test conditions have reduced the iron level more than the intake lifter wear.

2.4.2.1. This an indication that the test changes have reduced corrosion and excessive wear within the engine.

2.5. Slide #5:



2.5.1. The iron separation between REO300 and REO1012 is directionally correct.

2.5.2. *Shell's Comments:*

2.5.2.1. The Surveillance Panel needs to collect Rockwell Hardness data through the depth of the camshaft.

2.5.2.2. Lubrizol noted that this information was collected by Lubrizol, Southwest and Oronite earlier in the development of this test.

2.5.2.2.1. The Lubrizol and Oronite measurements matched very closely.

2.5.2.3. OHT questioned whether this should be a Surveillance Panel action item when companies can do this work on their own.

2.5.3. Exxon's Comments:

2.5.3.1. It is useful to compare the hardness of the camshafts and the lifters.

2.5.3.2. The Surveillance Panel needs a plan if the additional REO300 testing does not yield the desired results.

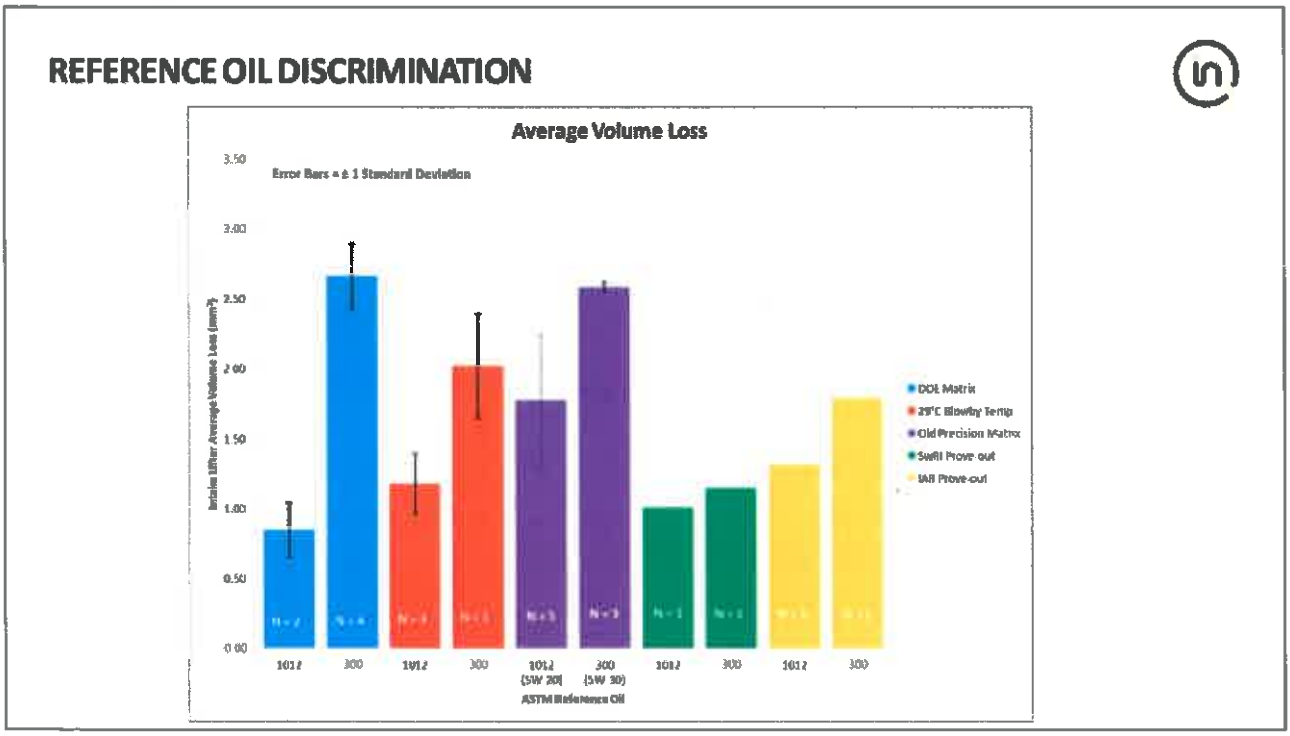
2.5.3.3. *Would laboratories be willing to donate tests to evaluate hardened camshafts?*

2.5.4. Afton's Comments:

2.5.4.1. *Has the group done an operational data review to identify potential differences between Intertek and Southwest?*

2.5.4.2. Intertek stated that this operational data review has not yet been done.

2.6. Slide #6:



2.6.1. The original DOE matrix displayed excellent discrimination between REO300 and REO1012.

2.6.1.1. The labs have not been able to replicate these results.

2.6.2. There was still good discrimination between REO300 and REO1012 when the 29°C blowby temperature set-point was introduced.

2.6.3. 1st Precision Matrix:

2.6.3.1. The severity of the test increased after the blowby temperature trials.

2.6.3.2. The results from REO1012 were highly variable.

2.6.4. Current Prove-Out Testing:

2.6.4.1. There has not been adequate discrimination between the two oils.

2.6.4.2. All four labs (Intertek, Southwest, Exxon and Lubrizol) offered to run additional REO300 tests to help establish separation.

2.6.4.3. The results at Southwest are milder than the results at Intertek.

2.7. Slide #17:

PRECISION MATRIX DESIGN

Run Order	IAR Stand 1	IAR Stand 2	IAR Stand 3	SwRI Stand 1	SwRI Stand 2
1	300	1011	300	1011	1012
2	1012	1012	1011	300	1012
3	1012	300	1011	300	1011
4	1011	300	1012	1012	300

2.7.1. The statisticians will need to add two additional columns for the tests donated by Lubrizol and Exxon.

2.7.2. Lubrizol asked Toyota and Intertek to list the requirements for these donated tests.

2.7.2.1. Lubrizol and Exxon will need to complete two valid prove-out tests with the latest procedure to be eligible for the Precision Matrix.

2.7.2.2. The results for the donated tests need to be available before the San Antonio laboratories finish Row #4 of the Precision Matrix.

2.7.2.3. Each lab will need to complete a minimum of two valid tests (one test on each oil).

2.7.2.4. The labs will need to submit data from each test for an operational review.

2.7.3. Intertek's Comments:

2.7.3.1. Intertek inquired whether prove-out test results could be applied towards the Precision Matrix.

2.7.3.2. The statisticians stated that they would prefer to keep the prove-out and Precision Matrix data separate if possible.

2.7.4. Engine Hardware:

2.7.4.1. Batch Code #1 (BC1) engines will be used for the prove-out matrix.

2.7.4.2. Batch Code #2 (BC2) engines will be used for the Precision Matrix.

2.7.4.3. OHT is willing to donate BC2 engines to Lubrizol and Exxon for their supplemental Precision Matrix tests.

2.7.4.3.1. Lubrizol and Exxon will lose some time because they must break-in these engines.

2.7.4.4. OHT has already donated (5) BC2 engines to the San Antonio labs for the Precision Matrix.

2.7.4.4.1. Four of these engines have already been broken in.

2.7.4.4.2. OHT has donated oil pans to go with these engines.

2.8. OHT Update:

2.8.1. They have donated enough test kits to Lubrizol and Exxon to allow them to complete their supplemental prove-out tests.
2.8.2. OHT has a 3-4-year supply of Batch-D camshafts.
2.8.2.1. They are already working with Toyota on the next batch.
2.8.3. They also have a sufficient quantity of cylinder head replacement kits in place.
2.8.3.1. OHT inquired whether the Surveillance Panel still intends to replace cylinder heads at a predetermined interval.

2.8.4. Intertek's Comments:

2.8.4.1. Intertek, Southwest and Lubrizol will need to supply iron curves for each of the engines that they have run (long term action item).
2.8.4.2. This will help establish the useful life of a given test engine.
2.8.4.3. Lubrizol offered to disassemble and inspect its prove-out matrix engine.
2.8.4.3.1. Lubrizol performed a similar analysis on previous engines that ran under the older test conditions.

2.9. Haltermann Update:

2.9.1. Haltermann has delivered 30,000-gallons of the latest batch of KA24E fuel to the labs.
2.9.2. Haltermann still has 20,000-gallons of this fuel in their inventory.

2.9.3. Exxon's Comments:

2.9.3.1. They plan to use the latest batch of KA24E fuel to complete their donated prove-out and Precision Matrix tests.
2.9.3.2. Once their stand is calibrated, they plan to use their original 20,000-gallon batch of KA24E fuel.
2.9.3.3. The Surveillance Panel has no objection to this if Exxon calibrates their stand on their original batch of fuel.
2.9.3.4. This batch of fuel falls within the new sulfur specification.

2.10. Open Discussion:

2.10.1. Toyota's Comments:

2.10.1.1. There is not enough data available with REO300 to be concerned about discrimination.
2.10.1.2. Their target for the borderline oil (REO300) is an average intake lifter volume loss of 1.5-2.0mm^3.
2.10.1.3. Test development is going in the correct direction.

2.10.2. Intertek's Comments:

2.10.2.1. The performance of REO300 matches the expectations of the oil supplier.
2.10.2.2. The results from a "borderline" oil such as REO300 will be more variable than a "good" or "bad" oil.
2.10.2.3. The Surveillance Panel attempted to introduce REO300 in the Sequence IVA test several years back.
2.10.2.3.1. TMC noted that this attempt was unsuccessful because the oil produced too much variation in lobe-to-lobe wear.
2.10.2.4. Infineum's Question: Is it possible that the lack of discrimination with REO300 is a laboratory difference?
2.10.2.4.1. Intertek responded that a very thorough laboratory audit was conducted the day before at both San Antonio laboratories.
2.10.2.4.2. This audit did not identify any obvious cause for the difference in test severity.

2.10.3. TMC's Comments:

2.10.3.1. The audit only identified one significant non-compliance.
2.10.3.2. Stand SWRI-18 had the blowby heat exchanger plumbed backwards.
2.10.3.3. Afton's Comments:

2.10.3.3.1. This reversal of flow through the heat exchanger could change its performance.

2.10.3.4. Exxon's Comments:

2.10.3.4.1. This non-compliance may not be a major concern because the blowby heat exchanger is not running near its maximum capacity.

2.10.4. History of REO300:

2.10.4.1. The supplier of REO300 was originally asked to provide a mid-wear reference oil for the Sequence IVA.

2.10.4.2. The performance of REO300 was more severe than expected with the Sequence IVA.

2.10.4.3. This is a 5W-30 oil with GF-5 technology.

2.10.4.4. It uses a full additive package with a reduced treat rate for the anti-wear chemistry.

2.10.4.5. It has proven to perform well in terms of oxidation control.

3. UPCOMING ANALYSIS BY STATISTICIANS:

3.1. Operational Data Analysis:

3.1.1. The statisticians were asked to perform an operational data analysis.

3.1.1.1. Kevin O'Malley will lead the analysis.

3.1.1.2. This analysis will focus on data generated between 101-102HRS.

3.1.1.3. It is up to the discretion of the lab to supply data from a different test hour if they experienced unscheduled downtime between 101-102HRS.

3.1.2. The statisticians have also been asked to recommend a QI strategy for the coolant outlet temperature.

3.1.3. The analysis will include data for the following oils: *REO300, REO1012 and IVB-LFO.*

3.1.4. Lubrizol's Comments:

3.1.4.1. The template needs to be modified with columns for the additional thermocouples in the external blowby system.

3.1.4.2. The template already contains columns for the OBD-II parameters.

3.1.5. The Surveillance Panel agreed to pause testing temporarily until the operational data review can be completed.

3.1.6. Southwest and Afton both agree that the operational data review should be conducted before the "ready for matrix" vote.

3.1.7. The laboratories tentatively agreed to have their operational data uploaded to the TMC website by October 9th.

3.2. Laboratory Updates:

3.2.1. Exxon:

3.2.1.1. Exxon damaged a front dyno bearing during their current test.

3.2.1.2. The dynamometer had to be replaced.

3.2.1.3. They expect to resume the test tomorrow morning.

3.2.1.4. Exxon cannot say with certainty whether they will have their result by next Wednesday.

3.2.2. Lubrizol:

3.2.2.1. Lubrizol will have its preliminary results available by next Monday (10/9) before lunch.

3.2.2.2. Initial iron measurements suggest that the test will be mild.

3.3. Forward Action Plan:

3.3.1. Toyota's Comments:

3.3.1.1. Toyota is concerned about postponing the "ready for matrix" vote until January 2018.

3.3.1.2. The additional delay will force OEM's to implement contingency plans for vehicle certification.

3.3.2. Intertek will keep the statisticians updated on the latest results from the ongoing prove-out matrix.

3.3.3. Exxon's Comments:

3.3.3.1. What happens if there is not enough discrimination between REO300 and REO1012?

3.3.3.2. The Sequence IIIH, VIE and Chain Wear tests all experienced issues after they completed their respective Precision Matrices.

3.3.3.3. Afton and Lubrizol agreed that a contingency plan should be discussed.

3.3.4. Intertek's Comments:

3.3.4.1. They listed three potential options if discrimination cannot be established between REO300 and REO1012:

3.3.4.1.1. Evaluate a harder surface finish for the camshaft.

3.3.4.1.2. Adjust the fuel sulfur higher.

3.3.4.1.3. Increase the test length by 25HRS.

3.3.4.2. Changing the camshaft hardware is not ideal for Toyota.

3.3.4.3. Increasing the fuel sulfur is also not ideal because it will increase corrosion in the engine.

3.3.5. Afton's Comments:

3.3.5.1. REO300 was originally referred to as a failing reference oil.

3.3.5.2. Now REO300 is being referred to as a borderline reference oil.

3.3.5.3. The Surveillance Panel needs to maintain consistency in its naming conventions.

Action Items	Person responsible	Completion Date

Follow-up Notes/Updates	Initials	Date Added

Attendees	Organization	Contact Information
See attached list.		

Sequence IV Surveillance Panel

San Antonio, TX
Intertek
October 3, 2017
9:00 a.m. - 5:00 p.m.

AGENDA

1. Chairman comments
2. Attendance sign-in sheet distribution
3. Membership changes
4. Motion and action recorder
5. Approval of minutes for June 6-8, 2017, July 12, 2017, July 19, 2017, July 26, 2017, August 8, 2017 and September 21, 2017
6. Previous action item review
7. Prove-out mini-matrix review
8. Additional prove-out testing update
9. Precision matrix readiness discussion/vote
10. Sequence IVB timeline review
11. Precision matrix lab audit review
12. Status of the Sequence IVB test procedure
13. Status of the Sequence IVB wear measurements
14. Status of engine coolant out temperature QI calculation
15. Status of the precision matrix hardware
16. Status of the precision matrix fuel batch
17. Status of the precision matrix and supplemental data labs
18. Motion and action item review
19. Next meeting
20. Adjourn

MEMBERSHIP
SEQUENCE IV SURVEILLANCE PANEL

October 3, 2017

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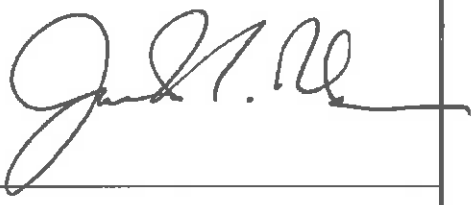
Bowden, Jason	OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 Phone No.: 440-354-7007 Fax No.: 440-354-7080 Email: jhbowden@ohtech.com	
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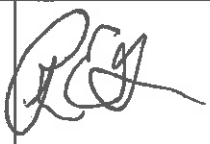
Grundza, Rich	ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 Phone No.: 412-365-1031 Fax No.: 412-365-1047 Email: reg@astmtmc.cmu.edu	
Hopp, Meryn	GM Powertrain Mail Code 483-730-322 823 Joslyn Rd. Pontiac, MI 48340-2920 Phone No.: Fax No.: Email: Meryn.hopp@gm.com	ON WEBEX
Hosseini, Mahboobeh	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	ON WEBEX
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MEMBERSHIP
SEQUENCE IV SURVEILLANCE PANEL

October 3, 2017

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Overaker, Mark	Haltermann Solutions 15635 Jacintoport Blvd. Houston, TX 77345 Phone No.: 832-376-2202 Fax No.: Email: mhoveraker@jhaltermann.com	
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MEMBERSHIP
SEQUENCE IV SURVEILLANCE PANEL

October 3, 2017

NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
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	Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	

NON-MEMBER MAILING LIST
SEQUENCE IV SURVEILLANCE PANEL

October 3, 2017

NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
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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	ON WEBEX
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NON-MEMBER MAILING LIST
SEQUENCE IV SURVEILLANCE PANEL

October 3, 2017

NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
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NON-MEMBER MAILING LIST
SEQUENCE IV SURVEILLANCE PANEL

October 3, 2017

NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
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NON-MEMBER MAILING LIST
SEQUENCE IV SURVEILLANCE PANEL

October 3, 2017

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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	ON WEBEX

NON-MEMBER MAILING LIST
SEQUENCE IV SURVEILLANCE PANEL

October 3, 2017

NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
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Tumati, Prasad	Haltermann Phone No.: (313) 300-8300 Fax No.: Email: ptumati@jhaltermann.com	Prasad Tumati
Charlie Leseretf	 Phone No.: Fax No.: Email:	
	  Phone No.: Fax No.: Email:	

NON-MEMBER MAILING LIST
SEQUENCE IV SURVEILLANCE PANEL

October 3, 2017

NAME	COMPANY-ADDRESS-PHONE-FAX-EMAIL	SIGNATURE
	Phone No.: Fax No.: Email:	
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Sequence IV Surveillance Panel
October 3, 2017
9:00AM – 5:00PM
Intertek
San Antonio, TX

Motions and Action Items
As Recorded at the Meeting by Bill Buscher

1. Action Item – Perform a sectional Rockwell hardness test on a test intake camshaft.

2. Action Item – Ask the supplier of IVB-LFO-1 if the directional performance between prove-out tests, of the intake lifter wear, can be shared with the surveillance panel.

3. Action Item – Update the operational data review Excel template to include the extra blowby temperature parameters.

4. Action Item – Lab to provide 1 hour, test hour 101 to 102 (NOTE: if an unscheduled shutdown occurred between test hour 101 and 102, then obtain data from the next full hour of test time without any scheduled or unscheduled shutdowns), of operational data, using the updated operational data review Excel template, from all of the prove-out tests, to the TMC for posting, so that a thorough operational data analysis can be performed Rich Grundza and Kevin OMalley. A total of 12 prove-out tests to be included. Labs to have data uploaded by 10/9/17. A follow-up conference call to be scheduled for 10/12/17.

5. Action Item – Travis Kostan to obtain the engine coolant out temperature data from the operational data files indicated in the above action item, to calculate QI target and limits.

6. Action Item – Surveillance panel chair to collect the Intake Lifter Average Volume Loss results from the two ASTM REO 1012 and the seven ASTM REO 300 prove-out tests and forward to the industry statisticians group for statistical analysis.

intertek
Total Quality Assured.

SEQUENCE IVB
SURVEILLANCE PANEL UPDATE

October 3, 2017

PROVE-OUT MINI-MATRIX

Run Order	IAR Stand 1	IAR Stand 2	SwRI Stand 1	SwRI Stand 2	Lubrizol	ExxonMobil
	Required	Required	Required	Required	Supplemental	Supplemental
1	300	IVB-LFO-1	1012	IVB-LFO-1	300	300
2	1012		300	IVB-LFO-2	1012	1012
3		300	300	300		

= Completed

= Running

- **Row 1 and 2 of the required testing has completed**
- **Row 1 of the supplemental testing currently running**
- **Row 3 has been added, and is running**

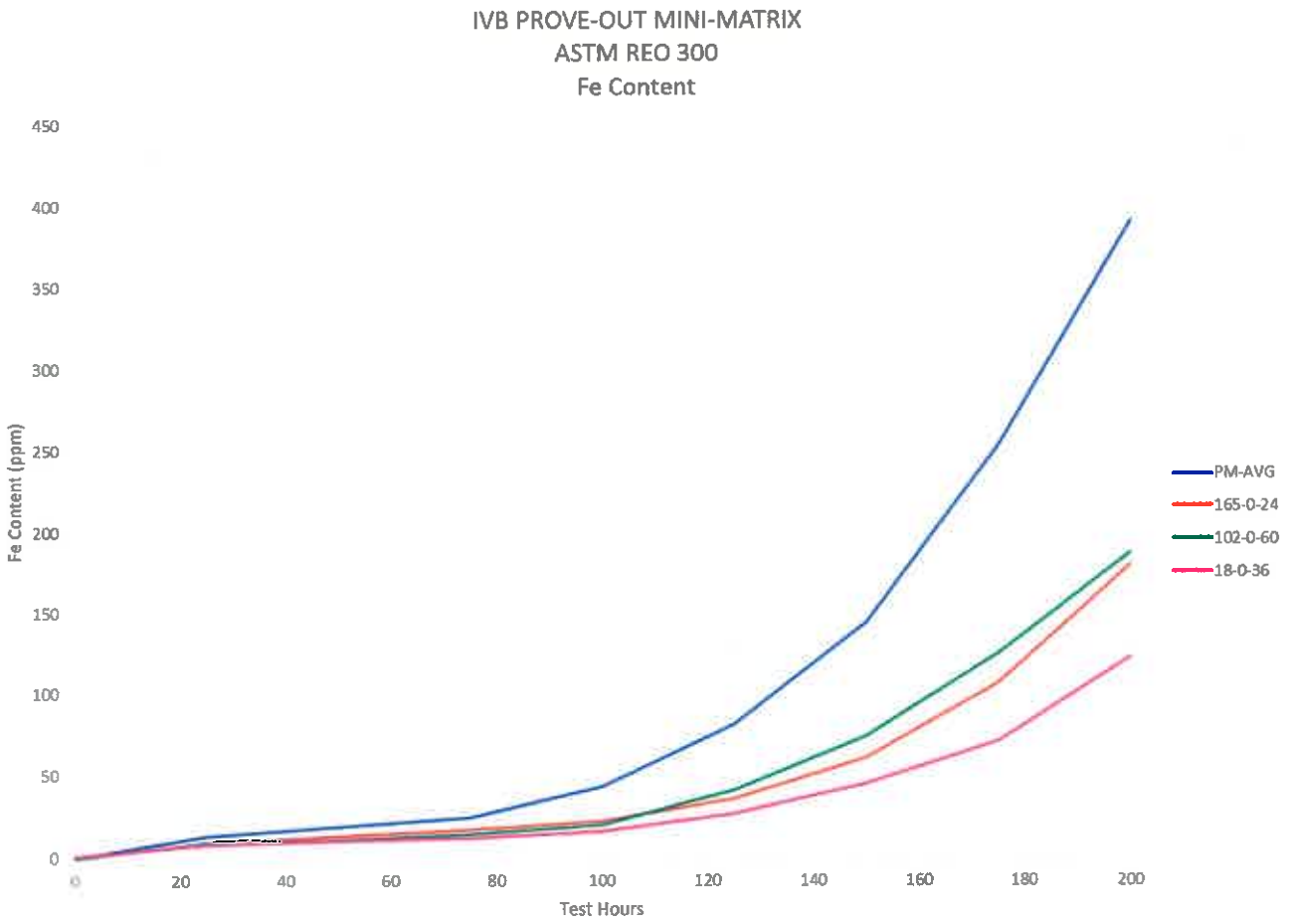
PROVE-OUT MINI-MATRIX

Test Number	Lab	Test Purpose	Test Oil	Date Completed	Test Fuel Batch	Test Fuel Sulfur Content	Test Oil Charge	Intake Camshaft Batch	Intake Camshaft Chamfered	Oil Pan Pick-up Tube Modified	25-HR Interval Oil Sample Size	5-HR Interval Oil Samples	Oil Separator and Plumbing Insulation	Engine Coolant Flow Direction	Engine Coolant Temperature Control Point	Fe at EOT ppm	Intake Camshaft Lobe Failure	Intake Lifter Average Volume Loss mm^3
165-0-24	IAR	Prove-out test for lower sulfur content fuel and larger initial oil charge.	ASTM REO 300	6/24/2017	EJ1721GP01	124 ppm	2600 g (≈ 3000 ml)	C	N	N	60 ml	Y	N	IN = Pipe OUT = Head	OUT, 52°C	180	None.	1.65 *
102-0-60	IAR	Prove-out test for all post-precision matrix changes.	ASTM REO 300	9/8/2017	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	187	None.	1.79 **
18-0-36	SwRI	Prove-out test for all post-precision matrix changes.	ASTM REO 300	9/22/2017	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	123	None.	1.15 **
102-0-58	IAR	Prove-out test for lower sulfur content fuel and larger initial oil charge.	ASTM REO 1012	6/25/2017	EJ1721GP01	124 ppm	2600 g (≈ 3000 ml)	C	N	N	60 ml	Y	N	IN = Pipe OUT = Head	OUT, 52°C	153	None.	1.19 *
18-0-35	SwRI	Prove-out test for all post-precision matrix changes.	ASTM REO 1012	9/11/2017	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	79	None.	1.01 **
102-0-61	IAR	Prove-out test for all post-precision matrix changes.	ASTM REO 1012	9/22/2017	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	153	None.	1.32 **
100-8-62	IAR	Prove-out test for lower sulfur content fuel and larger initial oil charge.	IVB-LFO-1	6/23/2017	EJ1721GP01	124 ppm	2600 g (≈ 3000 ml)	C	N	N	60 ml	Y	N	IN = Pipe OUT = Head	OUT, 52°C	340	None.	N/A
165-0-26	IAR	Prove-out test for all post-precision matrix changes.	IVB-LFO-1	9/8/2017	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	234	None.	N/A
20-0-52	SwRI	Prove-out test for all post-precision matrix changes.	IVB-LFO-1		FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	118	None.	N/A
20-0-53	SwRI	Prove-out test for all post-precision matrix changes.	IVB-LFO-2		FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	139	None.	N/A

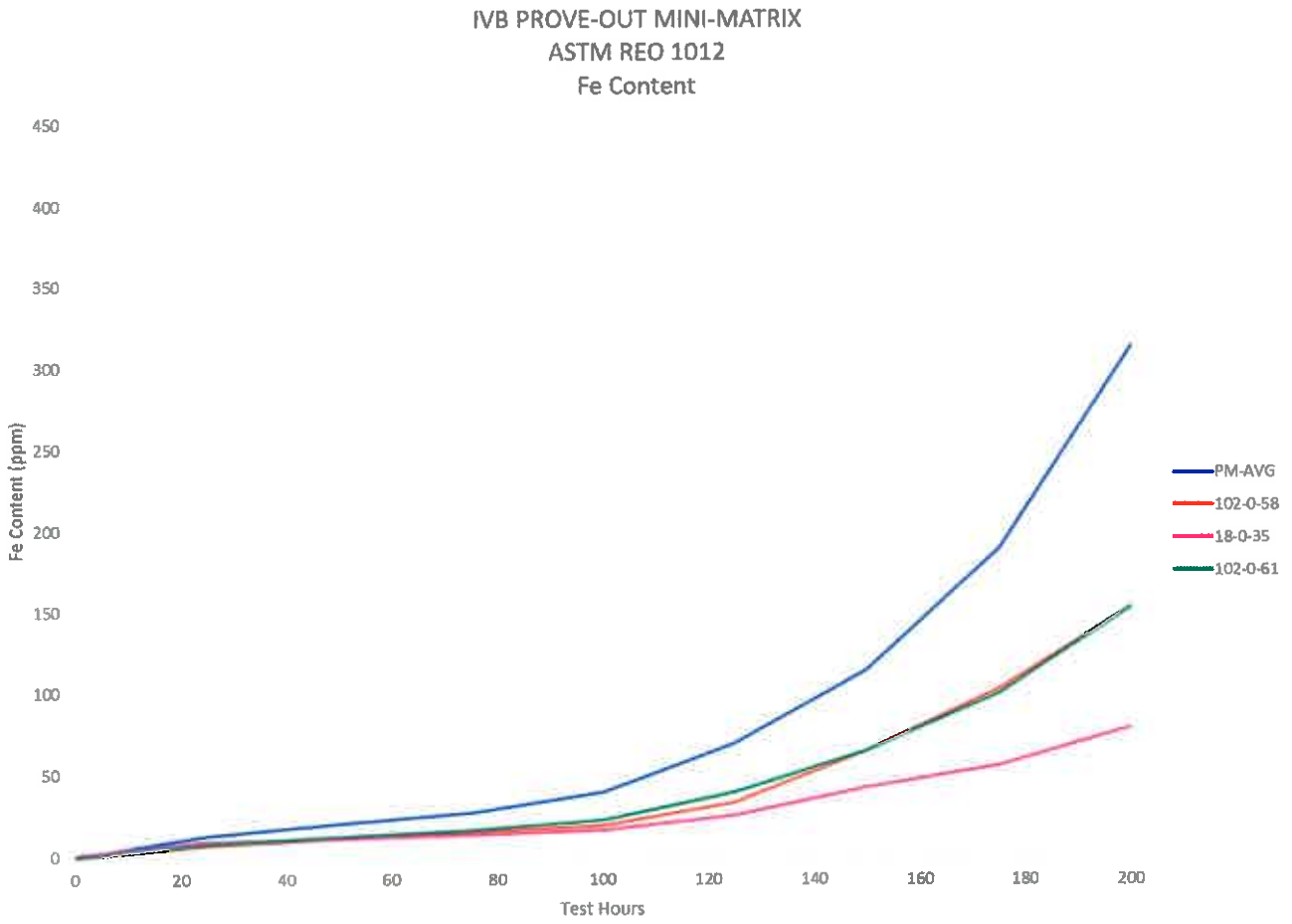
*** Volume loss measurements performed using the old Keyence software, the old settings and Talc Powder.**

**** Volume loss measurements performed using the new Keyence software, the new settings and Talc Powder.**

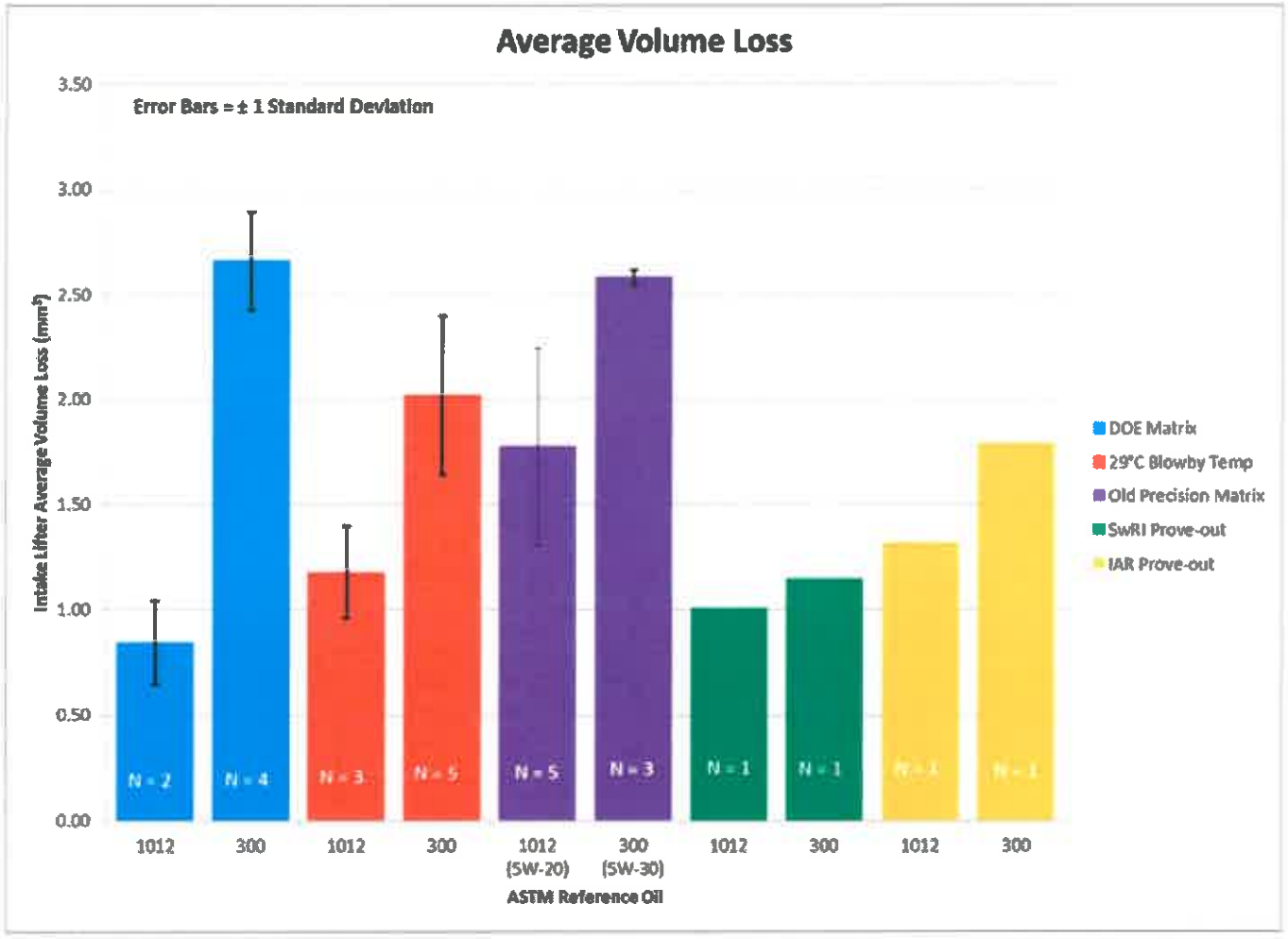
PROVE-OUT MINI-MATRIX



PROVE-OUT MINI-MATRIX



REFERENCE OIL DISCRIMINATION



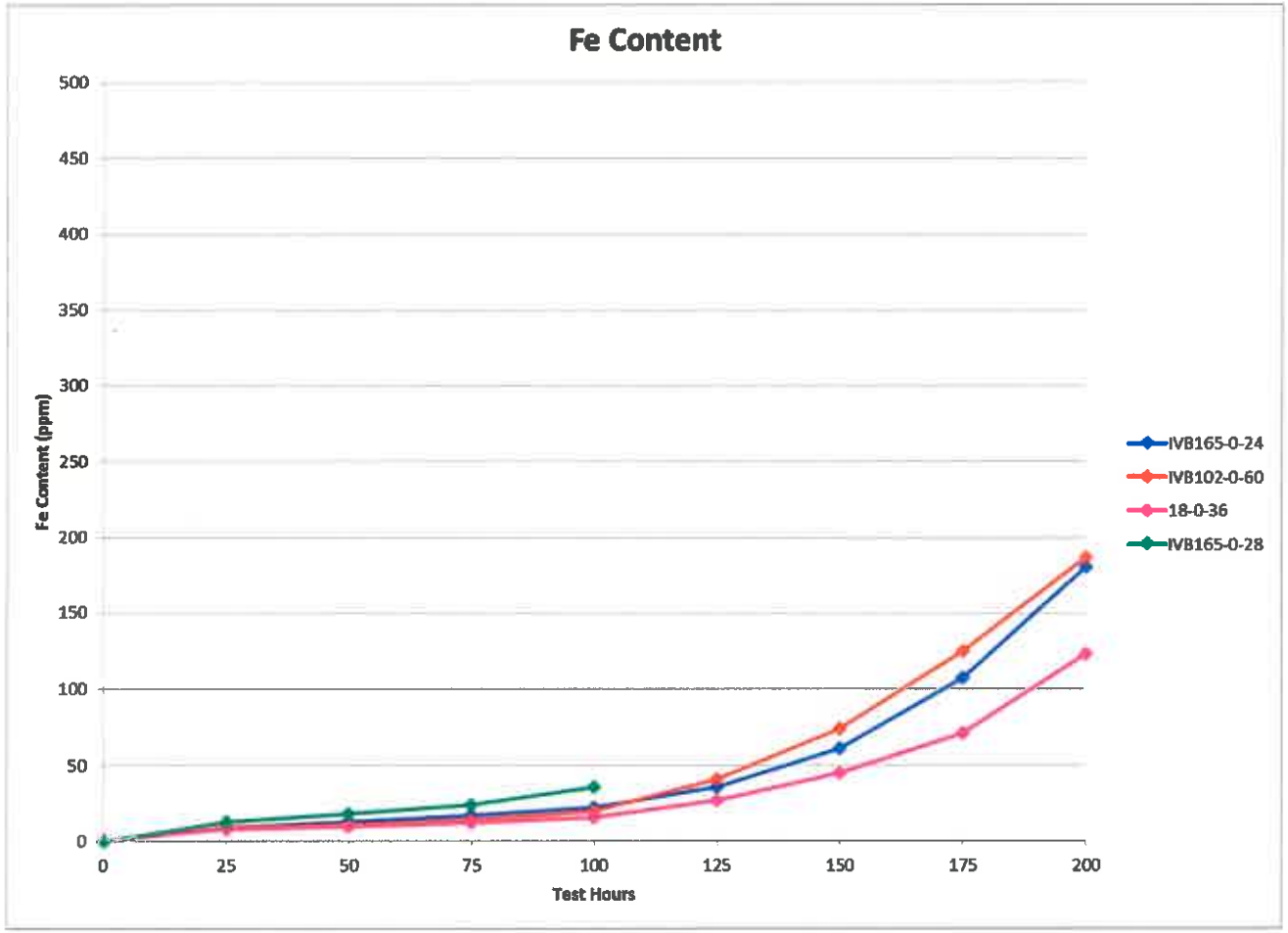
ASTM REO 300 PROVE-OUT TESTING

Test Number	Test Purpose	Test Oil	Date Completed	Test Fuel Batch	Test Fuel Sulfur Content	Test Oil Charge	Intake Camshaft Batch	Intake Camshaft Chamfered	Oil Pan Pick-up Tube Modified	25-HR Interval Oil Sample Size	5-HR Interval Oil Samples	Oil Separator and Plumbing Insulation	Engine Coolant Flow Direction	Engine Coolant Temperature Control Point	Intake Lifter Average Volume Loss mm^3	
IVB102-0-48	Prove-out test prior to precision matrix start.	ASTM REO 300	12/9/2016	EJ1721GP01	124 ppm	2400 ml (≈ 2100 g)	C	N	N	30 ml	Y	N	IN = Head OUT = Pipe	IN, 49°C	1.85 *	
IVB165-0-15	Prove-out test prior to precision matrix start.	ASTM REO 300	12/14/2016	EJ1721GP01	124 ppm	2400 ml (≈ 2100 g)	C	N	N	30 ml	Y	N	IN = Head OUT = Pipe	IN, 49°C	1.73 *	
IVB102-0-53	Precision matrix test.	ASTM REO 300	3/8/2017	EL3021LT10	185 ppm	2400 ml (≈ 2100 g)	C	N	N	30 ml	Y	N	IN = Head OUT = Pipe	IN, 49°C	2.83 *	
IVB165-0-22	Precision matrix test.	ASTM REO 300	4/23/2017	EL3021LT10	185 ppm	2400 ml (≈ 2100 g)	C	N	N	30 ml	Y	N	IN = Head OUT = Pipe	IN, 49°C	2.77 *	
IVB165-0-24	Prove-out test for lower sulfur content fuel and larger initial oil charge.	ASTM REO 300	6/24/2017	EJ1721GP01	124 ppm	2600 g (≈ 3000 ml)	C	N	N	60 ml	Y	N	IN = Pipe OUT = Head	OUT, 52°C	1.65 *	
IVB102-0-60	Prove-out test for all post-precision matrix changes.	ASTM REO 300	9/8/2017	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	1.79 **	
18-0-36	Prove-out test for all post-precision matrix changes.	ASTM REO 300	9/21/2017	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C	1.16 **	SwRI Test
IVB165-0-28	Prove-out test for all post-precision matrix changes.	ASTM REO 300	running	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C		
18-0-37	Prove-out test for all post-precision matrix changes.	ASTM REO 300	running	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C		SwRI Test
20-0-54	Prove-out test for all post-precision matrix changes.	ASTM REO 300	running	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C		SwRI Test
	Prove-out test for all post-precision matrix changes.	ASTM REO 300	running	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C		Exxon Mobil Test
	Prove-out test for all post-precision matrix changes.	ASTM REO 300	running	FG1721LT10	124 ppm	2600 g (≈ 3000 ml)	D	N	Y	60 ml	N	Y	IN = Pipe OUT = Head	OUT, 52°C		Lubrizol Test

*** Volume loss measurements performed using the old Keyence software, the old settings and Talc Powder.**

**** Volume loss measurements performed using the new Keyence software, the new settings and Talc Powder.**

ASTM REO 300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Test Hours
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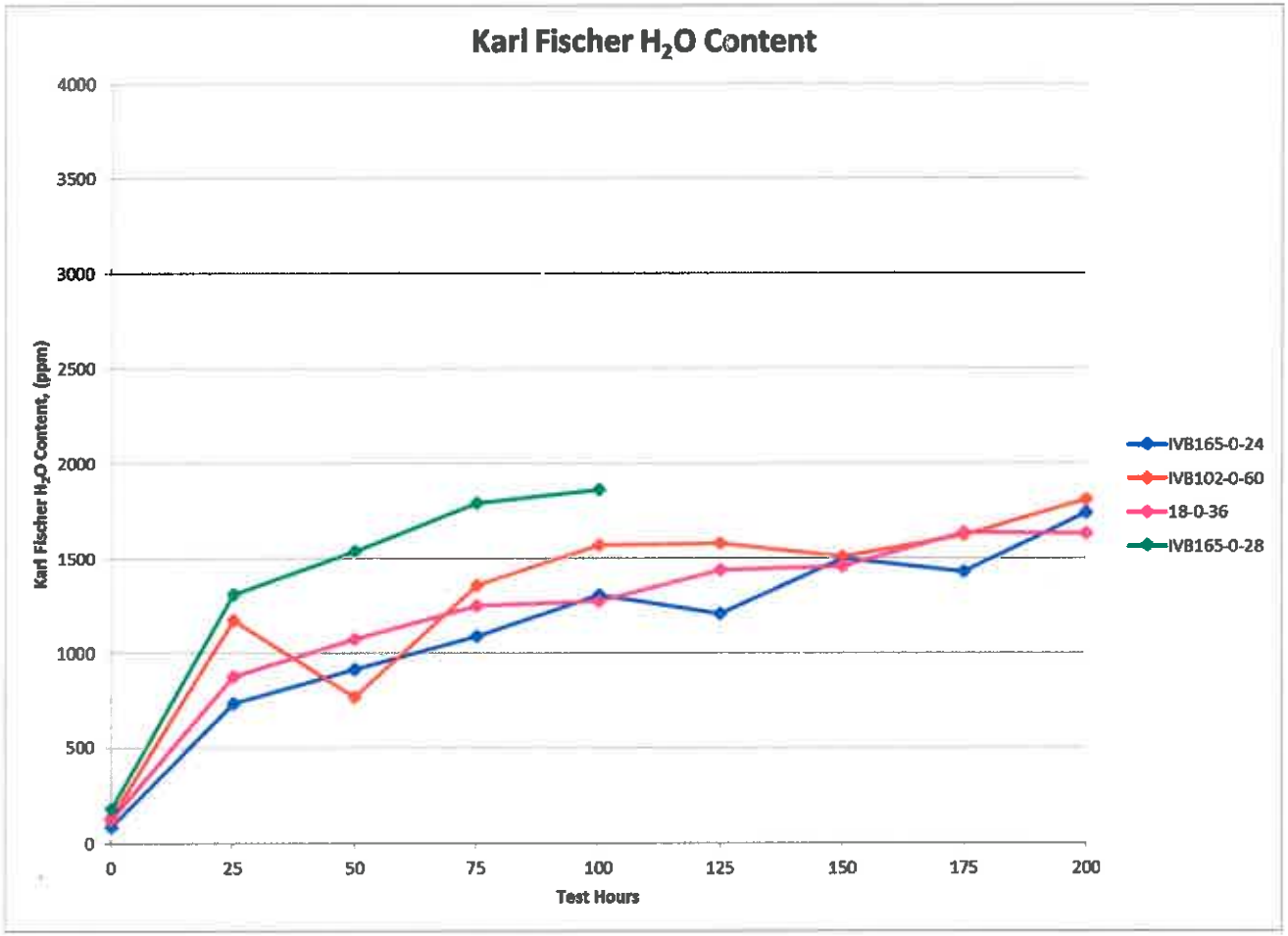
ASTM REO 300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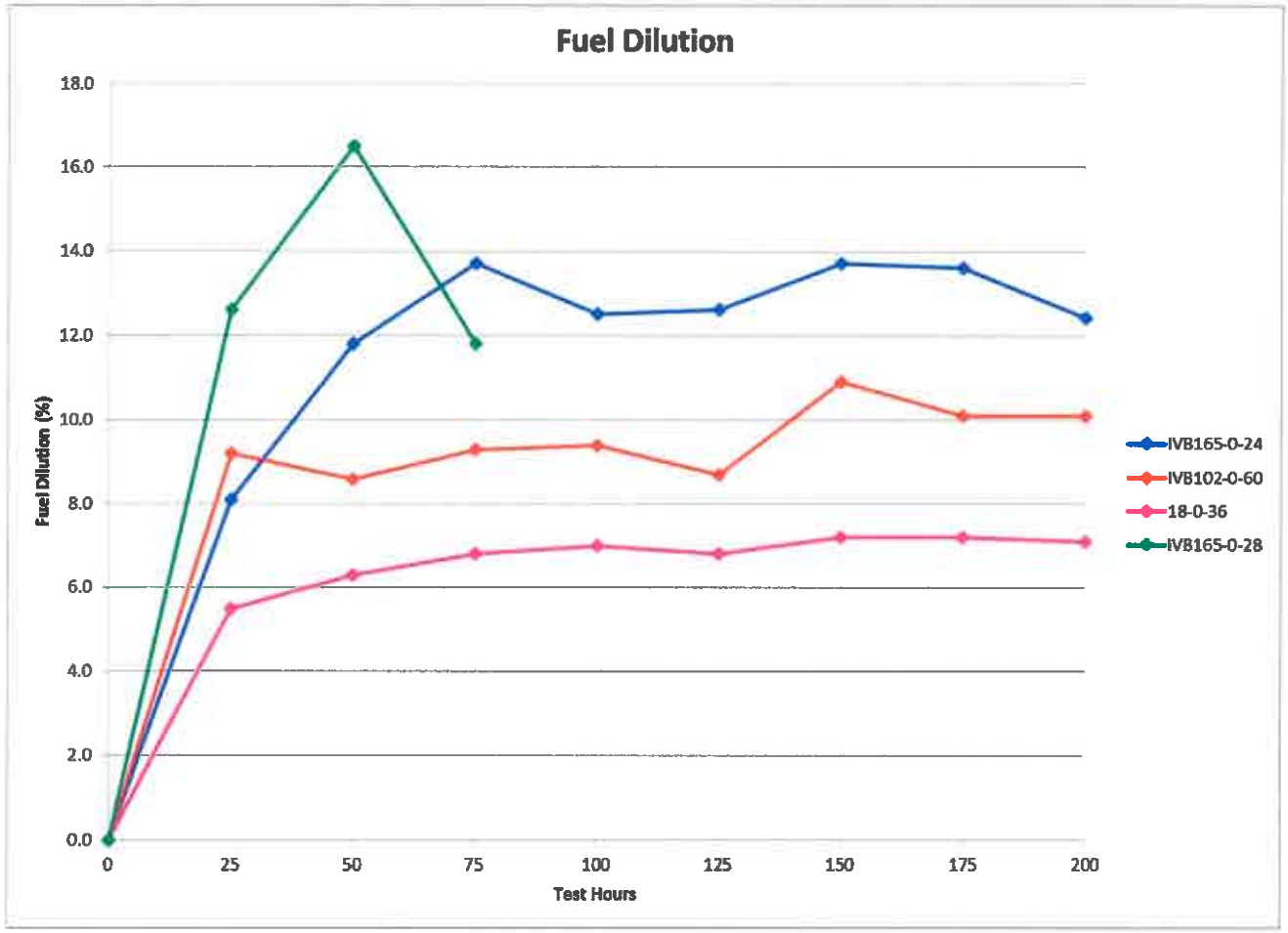
ASTM REO 300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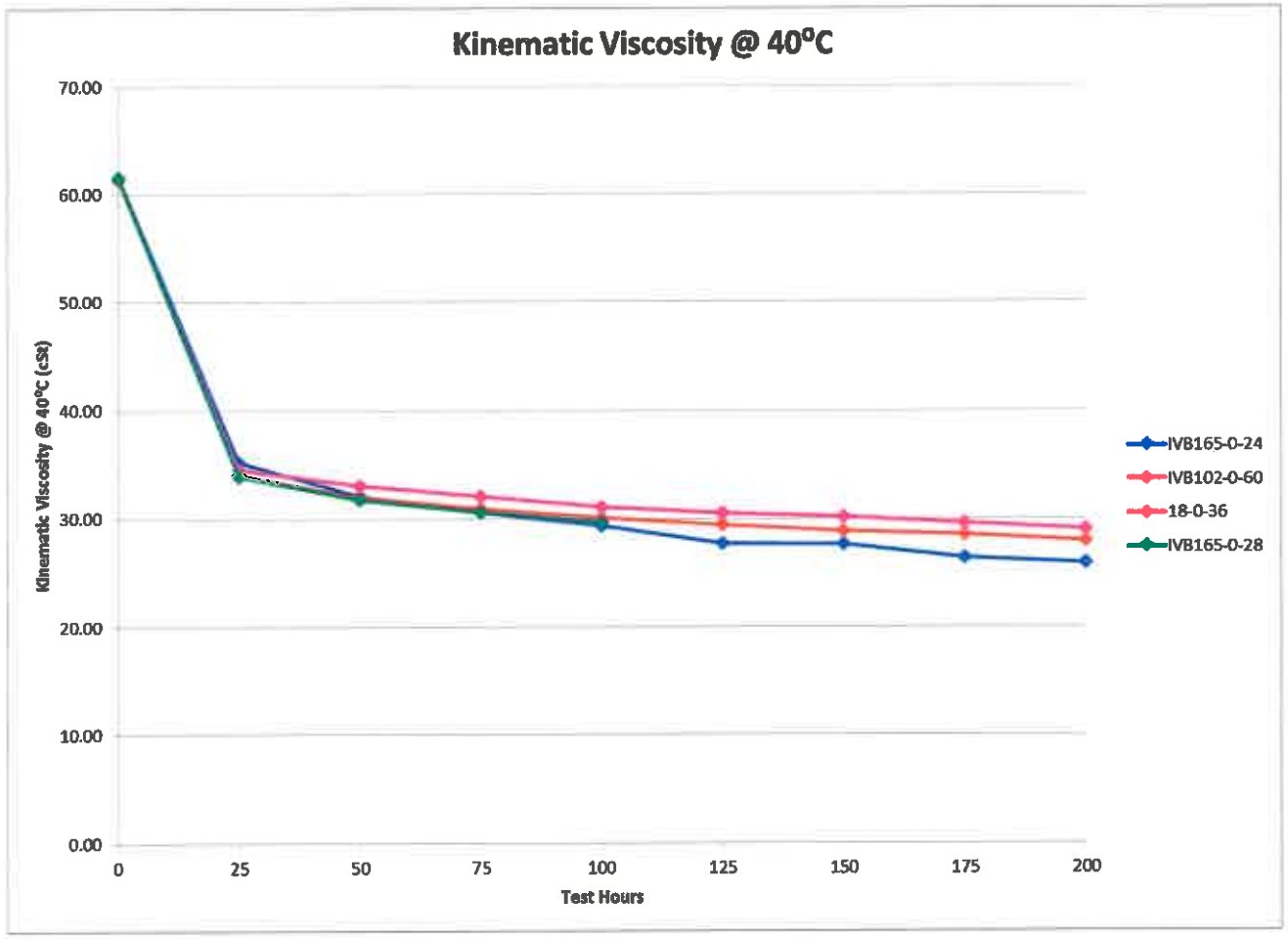
ASTM REO 300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Test Hours
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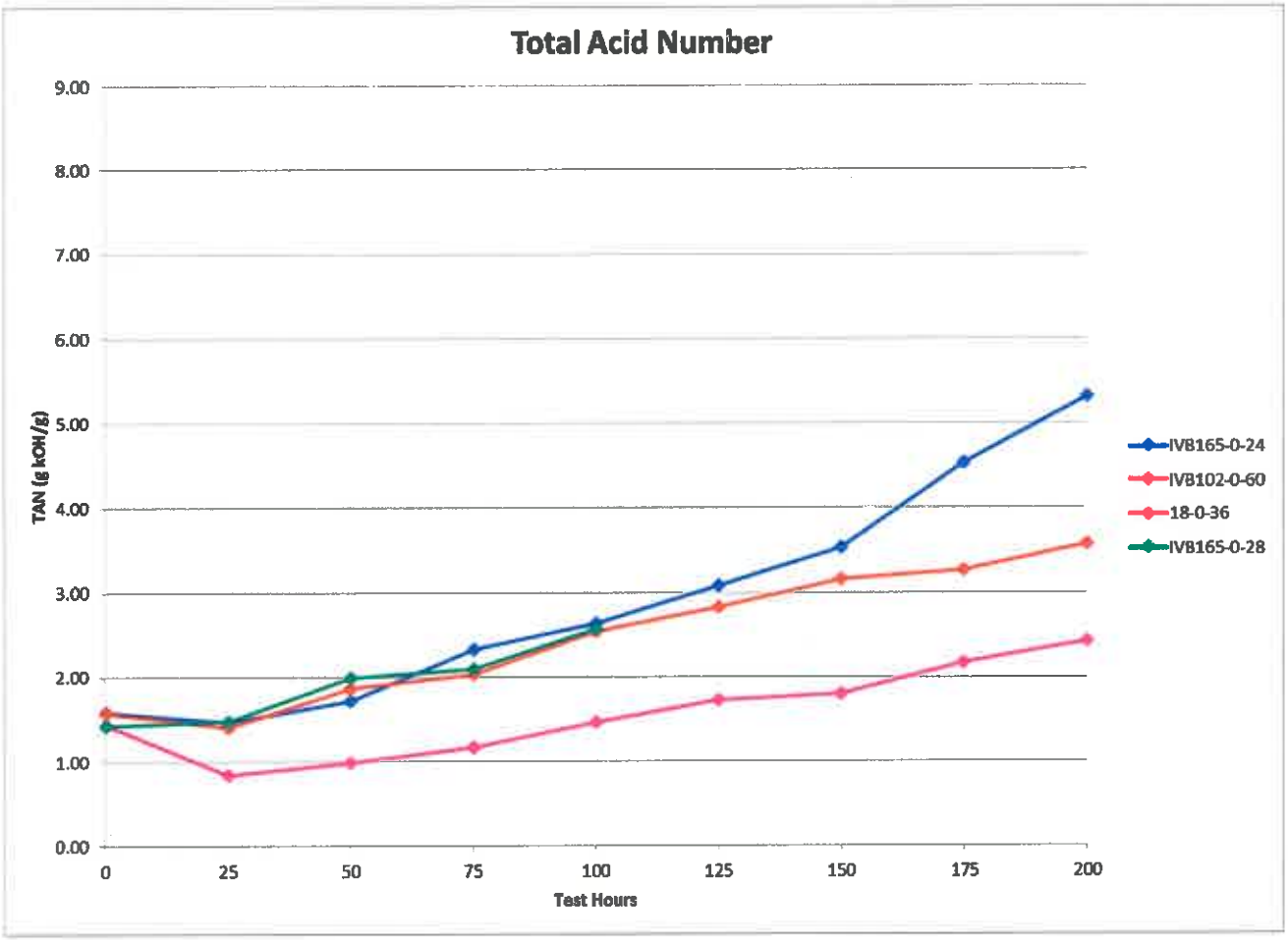
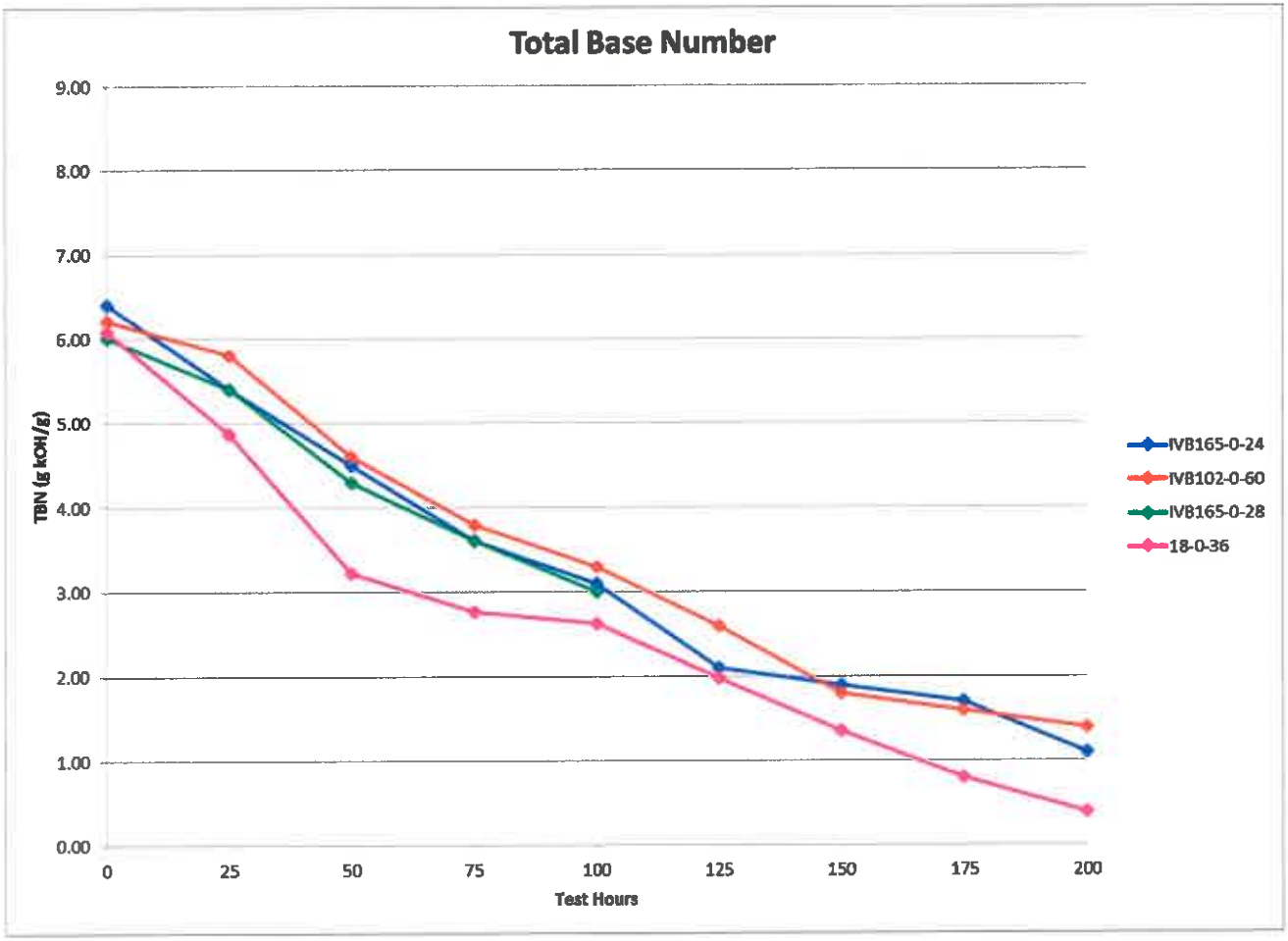
IVB165-0-28

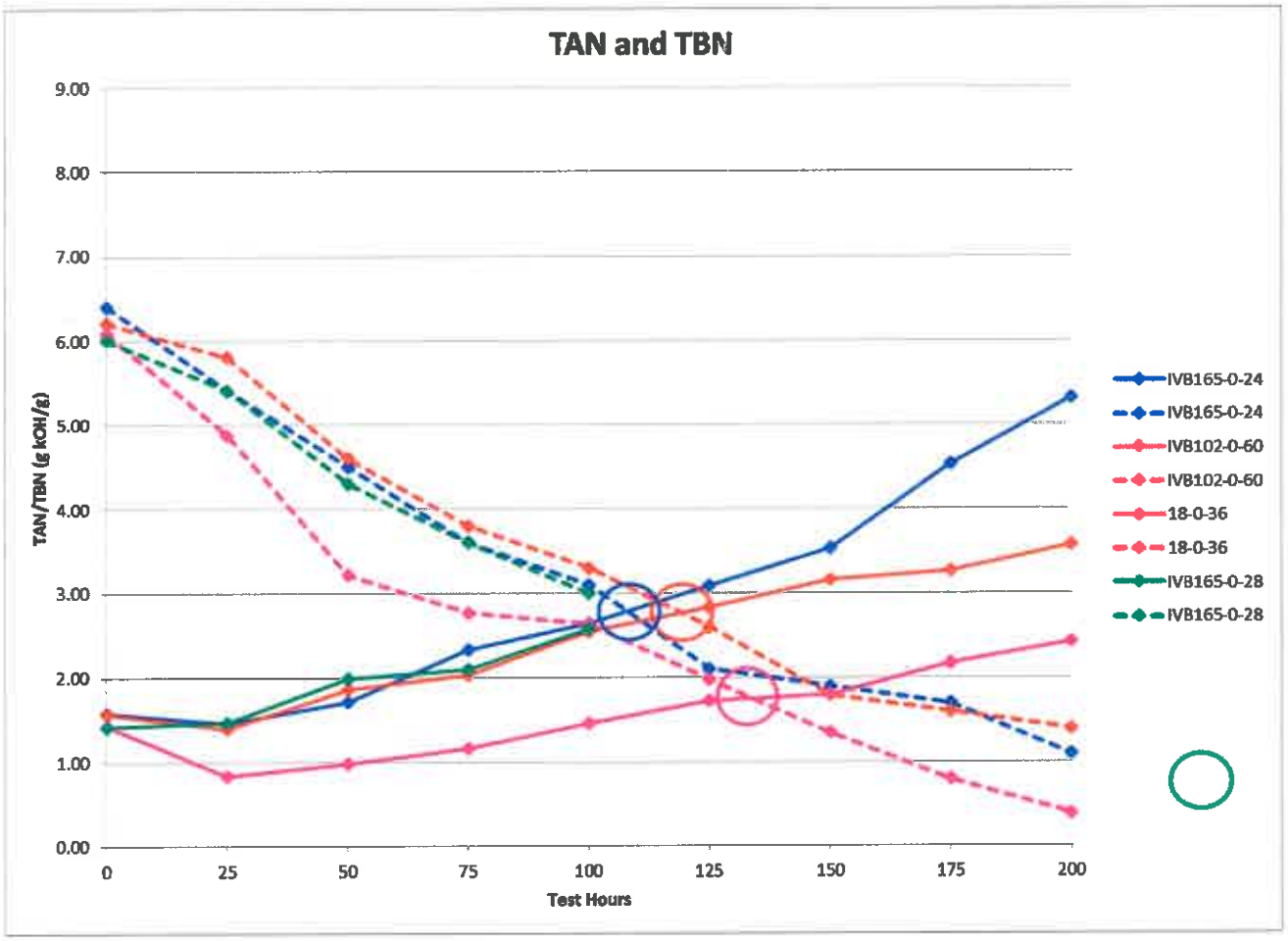
ASTM REO 300


Total Acid Number
TAN (g KOH/g)
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0
25
50
75
100
125
150
175
200
Test Hours
IVB165-0-24
IVB102-0-60
18-0-36
IVB165-0-28

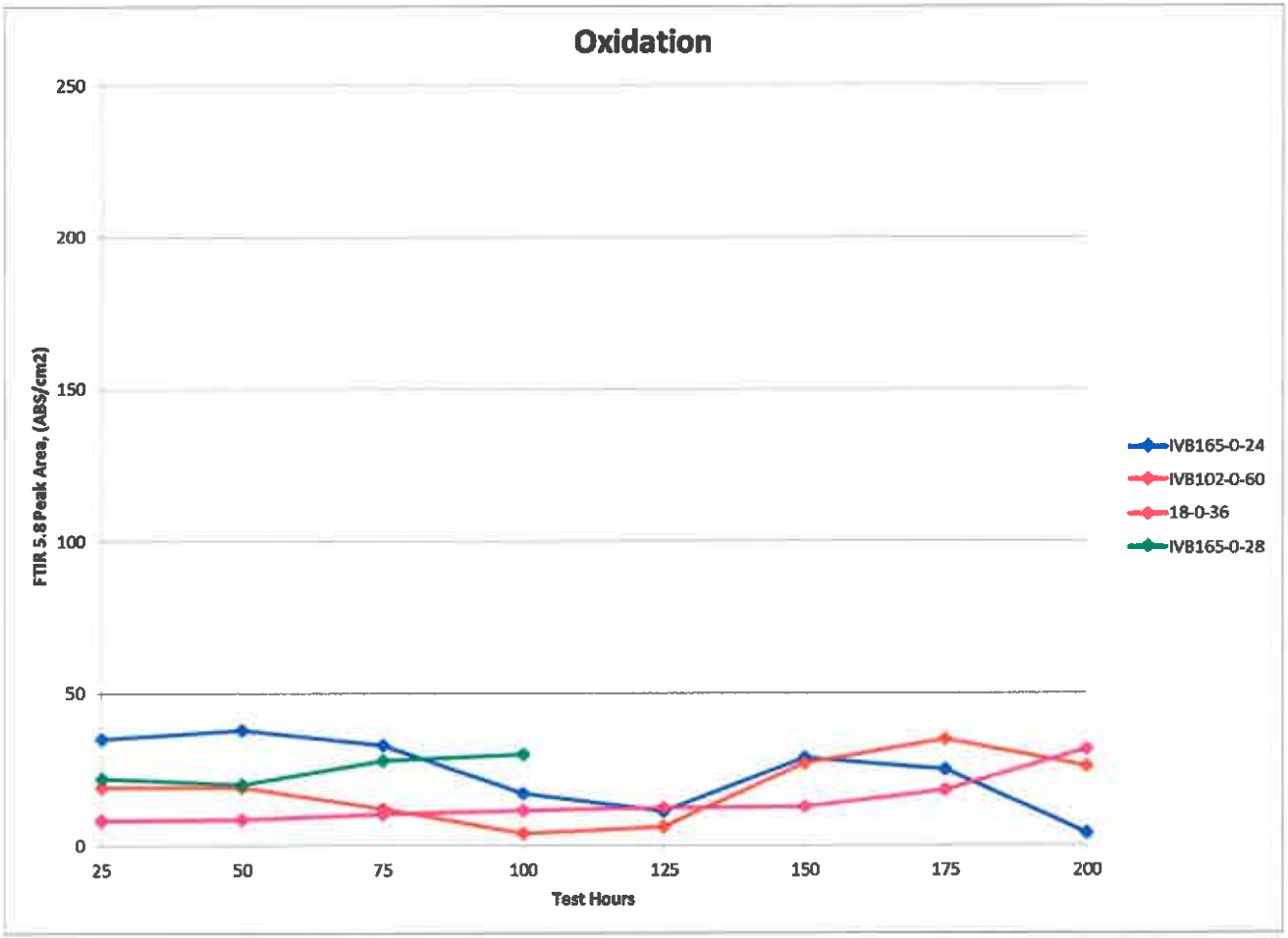
ASTM REO 300


Total Base Number
TBN (g KOH/g)
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0
25
50
75
100
125
150
175
200
Test Hours
IVB165-0-24
IVB102-0-60
IVB165-0-28
18-0-36

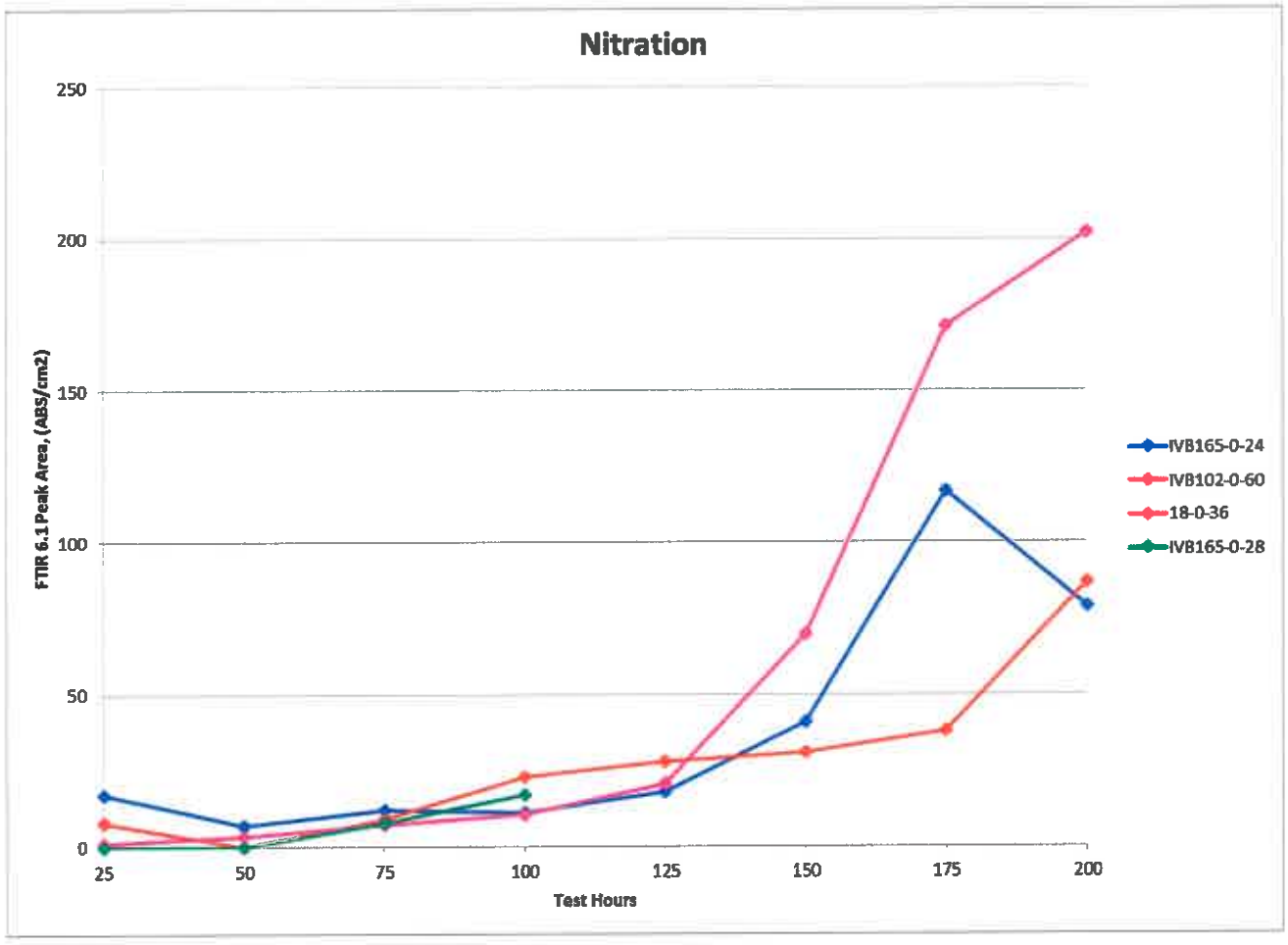
ASTM REO 300


TAN and TBN
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
TAN/TBN (g KOH/g)
0
25
50
75
100
125
150
175
200
Test Hours
IVB165-0-24
IVB165-0-24
IVB102-0-60
IVB102-0-60
18-0-36
18-0-36
IVB165-0-28
IVB165-0-28

ASTM REO 300


Oxidation
250
200
150
100
50
0
FTIR 5.8Peak Area, (ABS/cm2)
25
50
75
100
125
150
175
200
Test Hours
IVB165-0-24
IVB102-0-60
18-0-36
IVB165-0-28

ASTM REO 300


Nitration
FTIR 6.1 Peak Area, (ABS/cm2)
250
200
150
100
50
0
25
50
75
100
125
150
175
200
Test Hours
IVB165-0-24
IVB102-0-60
18-0-36
IVB165-0-28

PRECISION MATRIX DESIGN

Run Order	IAR Stand 1	IAR Stand 2	IAR Stand 3	SwRI Stand 1	SwRI Stand 2
1	300	1011	300	1011	1012
2	1012	1012	1011	300	1012
3	1012	300	1011	300	1011
4	1011	300	1012	1012	300

TIMELINE

Task	5-Stand Precision Matrix
Complete Test Fuel Blending	DONE
Complete Test Hardware Procurement and Preparation	DONE
Complete Preparation for Prove-out Testing	DONE
Complete Row 1 Prove-out Tests	DONE
Complete Row 2 Prove-out Tests	DONE
Complete Procedure Update	DONE
Complete Precision Matrix Lab Audits	DONE
Seq. IV Surveillance Panel Meeting	10/3/2017
Complete 5 ASTM REO 300 Prove-out Tests	10/9/2017
Complete Preparation for Precision Matrix	10/11/2017
Seq. IV Surveillance Panel vote for Ready for Precision Matrix	10/12/2017
Restart Precision Matrix (Start Row 1 Tests)	10/13/2017
Complete Row 1 Precision Matrix Tests	10/22/2017
Complete Row 1 Precision Matrix Operational Review	10/29/2017
Continue Precision Matrix	10/30/2017
Complete Precision Matrix	11/26/2017
Complete Final Precision Matrix Operational Review	12/3/2017
Start Statistical Analysis of Precision Matrix	12/4/2017
Complete Statistical Analysis of Precision Matrix	1/4/2018
Complete Development and Approve LTMS	
PCEOCP/AOAP Vote for Test Acceptance	1/11/2018
Stand Calibration Starts	1/12/2018

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