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COMMITTEE D02 ON PETROLEUM PRODUCTS, LIQUID FUELS, AND LUBRICANTS

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Originally Issued: November, 2020

Reply to: Richard Grundza
ASTM Test Monitoring Center
6555 Penn Avenue
Pittsburgh, PA 15206
Phone: 412-365-1031
Fax: 412-365-1047
Email: reg@astmtmc.cmu.edu

Unapproved Minutes of the November 19, 2020
Sequence IV Surveillance Panel Conference Call.

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The meeting was called to order by Chairman Buscher at 1:30 PM Central Time.

A copy of the agenda is included as attachment 1.

A list of attendees is included as attachment 2. Mike Deegan will replace Ron Romano as the representative for Ford.

The panel discussed list of action items from the previous meeting (see attachment 3). The panel discussed the status of the procedure, which is in final edit. The use of oil SL107 was discussed. One lab has introduced this oil with a reference. This oil is available in all labs but no other labs have pursued break in with this oil to date.

The panel reviewed the Fuels Task Force recommended fuel spec for the KA24E green fuel. (See attachment 4). Motions were made and approved to approve the fuel spec and to issue information letters to remove from the IVA and IVB procedures. The spec will be posted on the TMC website.

The panel discussed an ACC PAPTAG request to review and evaluate lobe failures on candidate tests. Labs discussed their experience as well as a review of the reference oil data base (see attachment 5). The panel also reviewed the reference oil history with lobe failures, see attachment 6. Several labs have not experienced lobe failures. Review of data and lab experience provided that chemistry may be responsible for some of the lobe failures. SwRI noted differences in lifter batches and has seen some increase in lobe failure from ~10% to ~17% . SwRI suspects that lifter rotation may be part of the issue but is still trying to understand surface finish and how it relates to rotation. Further discussion showed that batches A and B are similar while C and D may be different. Batch code is based on the receipt of the lifters. SwRI's presentation is included as attachment 7. SwRI and Intertek agreed to begin measuring of surface finishes between lifter batches. Labs may wish to review their candidate data to see if one or more batch codes are associated with lobe failure and if those are across multiple chemistries. The chair will be drafting a response to ACC PAPTAG and schedule another call to finalize a response.

The panel discussed some changes to the stand for approval by the panel. The first item was to allow the use of a different bulkhead fitting for pressure lines. A second request was made to allow the use of hinges, or pins, or both on the driveshaft cover. (Pictures included as attachment 8). The panel agreed that these changes would be allowable.

The meeting was adjourned at 3:25 PM CST.

Attachment 9 includes the motion and action items recorded during this meeting.

Sequence IV Surveillance Panel

Conference Call

November 19, 2020








1:30 p.m. - 3:30 p.m.

A G E N D A

1. Chairman comments.
2. Attendance.
3. Membership changes.
4. July 22, 2020 action item review.
5. Review TGC Fuels Task Force recommendation to the Sequence IV Surveillance Panel.
6. Review ACC PAPTG letter to the Sequence IV Surveillance Panel.
7. Petition for minor modifications to Sequence IVB Golden Stand.
8. Old business.
9. New business.
10. Motion and action item review.
11. Next meeting.
12. Adjourn.







**MEMBERSHIP
SEQUENCE IV SURVEILLANCE PANEL**

November 19, 2020

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SEQUENCE IV SURVEILLANCE PANEL**

November 19, 2020

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SEQUENCE IV SURVEILLANCE PANEL**

November 19, 2020

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November 19, 2020

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November 19, 2020

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November 19, 2020

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Sequence IV Surveillance Panel
July 22, 2020
9:30AM – 11:30AM
Conference Call

Motions and Action Items

As Recorded at the Meeting by Bill Buscher

1. Motion – The Sequence IV Surveillance Panel approves the editorial revisions of Section 2.5 & Note – 1 and Section 5, Note – 4 of the Sequence IVB ASTM test method, included in Sid Clark’s (ASTM facilitator) PowerPoint slides. Effective 7/22/2020.
Teri Kowalski / Bill Buscher / Passed Unanimously 16 – 0 – 0
Completed. Test procedure has been updated.
2. Motion – The Sequence IV Surveillance Panel approves replacing 1006-2 with SL 107 for Sequence IVB aging. Labs to compare used oil Si results from their first SL 107 aging to their historical 1006-2 aging and if comparable then labs will continue to introduce SL-107 with a reference test on the first test engine that has been aged with SL 107. Labs will be allowed to use up any remaining decoded 1006-2 for Sequence IVB aging as they transition to SL 107. Effective 7/22/2020.
Bill Buscher / Khaled Rais / Passed Unanimously 16 – 0 – 0
Completed. One or more test laboratories have used SL-107 for new engine aging and successfully calibrated with those engines.
3. Motion – The Sequence IV Surveillance Panel approves the addition of a test numbering practice scheme for aging numbering (original 95 min break-in + 50 hr aging) and break-in numbering (50 hr extended break-in) into the Sequence IVB ASTM test method.
Rich Grundza / Andrew Stevens / Passed Unanimously 16 – 0 – 0
In process. Will be effective with issuance of first information letters, once ASTM D8350 is published.
4. Action Item – When a lab has the need for a small Sequence IVB Golden Stand modification they can petition Toyota and the Sequence IV Surveillance Panel in writing on a case-by-case basis.
Completed. Motion presented today.

5. Action Item – Lubrizol to draft verbiage for the Sequence IVB ASTM test method for labs to follow internal weight calibration procedures for calibrating the standardized weight set manufactured for the Sequence IVB's load cell calibration, with the option to send them back to the manufacturer for calibration. The Surveillance Panel will then follow up with a motion to approve this procedural revision.

Completed. Motion to be presented at next surveillance panel meeting.

Rev. Date: 11/18/2019

TEST	METHOD	UNITS	SPECIFICATIONS			RESULTS
			MIN	TARGET	MAX	
Distillation, % Evap - IBP	ASTM D86	°F	75		95	
5%		°F				
10%		°F	120		135	
20%		°F				
30%		°F				
40%		°F				
50%		°F	200		230	
60%		°F				
70%		°F				
80%		°F				
90%		°F	300		325	
95%		°F				
Distillation - EP		°F	385		415	
Recovery		vol %		Report		
Residue		vol %		Report		
Loss		vol %		Report		
Gravity @ 60°F	ASTM D4052	°API	58.7		61.2	
Density @ 15°C	ASTM D4052	kg/l	0.734		0.744	
Reid Vapor Pressure	ASTM D5191	psi	8.8		9.2	
Carbon	ASTM D5291	wt fraction	0.8580		0.8667	
Carbon	ASTM D3343	wt fraction		Report		
Sulfur	ASTM D2622	wt %	0.0120		0.0140	
Lead	ASTM D3237	g/gal			0.05	
Oxygen	ASTM D4815	wt %			0.2	
Composition, aromatics	ASTM D5769	vol %	28.5		34.5	
Composition, olefins	ASTM D6550	vol %	5.0		10.0	
Composition, saturates	Calc	vol %		Report		
Oxidation Stability	ASTM D525	minutes	1440			
Copper Corrosion, 3 hr @ 50°C	ASTM D130	Class			1	
Gum content, washed	ASTM D381	mg/100ml			5	
Gum content, unwashed	ASTM D381	mg/100ml			10	
Research Octane Number	ASTM D2699	Rating	96.0		97.5	
Motor Octane Number	ASTM D2700	Rating		Report		
R+M/2	D2699/2700	---		Report		
Sensitivity	D2699/2700	---	7.5			
Net Heating of Combustion	ASTM D240	btu/lb		Report		
Color	Visual			Green		



November 3, 2020

Sent via Email

William Buscher, Sequence IVB Chair
Intertek Automotive
5404 Bandera Road
San Antonio, TX 78238

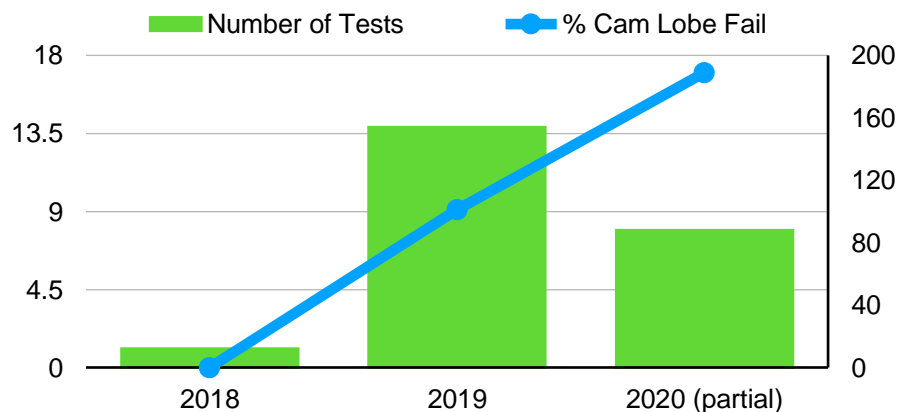
Dear Bill,

We are sending this letter to you as an official request for the Sequence IVB Surveillance Panel to investigate the increase in cam lobe failures that has become apparent to ACC members during candidate testing on calibrated and referenced Sequence IVB test stands.

Background:

During the development of oils for ILSAC GF-6 A/B, PAPTG has continued to monitor, via monthly reports provided by the ACC Monitoring Agency (MA), the occurrence of cam lobe failures in the Sequence IVB candidate runs. Attached please find the most recent report which also details the historical information collected by the ACC Monitoring Agency.

As witnessed in the MA report and summarized in the illustration below, there has been a steady increase in the percentage of cam lobe failures during 2019 and 2020.



Action Taken by ACC PAPTG:

Acknowledging a rise in the occurrence of cam lobe failures, ACC requested the MA to provide a summary of the candidate testing for additional analysis. The summary of the



anonymized data collected is also attached for your review. Several PAPTG member companies analyzed the data independently and the following conclusions were supported by PAPTG:

- The TMC data shows that the reference oils are not exhibiting the same rate of cam lobe failure as the candidates.
- The percent of non-interpretable results have an increasing trend since mid-2019.
- Non-interpretable results appear to occur at mainly at two of the labs: Labs A and C. More than a fifth of the runs from Lab C are non-interpretable.
- Candidate data indicates XW-16 viscosity grade oils may have a higher cam lobe failure rate than XW-20 and XW-30 viscosity grade oils raising concerns because lower viscosity grades are the future of passenger car engine oils. The table below summarizes this data:

Viscosity Grade	Total Number of Tests	% Cam Lobe Failure
xW16	33	30%
xW20	83	18%
xW30	74	5%

- There is a potential confounding of the lab/sponsor data which will require further investigation.

In the most recent attached monthly Monitoring Agency report to PAPTG, we are encouraged to see that the latest statistics for the recent activity in September shows nine candidate tests run with no non-interpretable results. While we are optimistic in seeing this positive trend we still are not certain if the shift can be explained. We would appreciate a review of these findings with the Panel to determine the best approach to investigate these findings and identify areas for improvement.

We hope the Surveillance Panel considers our request and we would be willing to assist in any way we can to ensure the Sequence IVB remains a reliable test for the industry.

Sincerely yours,

Joan Evans

Joan Evans
PAPTG Chair

Doug Anderson

Doug Anderson
PAPTG Manager



Seq. IVB Letter
November 3, 2020
Page 3

Cc: Rich Grunza
ASTM Test Monitoring Center
6555 Penn Ave, Pittsburgh, PA 15206
Via email
Cc: Jeff Harmening API via email

Attachment: MA Sequence IVB Report September 2020

Separate Attachment: ACC Candidate IVB Coded Data



ACC MA Sequence IVB Report September 2020

ACC Monitoring Agency


6555 Penn Avenue, Pittsburgh, PA 15206

<https://acc-ma.org>

Services Provided By:

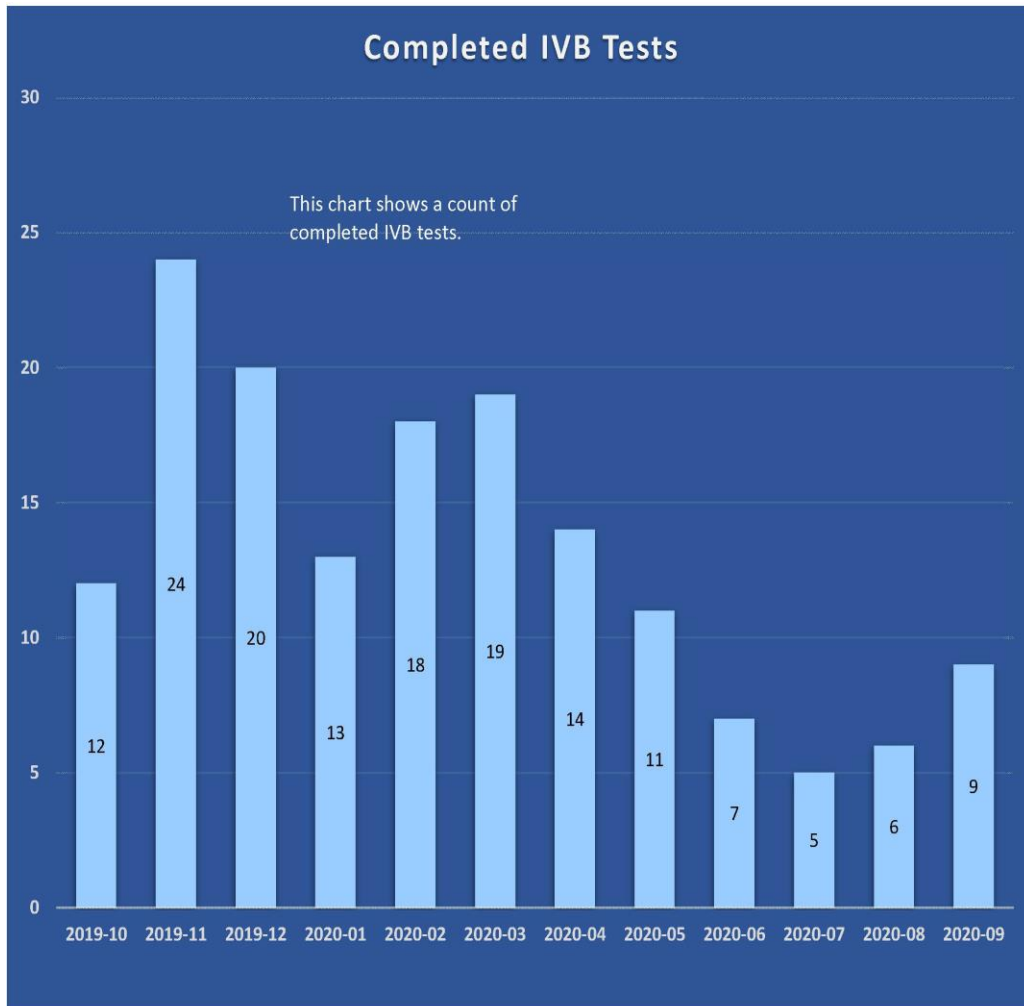


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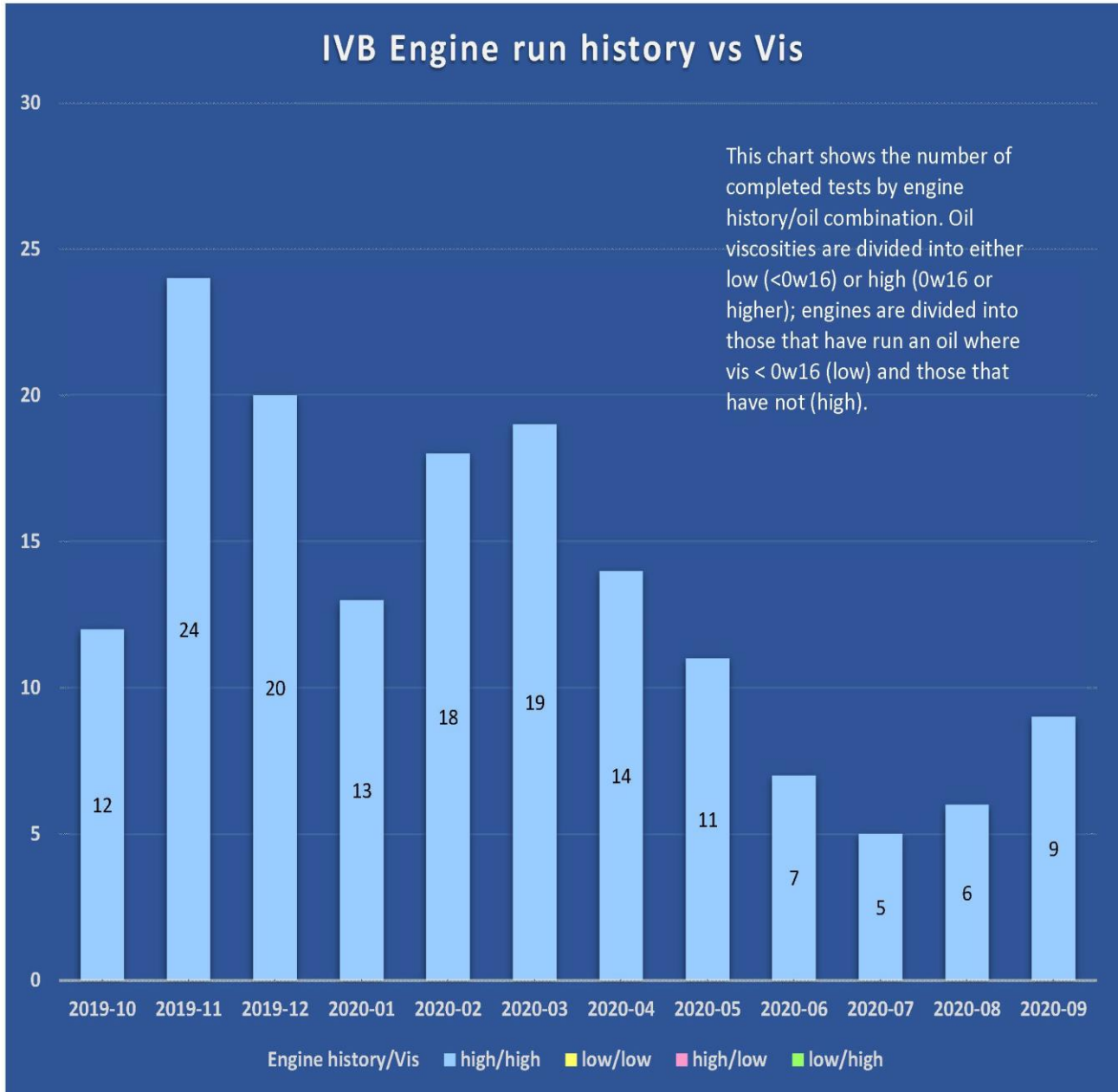
MEMORANDUM: 20-048
DATE: October 15, 2020
TO: Doug Anderson
FROM: Scott Parke 
SUBJECT: Additional IVB Reporting

PAPMG has requested the ACC Monitoring Agency to provide additional information regarding IVB testing. Following is a summary of IVB testing including tests reported through the end of September 2020.

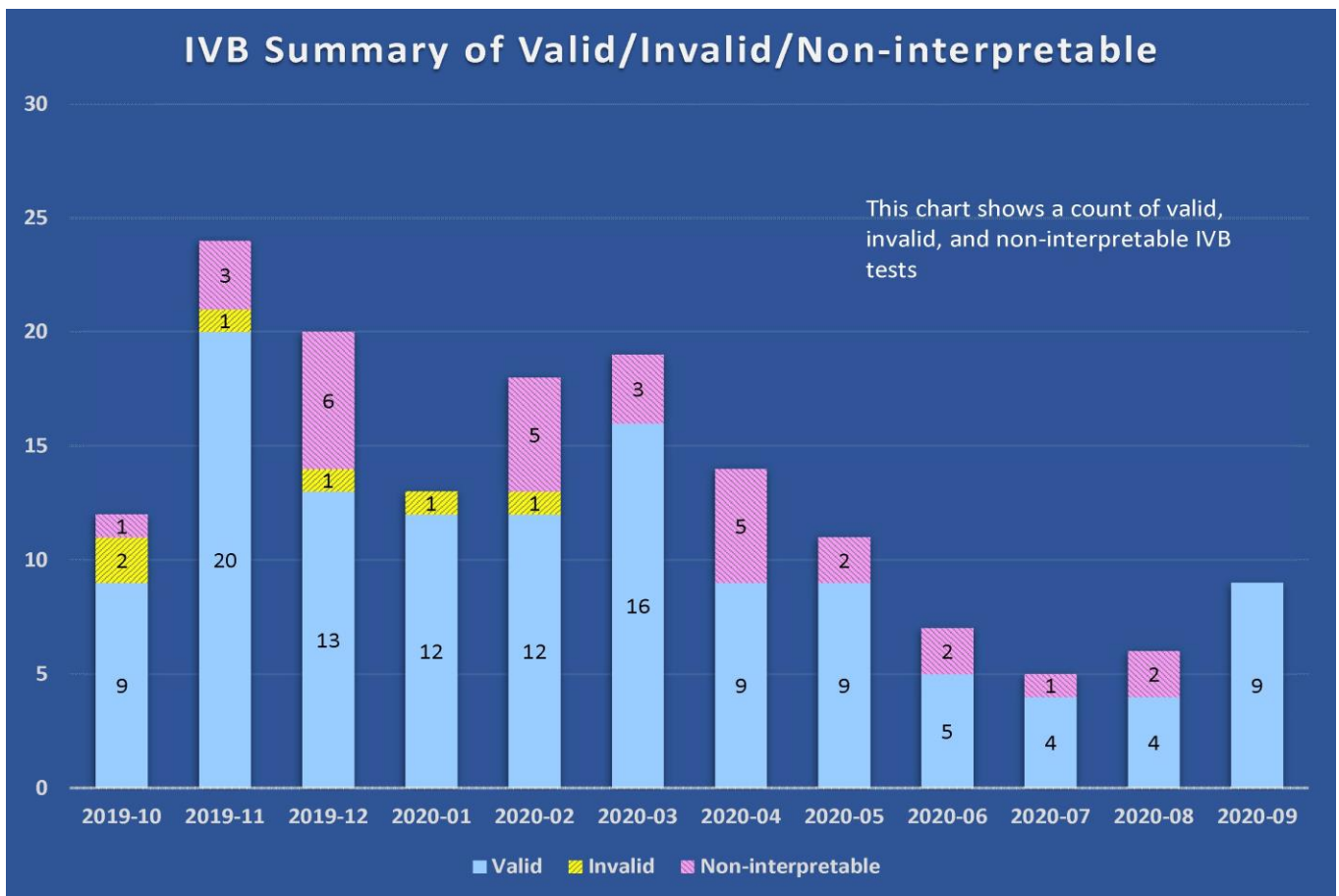
Shown below is a month-by-month tally of tests completed over the past year. Be aware, new tests for any month may be reported at any time.



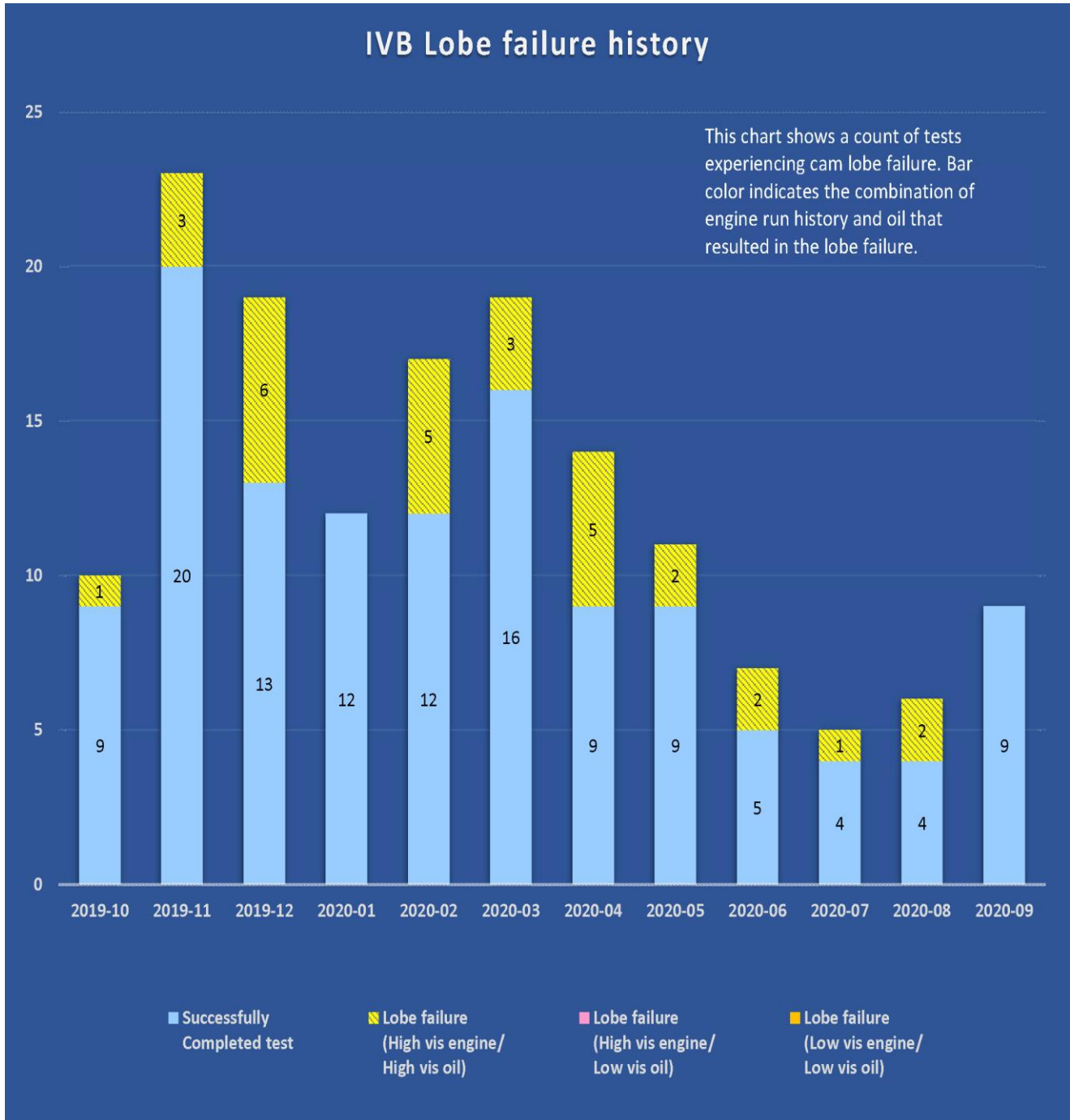
The stacked bar chart below shows the number of completed tests by engine history/oil combination. Oil viscosities are categorized as either “High” (0W-16 or higher) or “Low” (<0W-16) and engines are categorized as either having run a low viscosity oil (“Low”) or not (“High”). This results in four possible engine history/viscosity combinations. In the past twelve months, all tests have been conducted on oils 0W-16 or higher and in engines that have never run a low viscosity oil thus all bars are entirely solid blue (“high/high”).



The stacked bar chart below shows the outcome of tests reported over the past twelve months. Tests are declared either “Valid”, “Invalid”, or “Non-interpretable”. Valid tests are those that completed successfully and produced a usable (though not necessarily passing) test result. Examples of invalid tests would be tests aborted due to an instrumentation failure, or were unable to complete due to an oil leak, etc. The non-interpretable label is procedurally restricted for use on tests exhibiting cam lobe failure on one or more cam lobes. The data does not indicate that lobe failure is more common at any particular lab. Lobe failure does appear to be more common in the 0W-16 and 0W-20 viscosity grades. Thirty two percent of all registered 0W-16 tests (12 out of 38) and 17% of 0W-20 tests (15 out of 86) have experienced lobe failure. There have been a total of 33 lobe failures in 256 IVB tests (13%).



Shown below is a stacked bar chart showing the monthly breakdown of the total number of tests and the circumstances of all tests experiencing lobe failure. Each bar shows the number of successfully completed tests as well as the number of tests experiencing lobe failure. The lobe failures are classified as being one of the four possible combinations as previously described on page 2 (PAPTG has requested the omission of the low vis engine/high vis oil combination. This combination of failure has never occurred.). All lobe failures reported in the past twelve months have been on oils grade 0W-16 or higher in engines that have never run a formulation lower than 0W-16 and are thus shown in hatched yellow.





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Attachment 6

Test Monitoring Center

<http://astmtmc.cmu.edu>

IVB Lobe Wear

All Reference data reported through 11/17/20

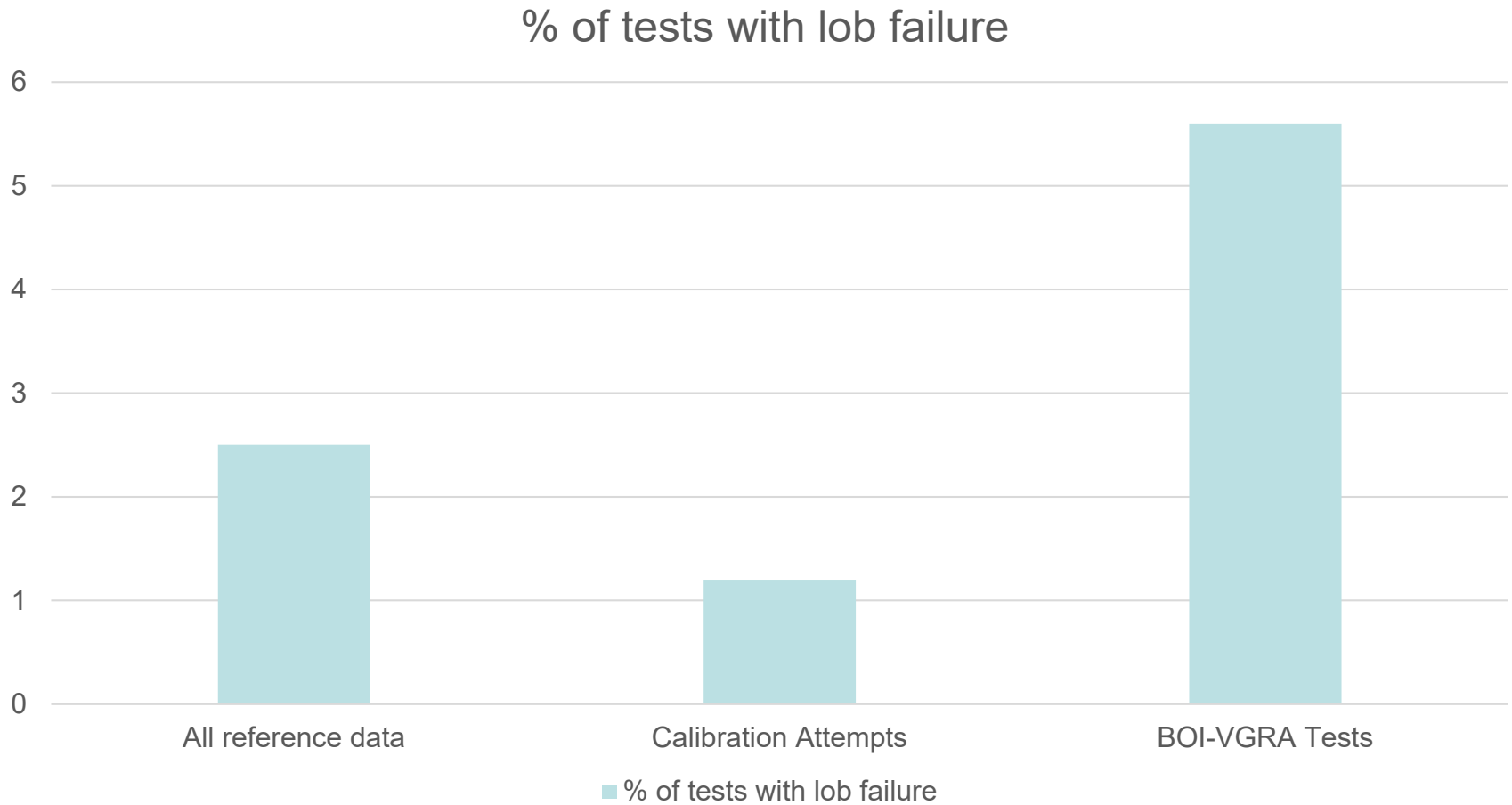
Summary of Review

- All data (prove out, development, matrix, BOI-VGRA and subsequent reference data) reviewed for occurrence of lobe failure
- Five occurrences noted in reference data with some 197 results.
- Most recent occurrence was a BOI-VGRA oil result on March 17, 2019.

Rates of Lobe Failure

- All data (prove out, development, matrix, BOI-VGRA and subsequent reference data) shows 5 lobe failures in 197 results
- Tests for calibration purposes showed a single lobe failure in 84 calibration attempts.
- One BOI-VGRA oil result exhibited lobe failure out of the eighteen BOI-VGRA tests run.
- Breakdown by oil indicates three tests on RO 300, one test on 1011 and one on a BOI-VGRA oil.
- Four of the five lobe failures occurred on 5W-30 oils and one occurred with a 0W-16 oil.

Rates based on Type of Test



Timeline of Lobe Failures

Date	Purpose	Oil	Vis Grade
9/15/2016	Prove out for Matrix 1	300	5W-30
3/23/2017	2 nd test on stand, 1 st matrix	1011	0W-16
11/17/2017	Matrix test	300	5W-30
6/16/2018	1 st calibration attempt on a new stand	300	5W-30
3/17/2019	BOI-VGRA test	IVB17-1	5W-30



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Lobe Failure Investigation

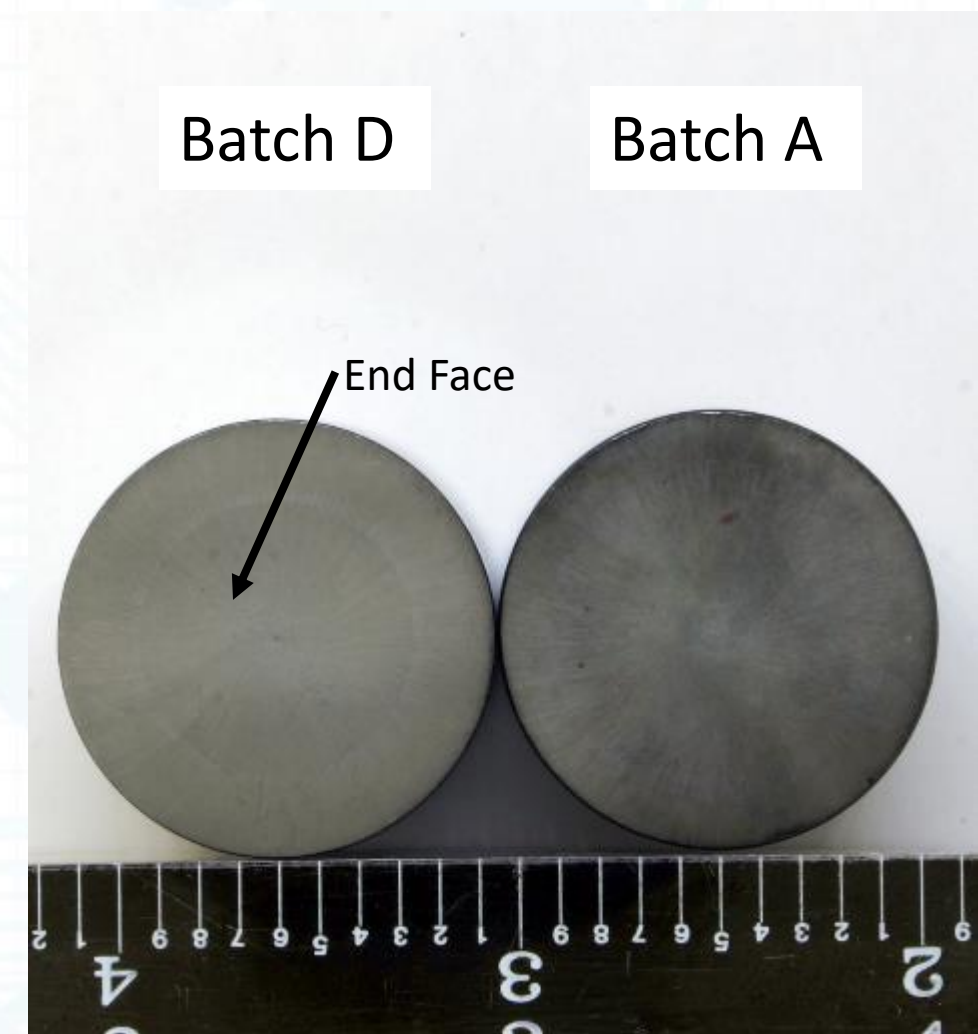
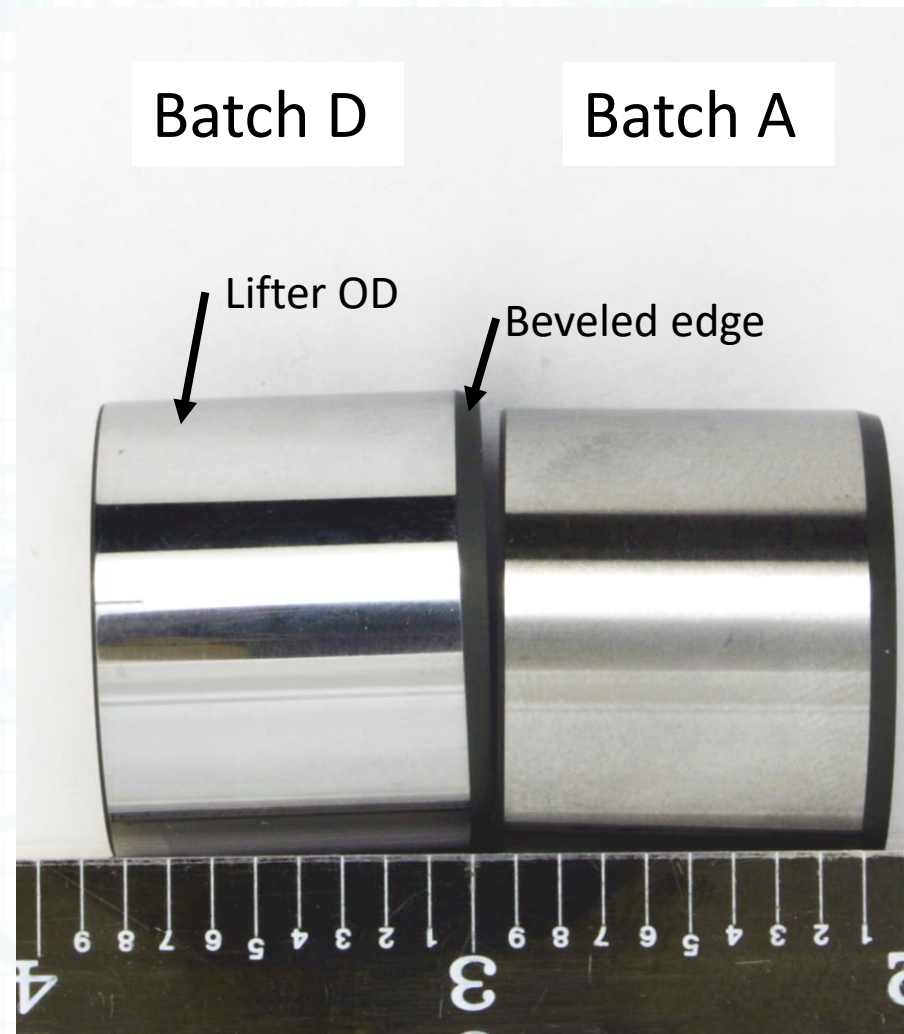
10/12/2020

Lifter Rotation

- SwRI is primarily focused on factors that affect rotation
- Hardness and other material factors have been studied but are more difficult to change at this stage
- Lifter rotation is often induced in valvetrains to reduce wear
- Lifter rotation has proven to have an impact in the ISB and IIG tests
- The resistance to rotation of IVB lifters during post-test inspection varies
- The IVB lifter batch that was introduced late 2019 has visual differences to earlier batches

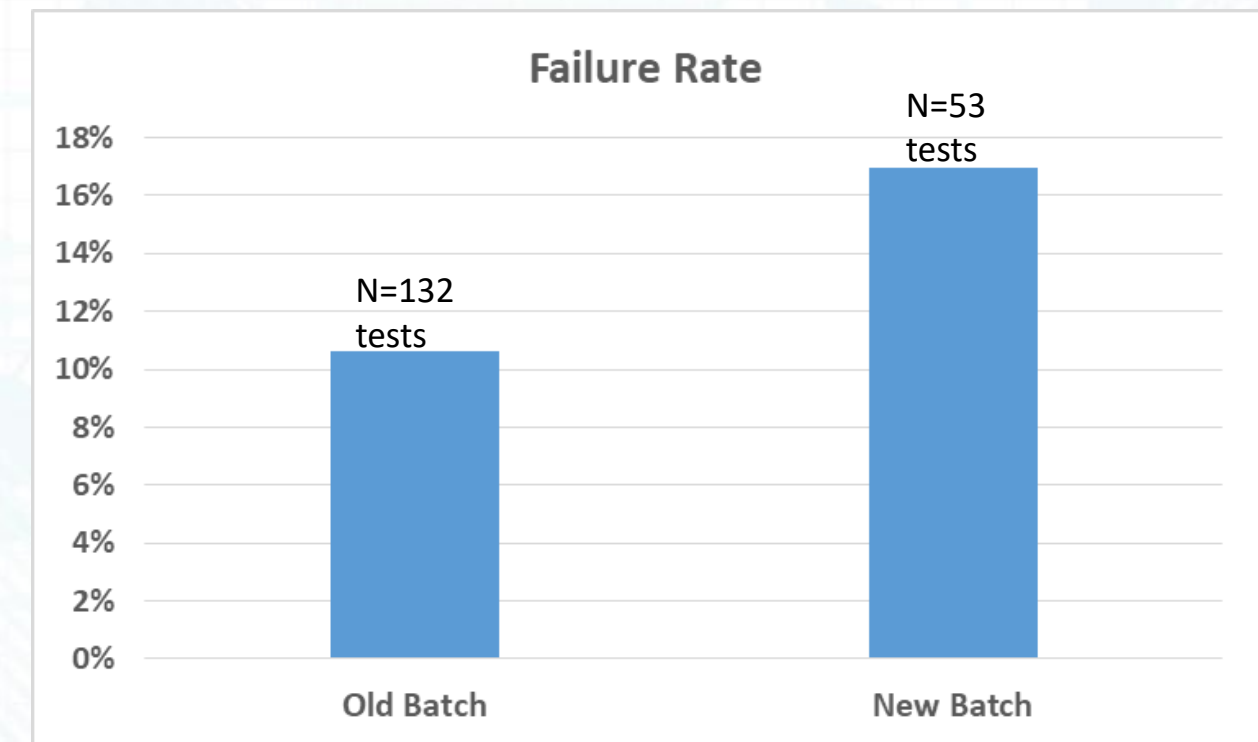
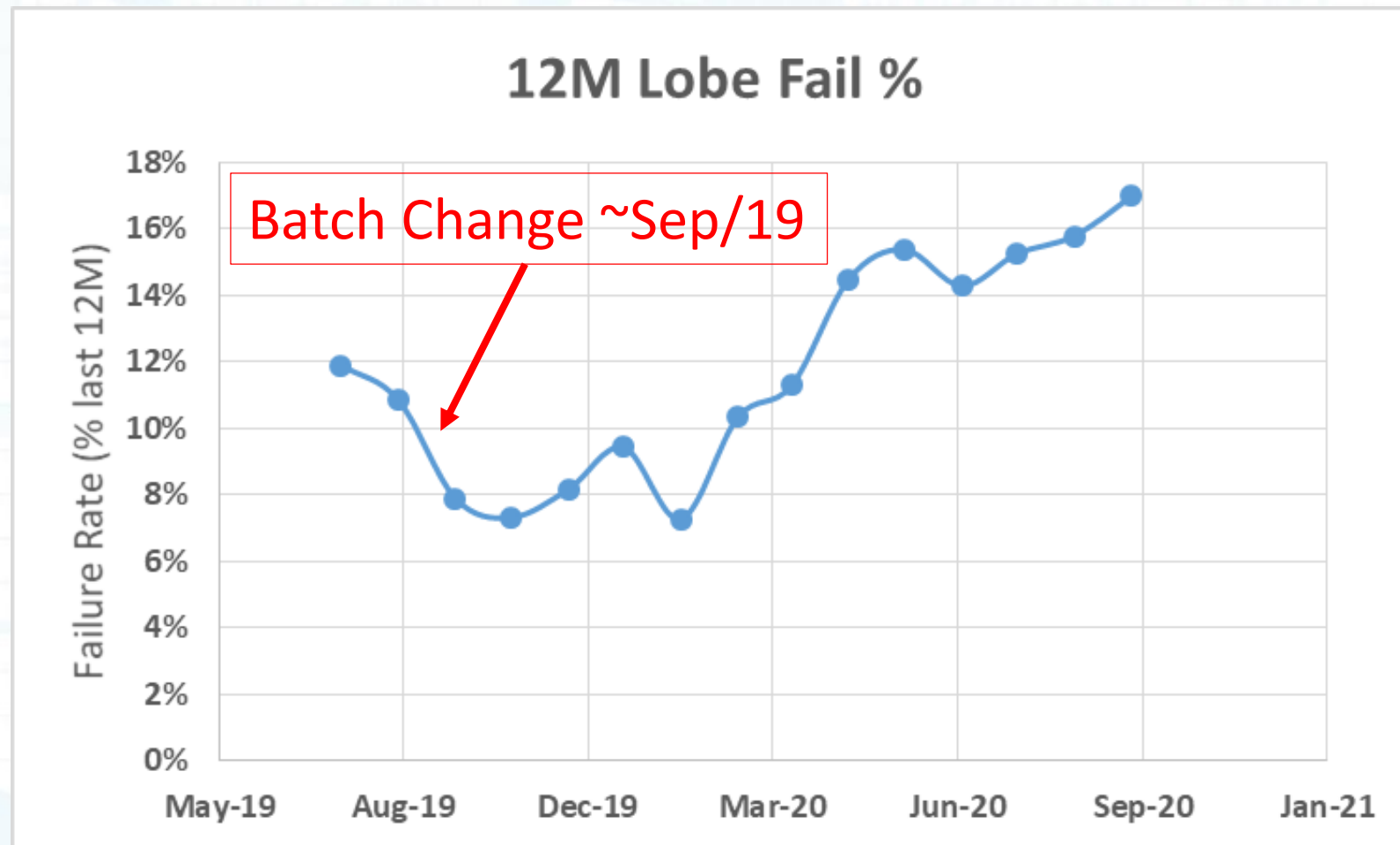
Lifter Batch Change

- IVB lifters do not have batch control but they are assigned letters when received by OHT
- SwRI began using D lifters in ~8/2019
- The OD of the D lifters appear more reflective than earlier lifters



Impact on lobe Failure Rate?

- The lobe failure rate has increased over the last year but there is limited data
- Further study is warranted

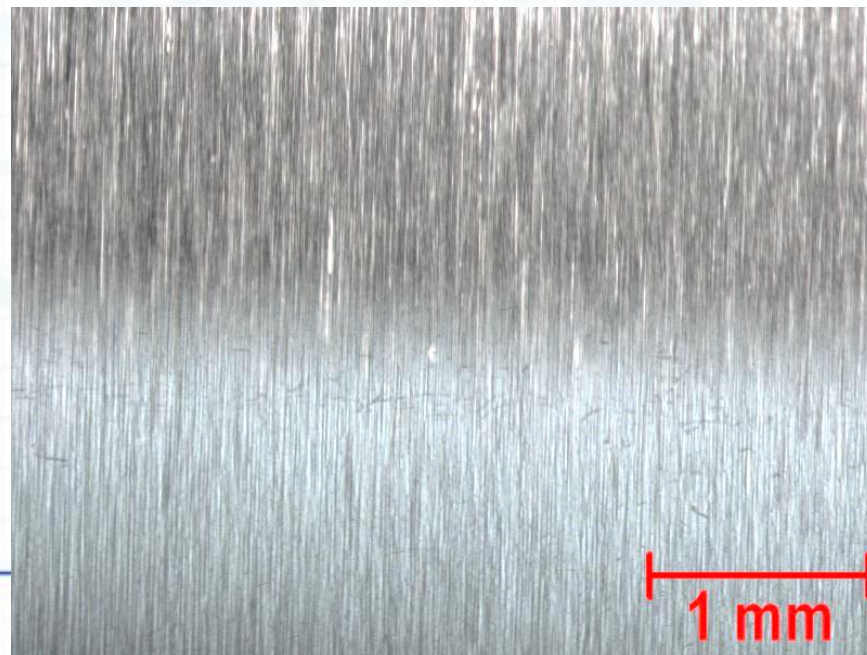


*Note: This data includes all registered candidates so there is potentially an oil effect

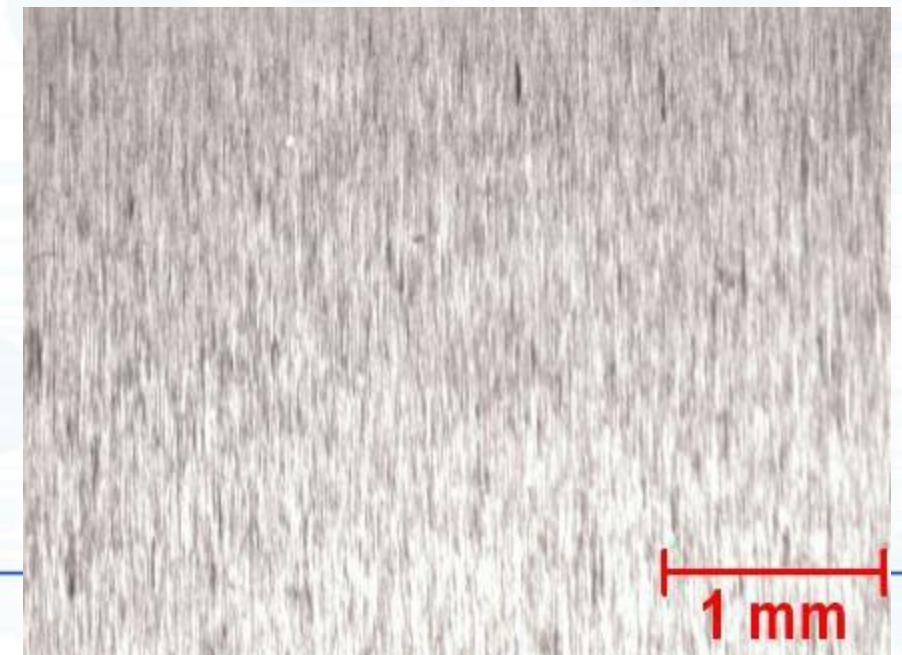
Lifter OD Inspection—Stereomicroscopy

- Representative OD surface areas were examined on both samples under diffusion and direct oblique lighting conditions
- The batch A sample appeared to exhibit slightly coarser machine lines compared to the batch D sample

Batch D Sample



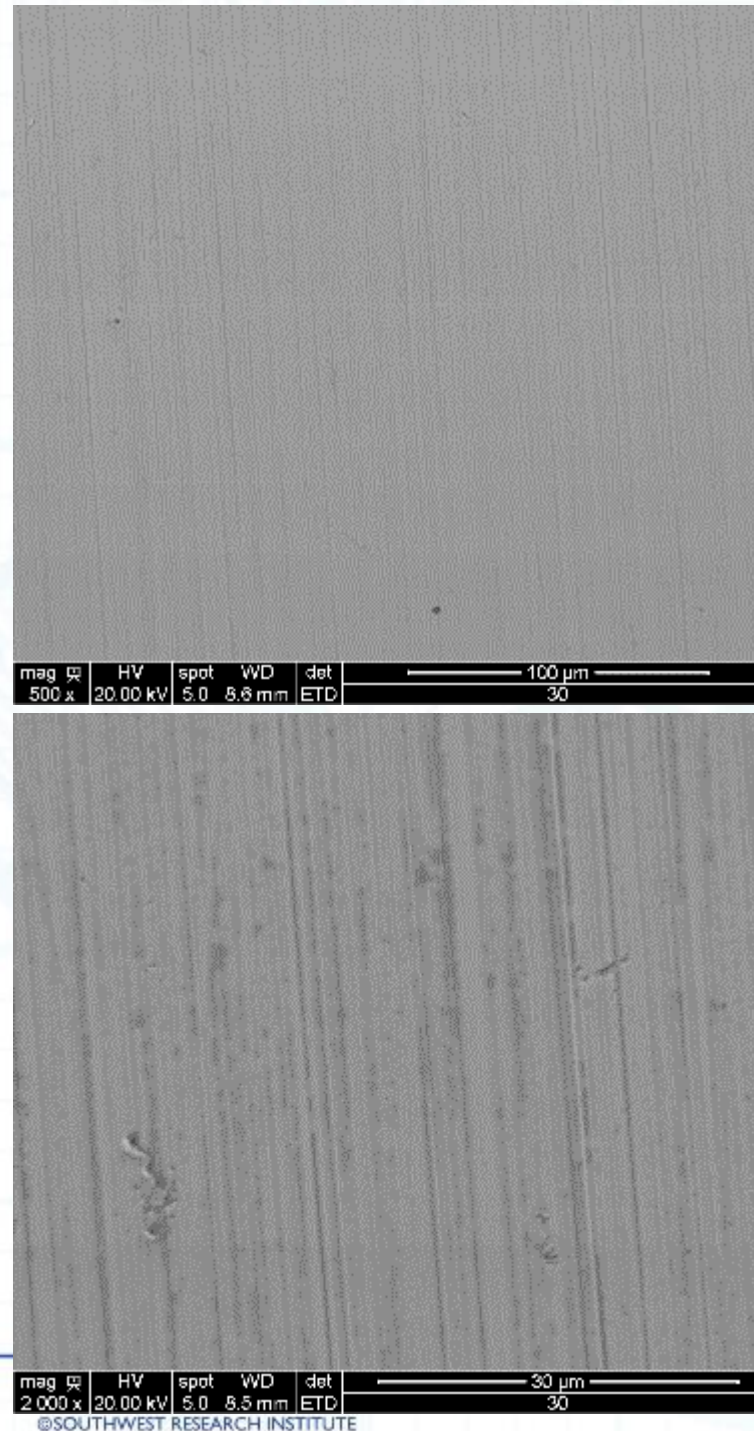
Batch A Sample



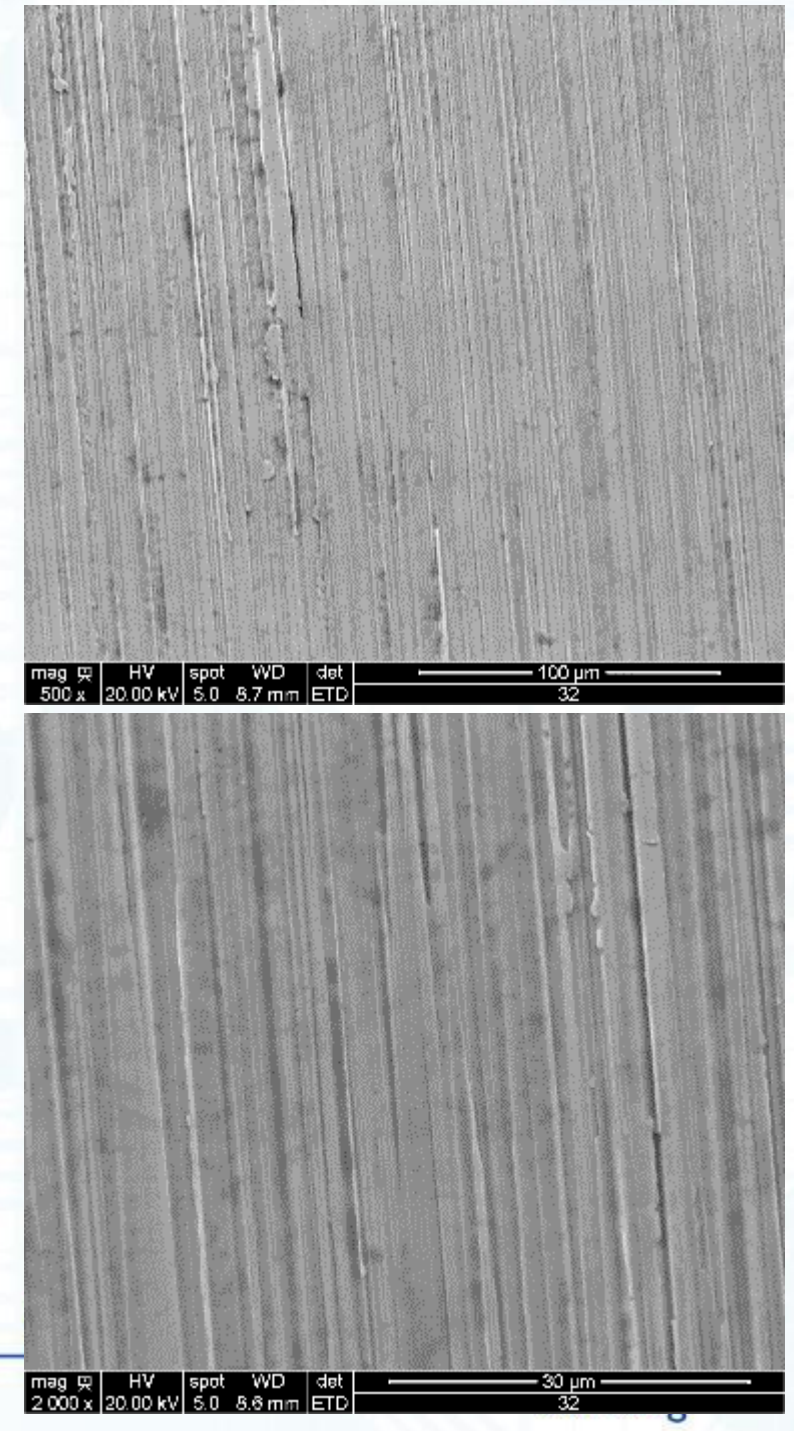
Lifter OD Surfaces—SEM

- Representative OD surface areas were examined at high magnification using SEM imaging
- Machining lines on the batch A sample were deeper, exhibited more severe microcutting and microplowing adjacent to individual lines

Batch D Sample



Batch A Sample



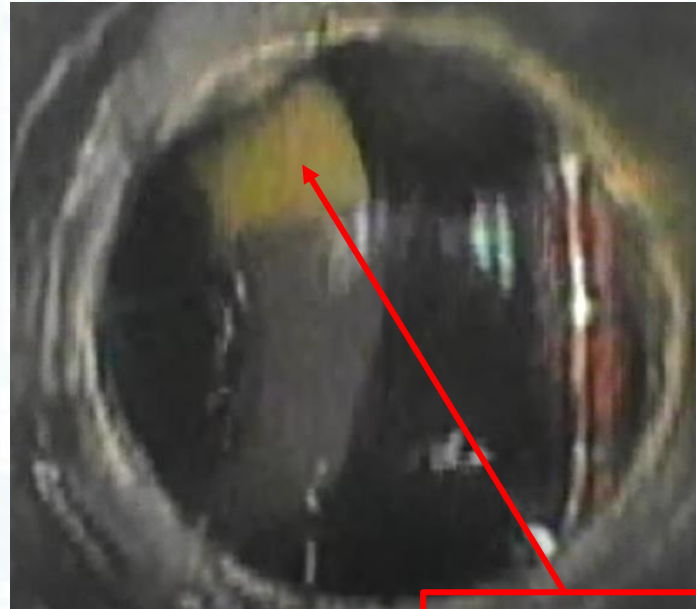
Lifter Inspection Summary

- There are significant differences in surface finish as well as some differences in coating composition
- However, the coating is believed to be removed relatively quickly as it is primarily for start-up protection
- The OD finish difference is expected to persist and may result in less oil retention and consequently less consistent rotation on the new batch D lifters?

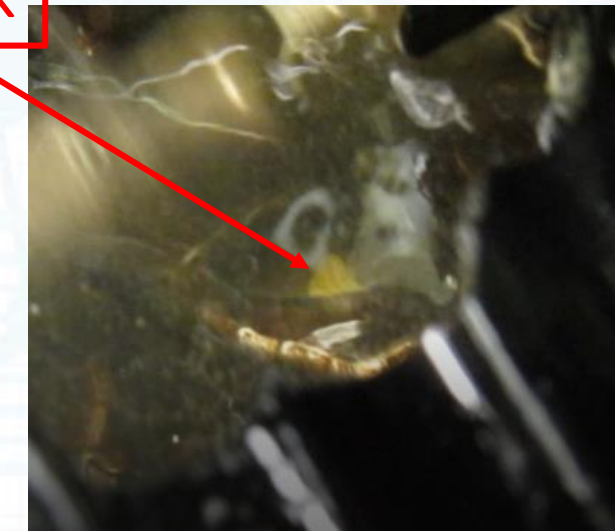
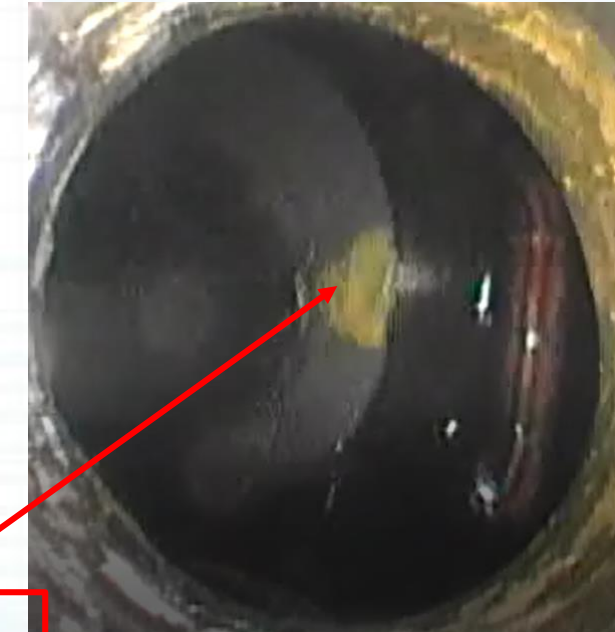
Lifter Rotation Observation

- Recordings of lifter rotation in the engine with each batch have been done
- SwRI marked the lifter with yellow paint marker and observed the lifter moving while the engine was running
- Some differences were witnessed at idle but over the test cycle it was unclear
- More study is needed

Batch D Sample



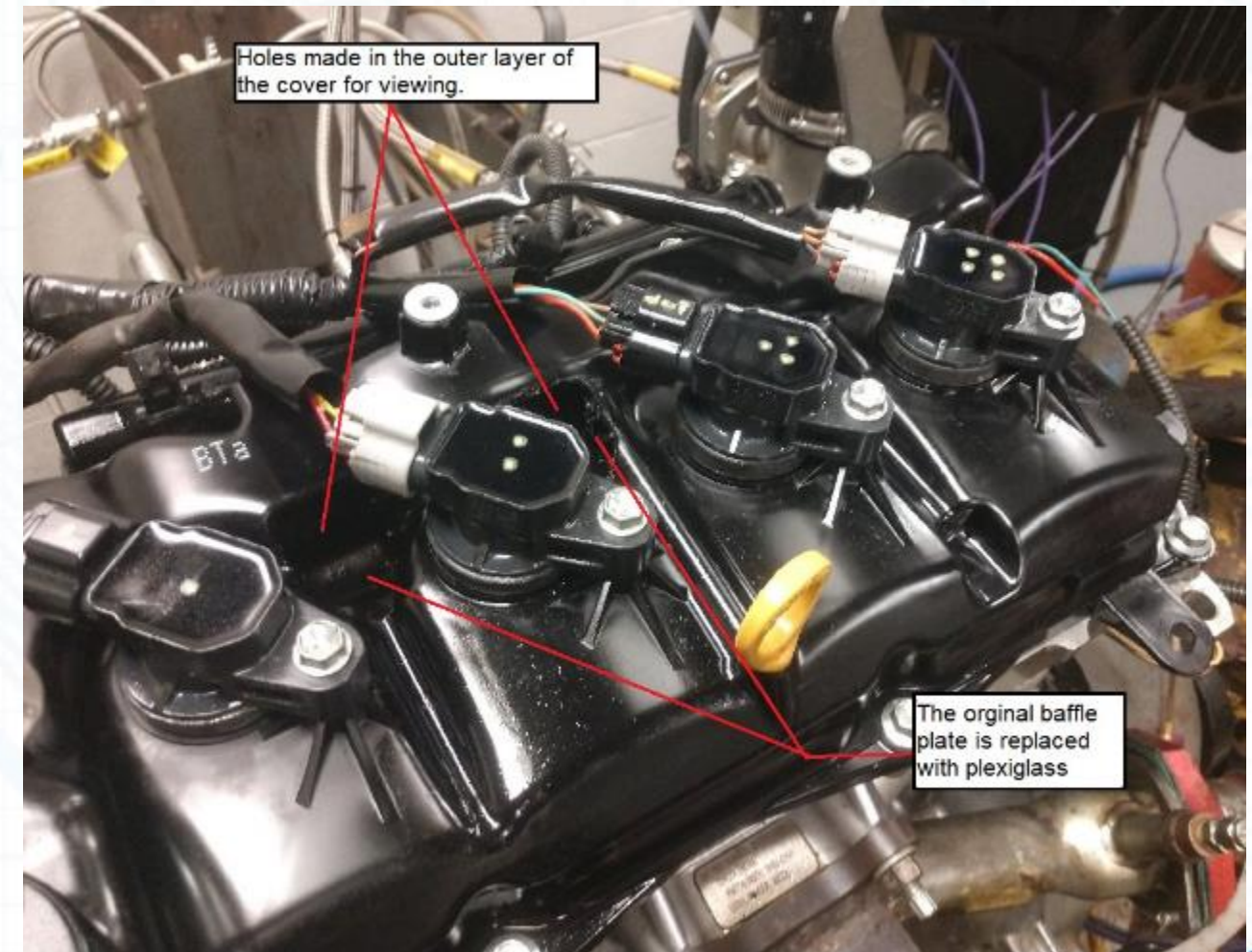
Batch A Sample



Yellow paint mark

Lifter Rotation Future Work

- Lifter rotation varies over each cycle and the course of the test
- Observation and quantification for an extended period is required
- SwRI has modified two valve covers for recordings
- Other methods are being explored

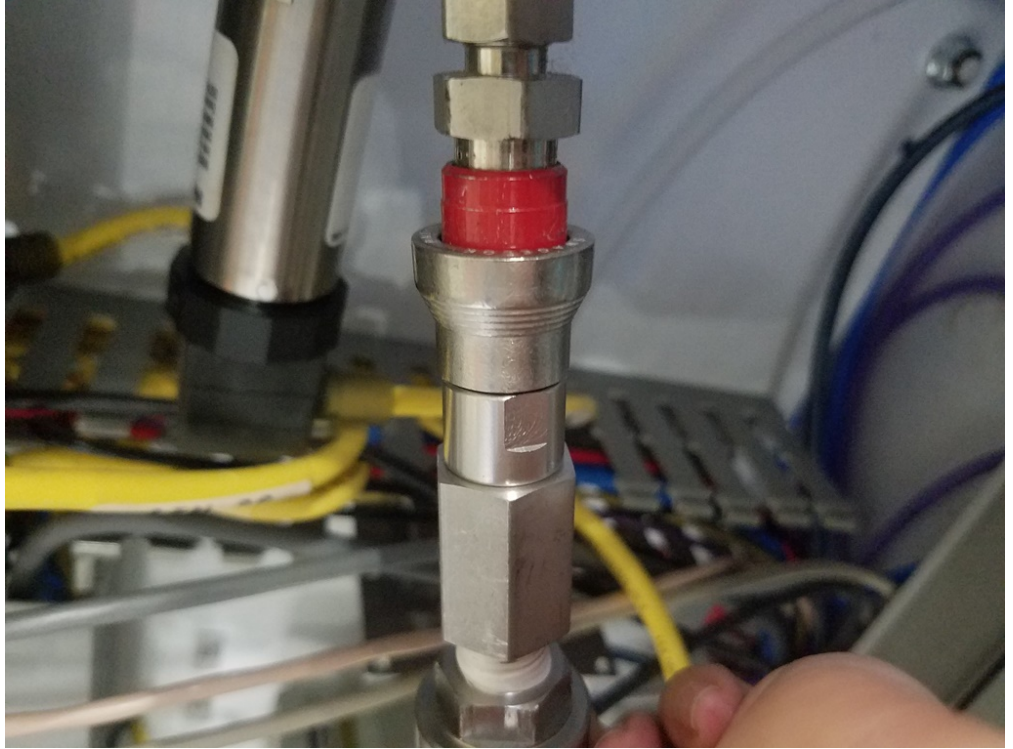


Lifter Rotation Future Work

- Once we have a system in place, we will:
 1. Determine if there is a difference in rotation rate between lifters with different surface finishes
 2. If so, consider making another batch with the finish that provides the highest rotation rate







Sequence IV Surveillance Panel
November 19, 2020
1:30PM – 3:30PM
Conference Call

Motions and Action Items

As Recorded at the Meeting by Bill Buscher

1. Motion – The Sequence IV Surveillance Panel approves the TGC Fuels Task Force recommendation for a revised KA24E Green test fuel specification as written.
Rich Grundza / William Buscher / Passed 16 – 0 – 1
2. Motion – The Sequence IV Surveillance Panel approves the TGC Fuels Task Force recommendation to remove the KA24E Green test fuel specification from the Sequence IVA (ASTM D6891) and the Sequence IVB (ASTM D8350) test procedures, and to post the fuel specification on the ASTM TMC website.
William Buscher / Teri Kowalski / Passed 16 – 0 – 1
3. Action Item – SwRI and Intertek to further investigate lifter differences that SwRI has visually observed. SwRI and Intertek to measure surface finish on a sampling of new lifters from Lifter Batches A, B, C and D. Lifter sides will be measured.
4. Action Item – ASTM TMC to conduct a correlation of lifter ID to lifter wear and lobe failures for reference oils and test users to conduct a correlation of lifter ID to lifter wear and lobe failures for candidate oils.
5. Action Item – Sequence IV Surveillance Panel chair to draft a response to ACC PAPTG and distribute to the surveillance panel members for feedback, prior to sending to the ACC PAPTG.
6. Motion – The Sequence IV Surveillance Panel approves changes to the Sequence IVB Golden Test stand, which include using a laboratory's commonly used bulkhead fitting, in place of the Golden Stand bulkhead fitting for the pressure lines and modifying the Golden Stand driveline guard to allow for the use of hinges and pins.
Ben Maddock / Andrew Stevens / Passed Unanimously 17 – 0 – 0

