

HEAVY-DUTY ENGINE OIL CLASSIFICATION PANEL
OF
ASTM D02.B0.02
December 10, 2019
New Orleans Marriott – New Orleans, LA

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ACTION ITEMS

MINUTES

1.0 Call to Order

- 1.1 The Heavy-Duty Engine Oil Classification Panel (HDEOCP) was called to order by Chairman Shawn Whitacre at 1:30 p.m. on Tuesday, December 10, 2019, in the Mardi Gras Ballroom FGH of the New Orleans Marriott.
- 1.2 There were 17 members present and 79 guests present. The attendance list is included as **Attachment 2**.

2.0 Agenda

- 2.1 The agenda circulated prior (included as **Attachment 1**) had a minor change. New item is a short presentation to announce the start of work on replacing EOAT with COAT.

3.0 Minutes

- 3.1 Minutes from June 2019 posted on TMC website. Minutes approved as posted.

4.0 Membership

- 4.1 There were 2 membership changes. Barbara Goodrich replaces Abdul Cassim for John Deere and David Brass replaces Bob Salgueiro for Infineum.

5.0 Existing Categories

- 5.1 HDEOCP Parts Task Force, Cory Koglin. **Attachment 3**
 - 5.1.1 HD Parts Task Force (TF) gave an update highlighting progress since the June 2019 meeting. The TF's goal is to anticipate parts shortages and to predict the need for a replacement test. The TF provided detailed inventory on hardware and usage. HD parts usage doesn't always line up; ex. pistons and rings may be used at different rates. Clarification: the dates in the graph is a projection from current usage.
 - 5.1.2 Volvo/Mack Test – The Mack T-8 model projects that 2nd ring and oil rings are the limiting hardware. In the Volvo T-13 the cylinder liner is the limiting part. Current batch is expected to be available until 2022.

- 5.1.3 Cummins Tests – The ISM model predicts that cross heads will run out in February 2020, while the ISB critical parts look good through 2024.
- 5.1.4 Daimler Test – DD13 oil rings and pistons are the critical parts. Availability is projected until January 2021.
- 5.1.5 CAT Tests – Oil filters are the critical parts. Available until early 2023.
- 5.1.6 In summary, the model is complete with the exception of the CAT test due to CAT keeping their own inventory. CAT will continue to support the test for quite some time. The TF suggests the TMC to keep inventory in the future. The Surveillance Panels should use the model to be proactive on hardware tracking and they should look into part changes every six months to a year.

5.2 TMC Maintenance Report, Sean Moyer. **Attachment 4**

- 5.2.1 Activity levels are down when compared historically. All COAT stands are calibrated. CAT tests have no issues. The reference oil for the 1MPC test cannot be re-blended. Matrix must be ran on a new oil, which is unlikely. The test will not be supported once current oil is depleted. The CAT Surveillance Panel (SP) is working on correlating the EOAT to COAT.
- 5.2.2 Mack T-12 skirts continue to be reused.
- 5.2.3 ISM crossheads have high rejection rate (75%). The SP is scheduled to discuss action on December 18, 2019. ISB Camshafts have been approved with wider taper specs.
- 5.2.4 RFWT no issues.
- 5.2.5 EOAT is using last known hardware. Test will not be available after 2024.
- 5.2.6 Future plan is to tie parts model with TMC update.

5.3 CLOG Status Update, Brent Calcut. **Attachment 5**

- 5.3.1 Looking for volunteers, contact Brent Calcut or Dennis Bachelder. CLOG was formed in 2015 for the purpose of GF-6 being able to monitor replacement tests and availability. During the last meeting, equivalency limits on IIIF to IIIH60/70 were discussed and proposed. CLOG presented the limits to API and limits were approved.
- 5.3.2 Current Status, 70HR IIIH 4 test matrix was run and data was analyzed by statisticians. The equivalency limits to IIIF were proposed and accepted by the Sequence IIIH SP. The new limits to be revised in D4485. **Motion was made to change to new limits proposed by CLOG, seconded by Eugene Scanlon of BASF. 13 in favor, 0 opposed and 1 waived. Motion carries.**
- 5.3.3 EOAT life is unknown. Expected EOL was last year but the test is still running. CLOG can help propose COAT equivalency limits.

5.4 COAT Update, Hind Abi-Akar. **Attachment 6**

- 5.4.1 EOAT life is questionable, on borrowed time. The COAT must replace it. The test has been running in all stands since May 13, 2019. The SP is drafting a matrix to generate data for backwards compatibility as an alternative to EOAT.
- 5.4.2 The CAT SP is asking CLOG to initiate the action and work on backwards compatibility and generated data on oil 1005.
- 5.4.3 CAT needs to submit a formal request at DEAOP. The SP will need to provide the data to CLOG and CLOG will analyze it.

5.5 ASTM D4485 Surveillance Panel, Laura Birnbaumer. **Attachment 7**

- 5.5.1 SP has been established to review ASTM D4485. The SP is reviewing current test specifications. Editors found typos in a table that refers to "IN" instead of "1N". In the past, any editing changes needed validation from numerous panels before changes could be made. Now, information letters are sent out with corrections instead of having a panel meeting. Editorial changes are not done by the SP alone and editorial comments are only suggested by the SP.

6.0 Old Business

6.1 Ford 6.7L Update, Mike Deegan. **Attachment 8**

- 6.1.1 Mike gave a quick history on why test was developed. The test length is 200 hr generating soot. Filter plugging occurred due to high soot, issue was resolved with dual filter set up. Independent labs completed prove out tests. The labs hit the three proposed soot windows.
- 6.1.2 The Long block is reused for 4-5 tests.
- 6.1.3 Data on PC-11B and Factory Fill oil was presented. Average weight loss is taken to show discrimination between the two oils. Currently working with independent statisticians to review data for discrimination. The precision matrix will require a minimum of 12 tests.
- 6.1.4 Iron plot was shown. Not enough discrimination to use as pass/fail.
- 6.1.5 Ford is working with teams to come up with the precision matrix. Possible use of 2 fuels (PC10 and pump fuel).
- 6.1.6 Draft ASTM procedure is expected to be completed by end of the year. Planning to post it on the TMC website.
- 6.1.7 Action items from EMA meeting: Compare test and failure modes to the ISB and ISM.

6.2 Fixed Limits for EOEC, Joe Franklin. **Attachment 9**

- 6.2.1 Original limits were set on fixed limits.
- 6.2.2 Reference Oil 1006 will not be available any longer. Replacement Reference Oil is 1007. Joe is proposing the use of a letter ballot or information letter to replace the RO1006 with the RO1007.
- 6.2.3 Proposing fixed limits based on the last 3 years of TMC RO1006-2 data. The data highlighted represents the average plus-minus 3 sigma. The data used the last 3 years to calculate the standard deviation. The standard 3 sigma was then used to determine proposed values. Joe did not want to make a motion since the data has not been reviewed by representatives.
- 6.2.4 The group may want to see the data on how limits were found.
- 6.2.5 Joe added that we have less than 6 months of oil left.

7.0 New Business

7.1 CBT Limits from HTCBT, Joe Franklin. **Attachment 10**

- 7.1.1 CBT test has little application to API categories, it is used in old categories only. CBT is only available in two labs. Propose to use HTCBT to replace it.
- 7.1.2 Proposal that the SP run performance study on the CBT reference oil in the HTCBT tests.
- 7.1.3 Question was asked what is the benefit of reviving this test if it's not part of D4485? Joe replied that there is no real reason why it is still around. Keeping old categories does not help OEMs if quality is uncontrolled.

8.0 Next meeting

8.1 The next meeting is scheduled for June 30, 2020 at the Washington Marriott Wardman Park in Washington DC.

9.0 The meeting was adjourned at 2:48 p.m.

D02.B0.02.1 HDEOCP

Shawn Whitacre

Chairman

Heavy-Duty Engine Oil Classification Panel

December 10, 2019

New Orleans, LA USA



AGENDA

D02.B0.02.1

Heavy-Duty Engine Oil Classification Panel

Tuesday, December 10, 2019 1:30pm CST

New Orleans Marriott

New Orleans, Louisiana USA

Attachment 1; Page 2 of 5



- 1) **Call to Order/Anti-trust statement**
- 2) **Minutes** – Approval of Minutes from June 25, 2019 Meeting in Denver, CO USA
- 3) **Membership**
 - a) Review current panel membership
- 4) **Existing tests/categories**
 - a) Review of status of carry-over engine tests that support API CK-4, FA-4 and legacy categories (Cory Koglin, Afton; Sean Moyer, TMC)
 - b) CLOG Update (Brent Calcut, Afton)
 - c) EOAT/COAT Update (Hind Abi-Akar, Caterpillar)
 - d) D4485 Surveillance Panel report (Laura Birnbaumer, Chevron Oronite)
- 5) **Old Business**
 - a) Update on Ford 6.7L Wear Test Development (Michael Deegan, Ford)
 - b) EOEC Fixed limits (Joe Franklin, Intertek)
- 6) **New Business**
 - a) HTCBT/CBT (Joe Franklin, Intertek)
- 7) **HDEOCP Adjournment (transition to DEOAP)**



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ASTM-HDEOCP Membership

Oil and Additive Companies		OEMs	
1	Shawn Whitacre - Chevron	1	Patrick Holmes – Volvo Powertrain
2	Steve Jetter - ExxonMobil	2	<i>Ryan Denton- Cummins Inc.</i>
3	Dan Arcy - Shell	3	Mesfin Belay - Detroit Diesel
4	Corey Taylor - BP Castrol	4	Hind Abi-Akar - Caterpillar Inc.
5	Ed Murphy – Valvoline	5	Heather DeBaun – Navistar
6	Eugene Scanlon - BASF	6	<i>Barb Goodrich - John Deere</i>
7	Justin Mills - Evonik	7	<i>Nathan Siebert (acting) - GM Powertrain</i>
8	Cory Koglin – Afton	8	Jason Andersen- Paccar
9	Robert Stockwell – Chevron Oronite	9	Mike Deegan - Ford
10	John Loop – Lubrizol		
11	<i>David Brass - Infineum U.S.A.</i>		
12	David Taber - Phillips 66 Lubricants		
13	<i>Angela Willis, TOTAL Lubricants</i>		

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New Orleans Marriott

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 - a) HTCBT/CBT (Joe Franklin, Intertek)
- 7) **HDEOCP Adjournment (transition to DEOAP)**

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12/10/2019		Chao	Kenneth	John Deere	319-292-8459	chaokennethk@johndeere.com
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12/10/2019		Clark	Sid	ASTM Facilitator	586-873-1255	slclark@comcast.net
12/10/2019		Cooper	Mark	Chevron Oronite	210-731-5606	mawc@chevron.com
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12/10/2019		Deegan	Michael	Ford Motor Co.	313-805-8942	mdeegan@ford.com
12/10/2019		Dennis	Barbara	BP	973-686-3313	barbara.dennis@bp.com

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12/10/2019		Farber	Frank	ASTM - TMC	412-365-1030	fmf@astmtmc.cmu.edu
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12/10/2019		Gbadamosi	Muibat	Royal Purple	713-705-9197	mgbadamosi@royalpurple.com
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12/10/2019		Holmes	Patrick	Volvo	717-658-8007	patrick.holmes@volvo.com
12/10/2019		Hopp	Meryn	General Motors	248-318-7303	meryn.hopp@gm.com
12/10/2019		Hsu	Jeffrey	Shell	281-544-8619	j.hsu@shell.com

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12/10/2019		Kalberer	Eric	Shell	346-814-0224	eric.kalberer@shell.com
12/10/2019		Koglin	Cory	Afton Chemical Corporation	248-350-0640	cory.koglin@aftonchemical.com
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12/10/2019		Lochte	Michael	Southwest Research Institute	210-522-5430	mlochte@swri.org
12/10/2019		Loop	John	The Lubrizol Corporation	440-347-5365	john.loop@lubrizol.com
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12/10/2019		Swedberg	S.	Consultant	623-551-4220	steveswedberg@cox.net
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LastMeetingDate	Initials	LastName	FirstName	Company	Business Phone	E-mail Address
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HDEOCP Parts Task Force

New Orleans, LA

12-10-2019

Agenda

- Review
- HD part model updates
- Next Steps

HD Parts TF Team

- DEC 2018: LSDRG requested adoption of similar PCMO methodology to understand viability of current API HDEO tests and hardware
 - Cory Koglin-Afton
 - Angela Willis-Willis Advanced Consulting/PCEOCP Chair
 - Sean Moyer-TMC
 - Mark Sutherland/Derek Grosch-TEI

TF Goals

- Long Term/Continuous
 - Prediction of the need for a replacement test or action by industry because of parts end of life
 - Prediction of timing need for new parts order of critical parts
 - Provide additional granularity and detail on HD test part status at Industry level

Model Background

- HD Parts model is Significantly different than PCMO model
 - HD does not rely on banking of hardware (like PCMO)
 - Parts orders are out of sync
 - Ex. Piston orders not lined up with rings
 - Inspection fallout differences between parts
- TEI is Central Parts Distributor (CPD) for Volvo, Detroit, Cummins tests
- Caterpillar is their own CPD

HD Parts Model Conclusions

- End Of Life (EOL) scenario best fit for model
 - Prediction of the need for a replacement test or action by industry
 - Ex. T8/T11/T12
- Batched critical parts scenario decent fit for model
 - Prediction of need or timing for new parts order of critical parts
 - Includes Larger inventories of batched parts, longer lead time parts, etc.
- Continuous production scenario not a great fit for model
 - non-batched, small inventoried parts relatively easy to obtain
 - Difficulty predicting part shortages or high rejections of a normally available part

Volvo T8/T11/T12 Critical Test Parts Update

- Liner projected availability until 2028
- Rate limiting critical part- 2nd ring/oil ring-July 2020
- T8 Piston readily available from dealer (quantity=0)

Test	Part description	Batch/Date	In Stock	~Reject %	Qty/kit	Total rebuilds	Calculated Part Depletion Date
T8, T11, T12	Cylinder liner	V	124	10%	6	522	3/1/2028
T8, T11, T12	Cylinder liner*	W	3058	1%	6		
T11, T12	Piston Crown	F	1326	1%	6	218	6/1/2023
T8, T11, T12	Piston Skirt	B	3,318	5%	6	525	5/1/2028
T8	Piston Assy	n/a	5	0%	6	0	12/1/2019
T8, T11, T12	Top ring	X	903	5%	6	142	2/1/2022
T8, T11, T12	Top ring	V	0	n/a	6		
T8, T11, T12	2nd Ring	W	264	5%	6	41	7/1/2020
T8, T11, T12	oil ring	W	264	5%	6	41	7/1/2020
T8, T11, T12	Con rod bearing	Y	960	15%	6	136	1/1/2022
T8, T11, T12	Main bearing	P	171	15%	1	145	2/1/2022

*Final Batch

Volvo T13 Critical Parts Update

- Only critical part (liner) available until January 2022

T-13							Total rebuilds	Calculated Part Depletion Date
Test	Part description	Part Number	Batch/Date	In Stock	~Reject %	Qty/kit		
T13	Cylinder Liner	21334768	B	877	2%	6	143	1/1/2022

Cummins Critical Test Parts Update

- ISM: Valve Cross-head Part availability Critical
 - New batch ordered
- ISB:
 - Predicted part availability at least until 2024

ISM						
Part Description	Batch	Qty/Kit	Total	Reject %	Total rebuilds	Calculated Part Depletion Date
Valve Crosshead (Batch F - 2015)	F-2015	12	110	30%	6	2/1/2020
Push Rod (Batch C)	C	6	670	10%	100	1/1/2024
Adjusting Screw, Injector (batch E)	E	6	2044	10%	306	2027+

ISB						
Part Description	Batch	Qty/Kit	Total	Reject %	Total rebuilds	Calculated Part Depletion Date
Camshaft (Batch "K")	K	1	233	50%	116	4/1/2024
Valve Tappet (Batch "E")	E	12	2974	15%	210	2027+
Valve Crosshead (Batch E)	E	12	2119	30%	123	7/1/2024
Push Rod (Batch C)	C	12	2727	30%	159	12/1/2024

Detroit Scuffing Critical Test Part Update

- Rate Limiting Part Availability
 - Oil Ring/Piston 1/1/2021
 - Top Ring: 8/1/2021

Part Number	Description	Batch	Qty/kit	Qty total	Reject rate	Total rebuilds	Calculated Part Depletion Date
HNF471C026	Top Ring	B	6	725	5%	114	8/1/2021
A4710517	2nd Ring	B	6	2,364	10%	354	5/1/2025
A4711118001	Oil Ring	A	6	493	5%	78	1/1/2021
A4710372201	Piston	A	6	464	1%	76	1/1/2021
A4710113310	Liner	D	6	3,786	25%	473	4/1/2027

C13 COAT Critical Test Part Update

- C13 COAT Filter availability predicted until Early 2023

	COAT							
Part Number	Batch/Date	In Stock	~Reject %	Qty/kit	Estimated total (based on reject rate)	# of rebuilds by batch	Total rebuilds	Calculated Part Depletion Date
Oil filter	A	107	0%	1	107	107	107	4/1/2023

Summary/Next Steps

- Model is complete for most of the current HD tests
 - Exception is C13 and SCOTE-will not include
- Finalize spreadsheet (user input/friendliness)
- Suggest TMC to keep current and provide updates at future ASTM meetings

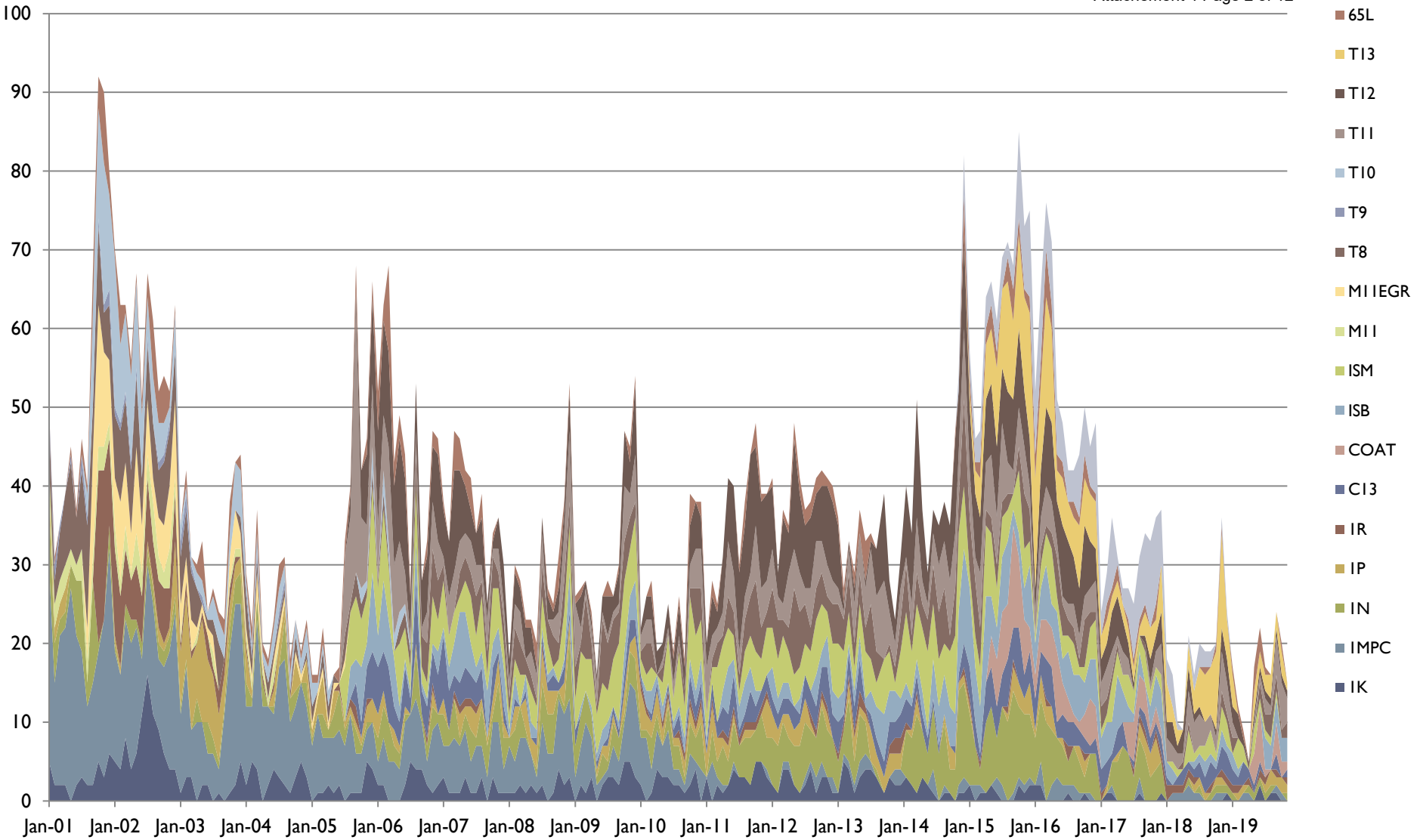
Request/Action to Surveillance Panels/Test Sponsors

- Will test parts and support be available past the current predicted part end date?
 - T8/11/12: Will critical parts (except Liner) be available to extend test to 2028
 - Cummins ISM-2024 for push rod
 - Cummins ISB-2024 for camshaft, cross-head, pushrod

D02.B0.02 Maintenance Report

December 2019

ALL TEST CANDIDATE ACTIVITY



Calibrated Labs and Stands*

Test	Labs	Stands
IK	2	2
IN	2	3
IM-PC	1	1
IP	2	2
IR	0	0
CI3	3	3
ISB	2	4
ISM	3	3
EOAT	0	0
RFWT	1	1
T-8/E	2	2
T-11	3	5
T-12/T-12A	3/3	3/3
T-13	3	4
COAT	3	3
DDI3	1	2

*As of 09/30/2019



Availability of API CH-4 through CJ-4 Tests

Test	Hardware Issues	Availability Through 2024	Notes
IK/IN	Auxiliary components	Likely	Ongoing resolution of issues with stand auxiliary systems and miscellaneous components.
IP/IR	No current issues	Likely	None
CI3	No current issues	Likely	Engine block, injectors, turbos only available through reman.



Additional Caterpillar Test Issues

➤ IMPC

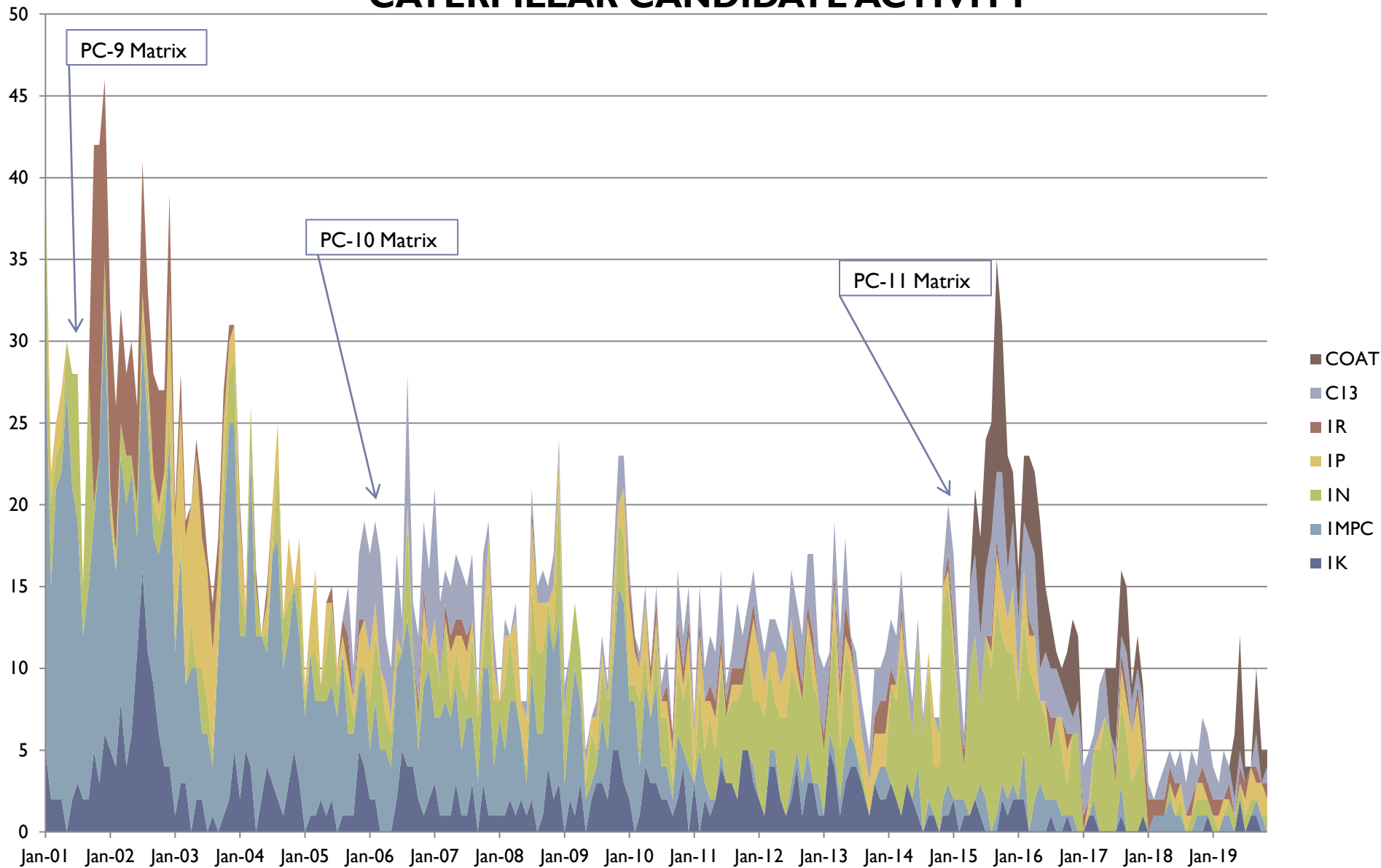
- Reference oil supply remaining for 2 tests. Reference oil can not be re-blended. Test will be unavailable once reference oil supply is depleted.

➤ COAT

- Surveillance panel discussions have begun for development of test plan to generated EOAT to COAT correlation.



CATERPILLAR CANDIDATE ACTIVITY

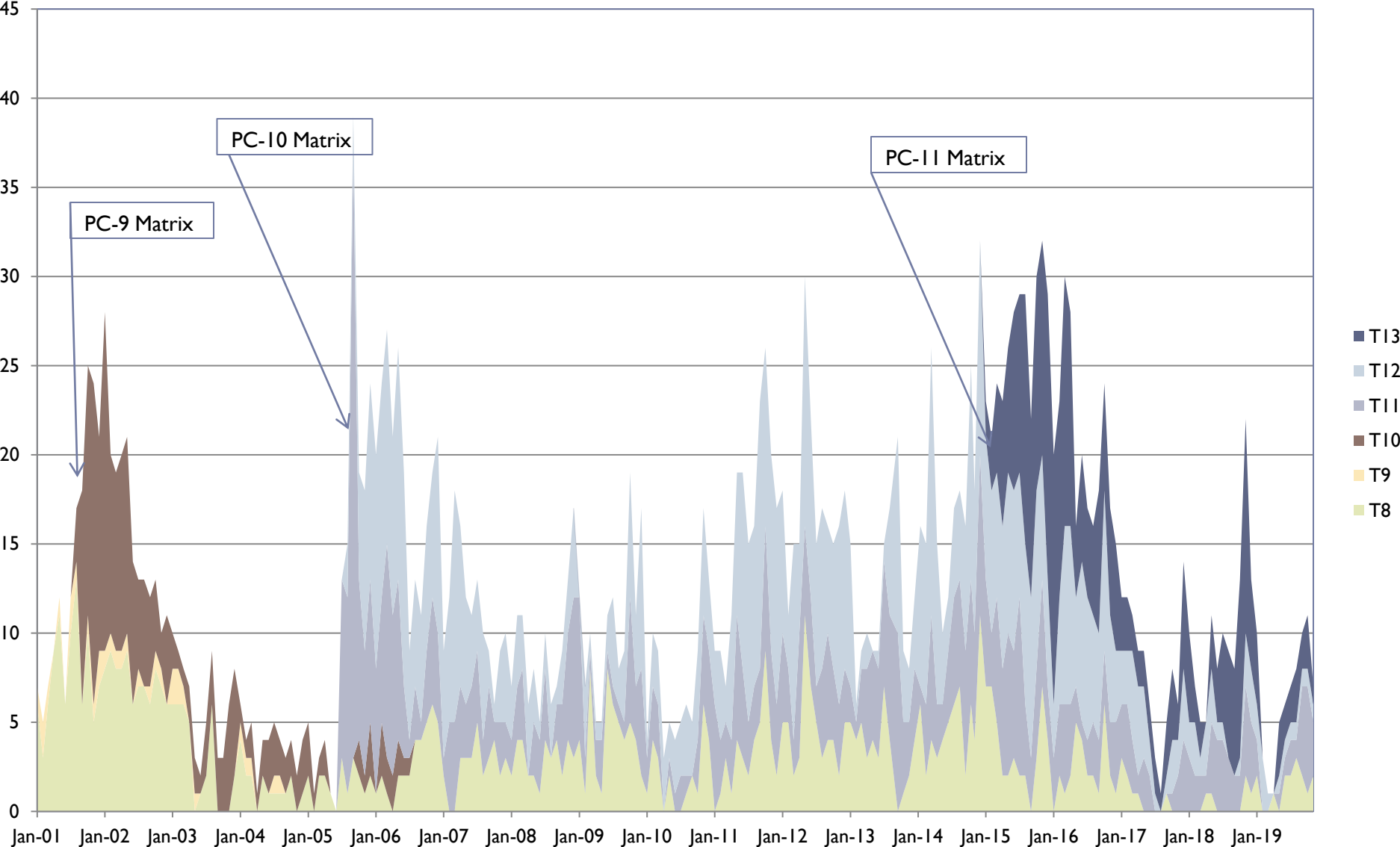


Availability of API CH-4 through CJ-4 Tests

Test	Hardware Issues	Availability Through 2024	Notes
T-8	No current issues	Likely	Engine block supply limited. Final liner batch ordered to take test to 2026
T-11	No current issues	Likely	Engine production ended 2006. Finite number of engine blocks. Engine build life issues with oil consumption. Final liner batch ordered to take test to 2026
T-12	Piston Skirts	Likely	Piston skirt batch out of spec. Rework in progress and temporary re-use of skirts allowed by panel. Final liner batch ordered to take test to 2026
T-13	No current issues	Likely	New connecting rod batch tested and approved for use.



MACK CANDIDATE ACTIVITY

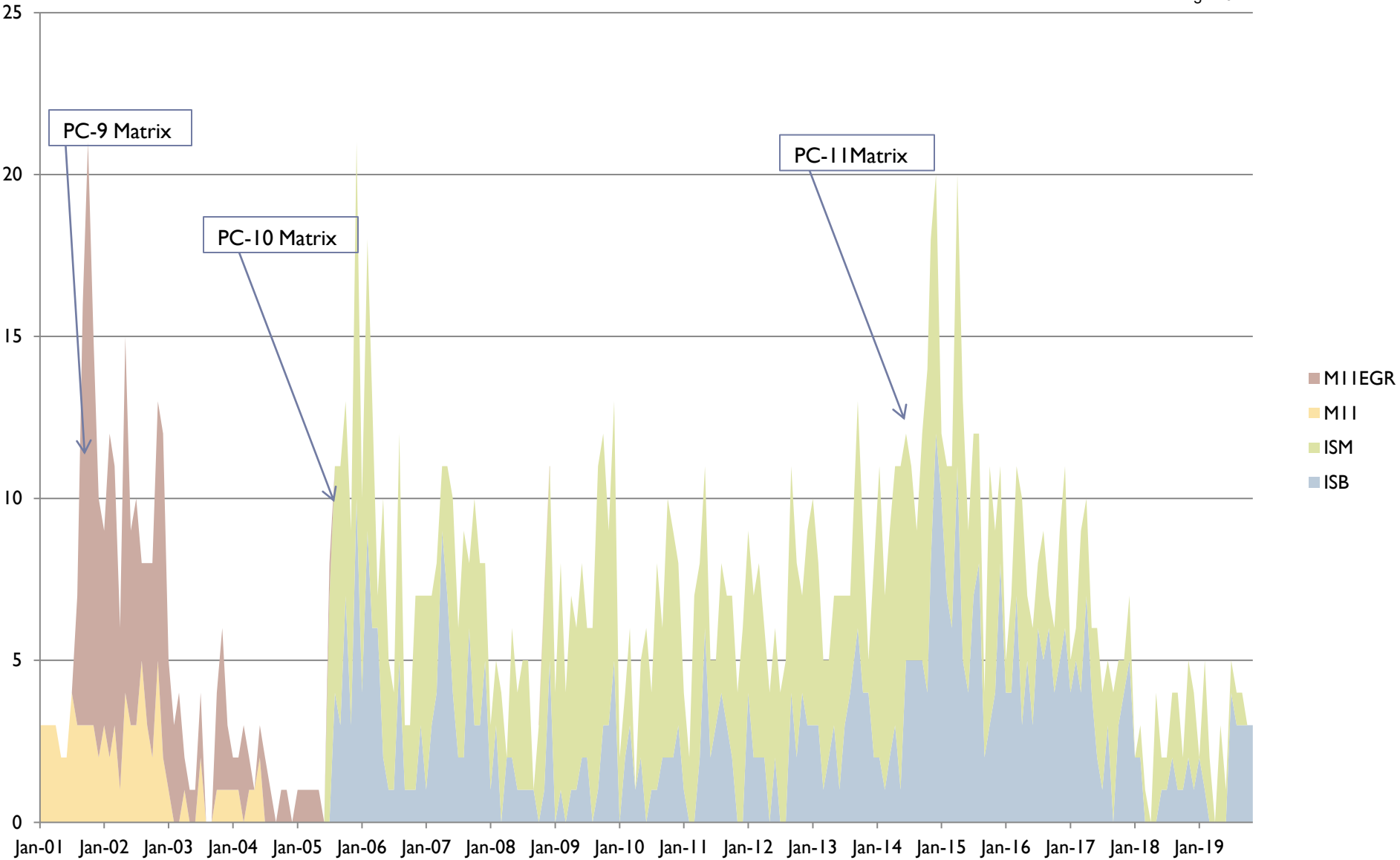


Availability of API CH-4 through CJ-4 Tests for PC-11

Test	Hardware Issues	Availability Through 2024	Notes
ISM	Crossheads	Likely	New crosshead batch has a high (~75%) rejection rate. Panel to meet 12/18 to discuss.
ISB	None	Likely	New camshaft batch secured and tests run. New camshafts approved for use with wider taper spec. Taper measurements indicated taper did not affect test results.



CUMMINS CANDIDATE ACTIVITY



Availability of API CH-4 through CJ-4 Tests for PC-11

Test	Hardware Issues	Availability Through 2024	Notes
RFWT	None	Likely	<p>Long term supply of test parts at CPD.</p> <p>6.5 L engine no longer in production at AM General, but available through supply network.</p> <p>Injection pump still available.</p>
EOAT	Using last known hardware	No	<p>Oil Temperature runs higher w/ current EOAT engine. Still no official EOAT / COAT correlation. Engine hardware available for one rebuild.</p>



B2 Action Items

- **No Action Items**
- **Comments**



CLOG Status Update

December 10, 2019



Membership

Member	Company	Member	Company
Brent Calcut	Afton	Robert Stockwell	Oronite
Matthew Ansari	Chevron	Reggie Dias	Phillips 66
Jo Lynne Parsons	CQA	Luc Girard	Sanjuro Consultant
Tia Sutton	EMA	Eric Kalberer	Shell
Rugved P. Pathare	ExxonMobil	Angela Willis	Total
Haiying Tang	Fiat Chrysler	Teri Kowalski	Toyota
Ron Romano	Ford	Mike Warholic	Valvoline
Joan Evans	Infineum	Carl Esche	Vanderbilt
Bill O'Ryan	Lubrizol	Jeremy Styer	Vanderbilt
Greg Raley	Motiva	Dennis Bachelder	API
Chris Castanien	Neste	Kevin Ferrick	API

Names in red must be confirmed

Mission

Category Life Oversight Group (CLOG)

The Category Life Oversight Group (CLOG) is a Lubricants Standards Group task force charged with monitoring the availability of tests in current API categories and recommending replacements or alternatives when availability of a test or tests is in question.

Objective

Establish Performance Criteria
for Existing API Categories
Using New Tests

Previous Meeting

- CLOG last met by teleconference on Feb. 8, 2019
- We agreed on Seq. IIF to IIH60/70 proposed limits for light duty and heavy duty categories
- CLOG chair presented the proposed limits for light duty categories to API
 - API adopted the proposed LD limits; ASTM adopted the proposed LD limits
- API Lubricants Group appointed a new CLOG Chair on Sept. 12, 2019

Summary of Status



Current Test	Replacement Test	Status	Remaining CLOG Activity	Estimated Timing
IIIF for HD	IIIH	Revised Limits proposed by statisticians and endorsed by CLOG	Revised Recommendation to be made to ASTM	Dec. 2019
IIIF for LD	IIIH	Recommendation made to API	None	Done
IIIG	IIIH	Completed	None	Done
IIIGA	ROBO	Completed	None	Done
IIIGB	IIHIB	Completed	None	Done
IVA	IVB	Completed	None	Done
VG	VH	Completed	None	Done
VID	VIE	Completed	None	Done
VID (XW-16)	VIF	Completed	None	Done
EOAT	COAT	Awaiting SP recommendation	Equivalency proposal	????

Current Status

❖ Sequence IIIF Vis Increase for Light Duty Categories

- ❖ Original proposed S category limits were deemed unacceptable
- ❖ 70HR IIIH 4 test matrix was run
- ❖ Data was analyzed by statisticians along with earlier data
- ❖ Recommendations were made for equivalency and endorsed unanimously by both the Sequence III Surveillance Panel and CLOG
- ❖ TMC updated the test procedure guidelines on how to incorporate 60 and 70HR tests at IIIH conditions
- ❖ API Lubricants Group approved these proposed limits

	API	60 PVIS, max	80 PVIS, max	WPD, min	PSV, min
IIIF Limits	SJ	325	-	3.2	8.5
	SL	-	275	4.0	9.0

Approved	API	60 PVIS, max	70 PVIS, max	70 HR WPD, min	70 HR PSV, min
IIIH Limits	SJ	307	-	2.5	7.5
	SL	-	181	3.3	7.9

Current Status

- ❖ **Sequence IIIF Vis Increase for HD categories**
 - ❖ Original proposed C category limits endorsed by HDEOCP
 - ❖ Approved by ASTM
 - ❖ 70HR IIIH matrix run for light duty and to re-validate heavy duty limits
 - ❖ Analysis of actual 70HR vis increase data vs interpolated and analysis of additional 60HR vis increase data has resulted in revised recommendations
 - ❖ Unanimously endorsed by Sequence III Surveillance Panel and CLOG
 - ❖ TMC updated the test procedure guidelines on how to incorporate 60 and 70HR tests at IIIH conditions

	API	60 PVIS, max	80 PVIS, max
IIIF Limits	CH-4	295	-
	CI-4	-	275
	CJ-4	-	275

Proposed	API	Current 60 PVIS, max	Current 70 PVIS, max (Interpolated)	Revised 60 PVIS, max	Revised 70 PVIS, max
IIIH Limits	CH-4	110	-	249	-
	CI-4	-	370	-	181
	CJ-4	-	370	-	181

Current Status

❖ Engine Oil Aeration Test

- ❖ Proposal based solely on oil 1005 made
- ❖ Request has gone out for data on other oils
- ❖ Surveillance Panel is reviewing proposals
- ❖ EOAT Life Expectancy: Q4 2018
- ❖ COAT Equivalency: Q1 2018

	API	% Aeration
EOAT Limits	CJ-4	8.0 max
	CI-4	8.0 max
	CH-4	8.0 max

No other comparison data provided

COAT was declared out of control;
provisional licensing invoked

Time to revisit?

	API	% Aeration
COAT Limits	CJ-4	TBD
	CI-4	TBD
	CH-4	TBD

Supporting data

Executive Summary of Current Proposal

- IIF – IIIH limit summary provided below with recommendation

Spec	IIF	IIF Limit	IIIH Hrs	Probability of Pass (IIIH)	PoP using IIIH SA s	IIIH Limit Recommendation	Previous IIIH Estimates
CI-4 / CJ-4 / SL	80 hr PVIS	275	60				60
			70	211	181	181	370 <i>Interpolated</i>
			80				400
CH-4	60 hr PVIS	295	60	225	249	249	110
			70				386 <i>Interpolated</i>
SJ	60 hr PVIS	325	60	291	307	307	120
			70				388 <i>Interpolated</i>
SJ	80 hr WPD	3.2	70	2.63	2.45	2.5	
			EOT				1.9
SL	80 hr WPD	4	70	3.3	3.3	3.3	
			EOT				2.3
SJ	80 hr APV	8.5	70	8.13	7.5	7.5	
			EOT (90)				6.6
SL	80 hr APV	9	70	8.19	7.84	7.9	
			EOT (90)				7.2

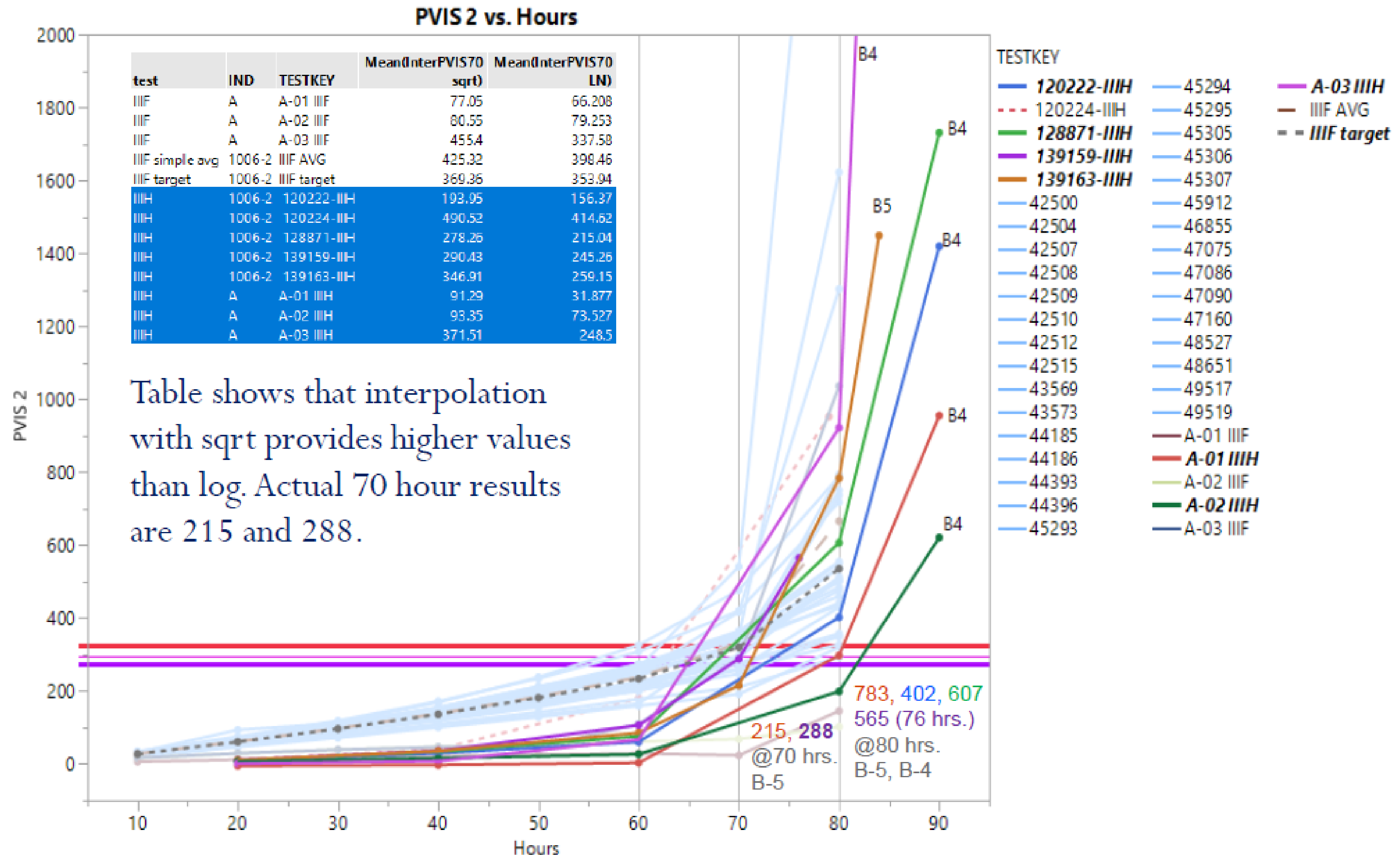
IIIH to IIIH Equivalency

Statistics Group
Jan. 22, 2019

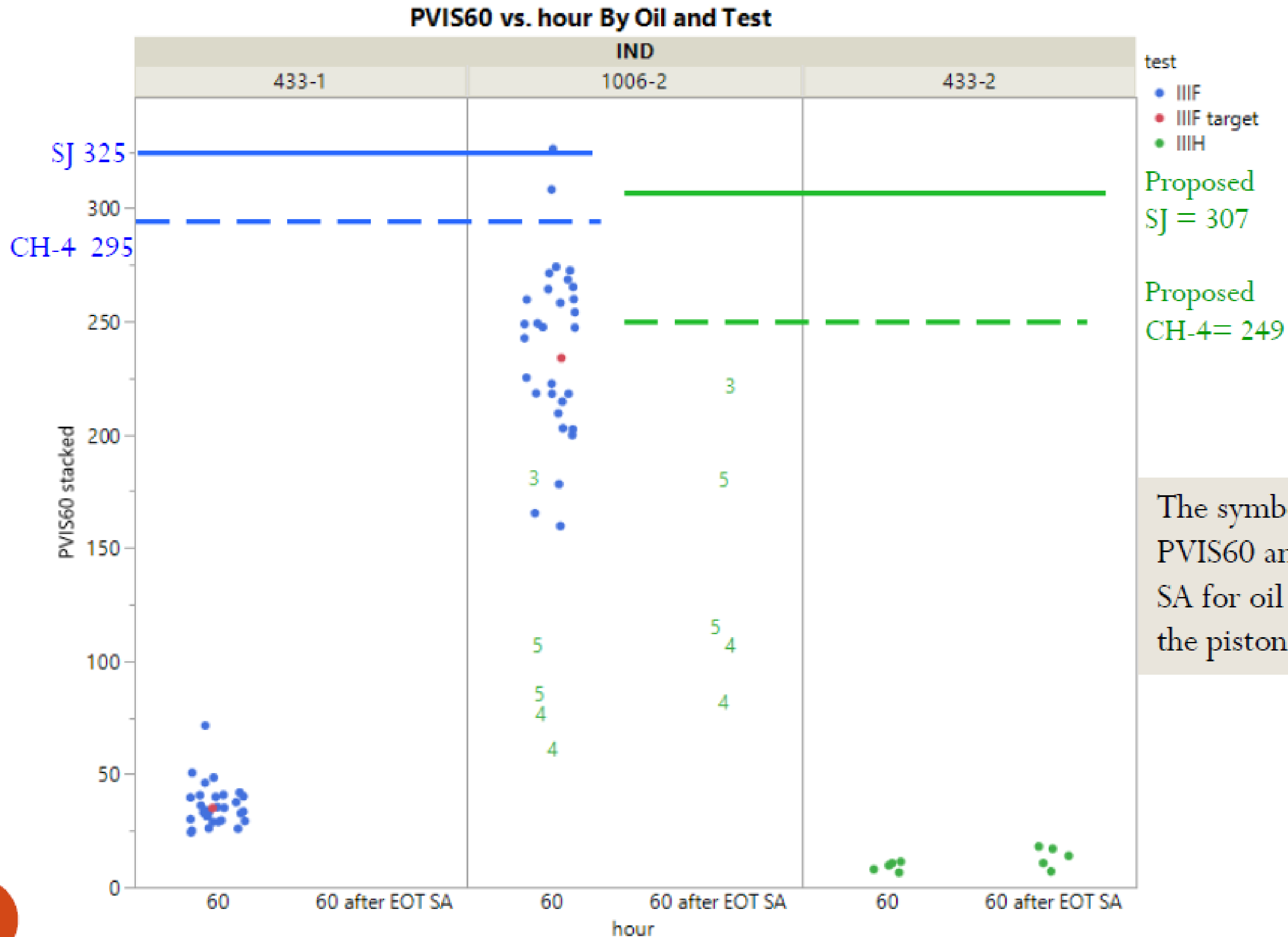
Jan. 22, 2019

IIF target PVIS (10 hour intervals) and IIH PVIS (20 hour intervals)

Zooming into region around the 1006-2 breaking point



IIF PVIS 60Hr and IIF Limits vs IIH PVIS 60Hr and IIH Proposed Limits



Proposed CJ-4/CI-4/CH-4 COAT limits



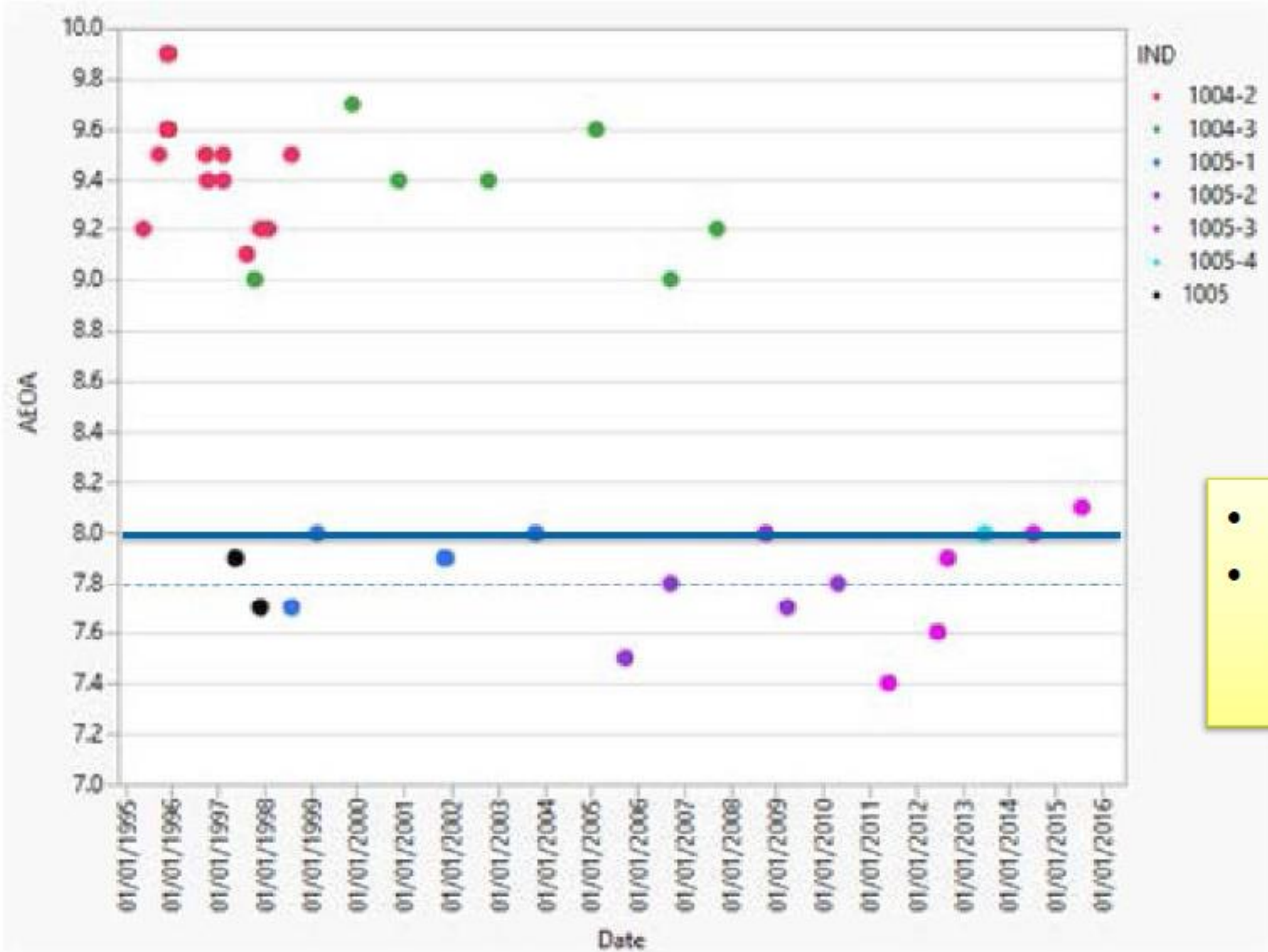
Based on EOAT Reference Oil 1005 (all batches) and Repeat 1005-4 runs in COAT development the equivalent EOAT/COAT equivalency API CJ-4, CI-4, CH-4



Option	# of COAT 1005-4 results	CJ-4/CI-4/CH-4 EOAT Limit	Proposed COAT Limit
1	3	8.0% max	13.5% max
2	4	8.0% max	13.2% max

Oct. 12, 2016

EOAT reference test data from TMC



- Test limit is 8.0% max
- Mean (over the life of the test) for 1005 is 7.8%



Establishing COAT as an alternative for EOAT in Legacy API C categories

Hind Abi-Akar
Caterpillar Inc.

New Orleans, Dec, 2019

ASTM HDEOCP / API DEOAP



Call to Action:
 Work must begin
 on establishing
 COAT as an
 equivalent for
 EOAT in legacy
 API C Categories

- Test alternative for EOAT is needed:
 - EOAT engine life is questionable
 - Referenced recently, but may not have many runs left
- COAT was announced available again for testing on May 13, 2019 and has been running reliably since
- Cat Surveillance Panel is drafting a test matrix to generate data which would allow the development of limits for COAT as an alternative to EOAT in API CH-4, CI-4 & CJ-4

DEOAP needs to direct CLOG to initiate this work

ASTM D4485 Surveillance Panel Update

Laura Birnbaumer
Heavy Duty Engine Oil Class Panel
New Orleans, LA
December 11, 2019

Membership

- Mesfin Belay
- Luc Girard
- Frank Farber
- Kevin Ferrick
- Joe Franklin
- Mike Kasimirsky
- Beth Schwab
- Hap Thompson
- Sid Clark

Lyle Bowman

- Thank you

Information Letters

Information Letter Number	Topic	Date Ballot (D02 19-05) Closed
19-1	Category Descriptions added to Appendix X2 GF-4 added to X5	9/26/19
19-2	Corrected type-os and made other edits to Table 3 CI-4 and Table 4 CJ-4	9/26/19
19-3	Added D7094 Flash to Table 1 SJ	9/26/19
19-4	Added SN Plus to Appendix as X6	9/26/19
19-5	Added GF-6A and GF-6B to Appendix as X8	9/26/19
19-6	Added SP to Appendix as X9	9/26/19
19-7	Updated SM with pass/fail limits; Added 60 and 70 hr IIIH to Table 1 SJ and SL	9/26/19

Information Letters

- The Information Letters without comments were incorporated into a 2019 version approved by API 11/1/2019 so this version should be on the web site.
- Thank you to all who read through the Informational Letters and found additional type-os and other editorial comments. These were adjudicated at the Section 10 meeting yesterday and will be included in a 2020 version of D4485.
- One comment requires formal action by this Class Panel as it is more than editorial.

Information Letters

Abstention with Comment

Ballot Number: D02 (19-05) Close Date: SEPTEMBER 26, 2019
Item Number: 016 Revision Of D4485-2018A Specification for Performance of Active API Service Category Engine Oils WK69141
Info letter 19-2 Sequence No. 2(SEE VOLUME 05.02)(CONCURRENT WITH .B000)
TECHNICAL CONTACT: Frank M Farber
fmf@astmtmc.cmu.edu
(412) 365-1030

Member's Name: Yong Li McFarland
Address: Southwest Research Inst
6220 Culebra Road
SAN ANTONIO TX 78238

Phone Nr: 210522 2715 Fax Nr:
Email Address: yongli.mcfarland@swri.org
File Attachment:
Statement:
Section Statement

D6278 test needs a test temperature for the viscosity measurement.

Table 3 CI-4 and Table 2 CH-4

D6417	D6417	percent volatility loss at 371 °C, max	17	15
D6278	D6278	Kinematic Viscosity after shearing, mm ² /s, min	SAE XW-30 9.3	SAE XW-40 12.5

^A See Annex A2 for additional information.

Motion: add “at 100 °C” to the D6278 in Tables 2 and 3 so that the parameter reads “Kinematic Viscosity after shearing, mm²/s at 100 °C, min”

D7109	Copper strip rating, ° max
	Kinematic viscosity after 90 pass shearing, mm ² /s at 100 °C, min

Ford 6.7L Valve Train Wear (VTW) Test Update ASTM December 2019

Team Members:

Patrick Joyce, John Loop (Lubrizol)/Ron Romano, Michael Deegan (Ford)/Andrew Smith (Intertek)/Robert Warden, Jose Starling, Travis Kostan (SwRI)

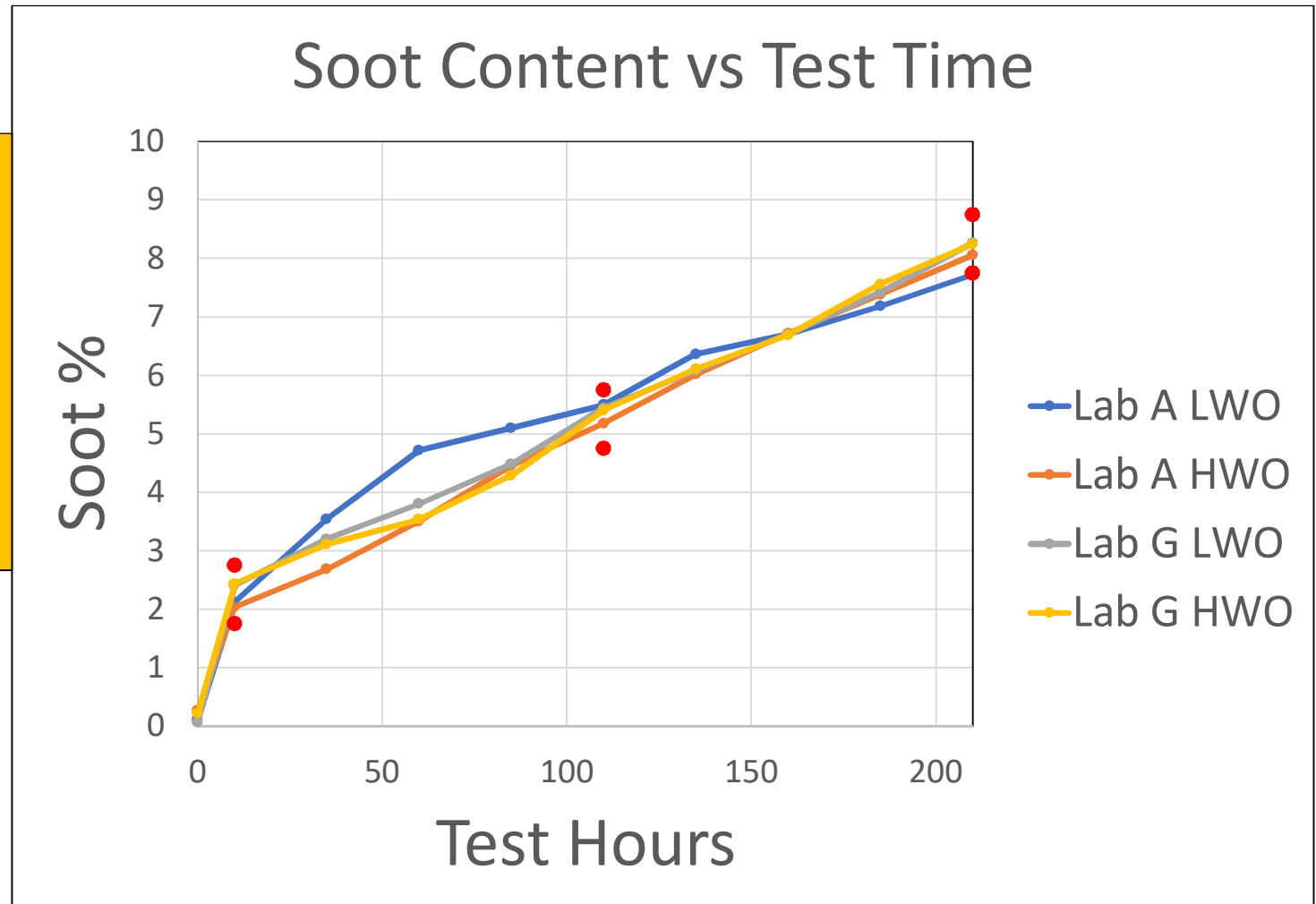
6.7I VTW Test Development: Why?

- Implemented due to CK-4 800ppm Phosphorus Wear results
 - 6.7I's Valvetrain, running CK-4 oil, showed higher wear than CJ-4 oils on 600hr FIE Durability Engine Test.
 - Phosphorus was one of the differences between the oils.
 - Testing CK-4 with same CJ-4 phosphorus PPM showed passing wear results.
- Ford/Lubrizol/Intertek/SwRI agree to develop ASTM Test Method.
 - Using soot as the mechanism to create the Valvetrain Wear.
 - Engine Test Hours targeted to 200 hours to correlate to Durability Test.

6.7 VTW Test Development: Status

- Completed Soot Generation Investigation-Wear Phase
 - Soot Generation controlled by adjusting Coolant Temp Signal to PCM which in turn changes Fuel Injection Timing.
- Resolved Filter Bypass Issue:
 - Dual Filter set up installed.
- Proveout Testing at All Labs.
 - Intertek & SwRI have completed First Proveout tests on HWO & LWO.
 - Tests hit the proposed soot windows.
 - Test results, including engine operation characteristics, were comparable between the two labs. See following pages for results.

Test Development Data: Soot Content vs Test Time

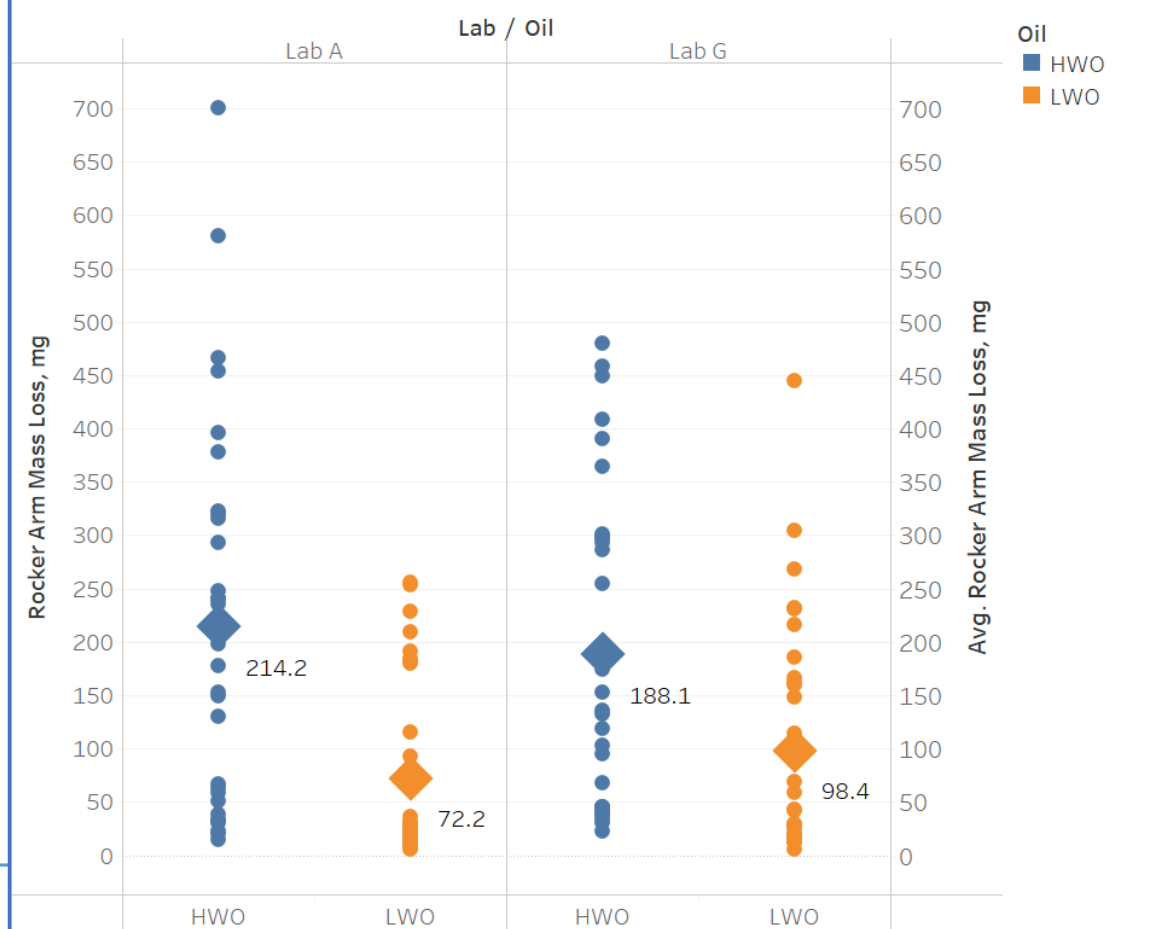


- Soot content shown for the (4) completed tests at each lab.
- Current soot window requirements shown at 10, 110, 210 hours.
- Ability to manage soot content via coolant temp shown.
- 25 test hour monitoring of soot necessary.

Test Development Data results for latest (4) Tests.

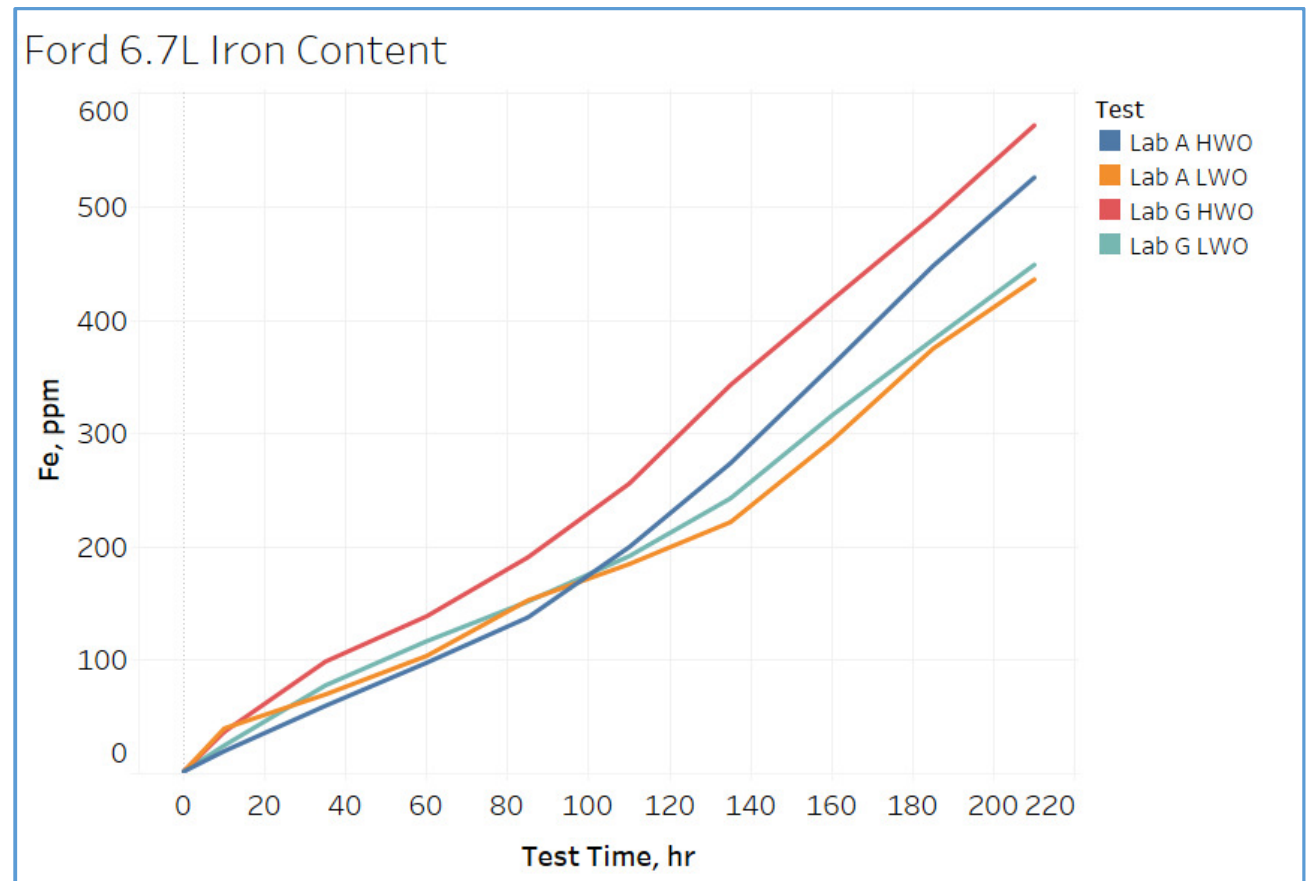
- HWO – “PC11B” (shown in blue)
 - 3.0 HTHS-150
 - 800 ppm phosphorus
- LWO – CJ-4 Factory Fill (shown in yellow)
 - 3.5 HTHS-150
 - 1100 ppm phosphorus
- Average Rocker Arm Mass appears to have the best chance of discrimination based on:
 - (2) each LWO/HWO run on latest test setup & procedure at SwRI and Intertek.
 - Both labs within Soot Window Limits.
 - Both Labs within Operational Limits.
- **Statistician reviewed for Discrimination and Precision Matrix (PM) Recommendations.**
 - Discrimination acceptable.
 - A transformation may be used to Improve Discrimination.
 - PM needs Minimum of (12) Tests.

6.7L Rocker Arm Weight Loss Averages



Test Development Data: Fe vs. Test Hours

- HWO EOT Fe > LWO EOT Fe
- Labs consistent with HWO & LWO Fe content.
- May be useful for predicting failure before end of test.

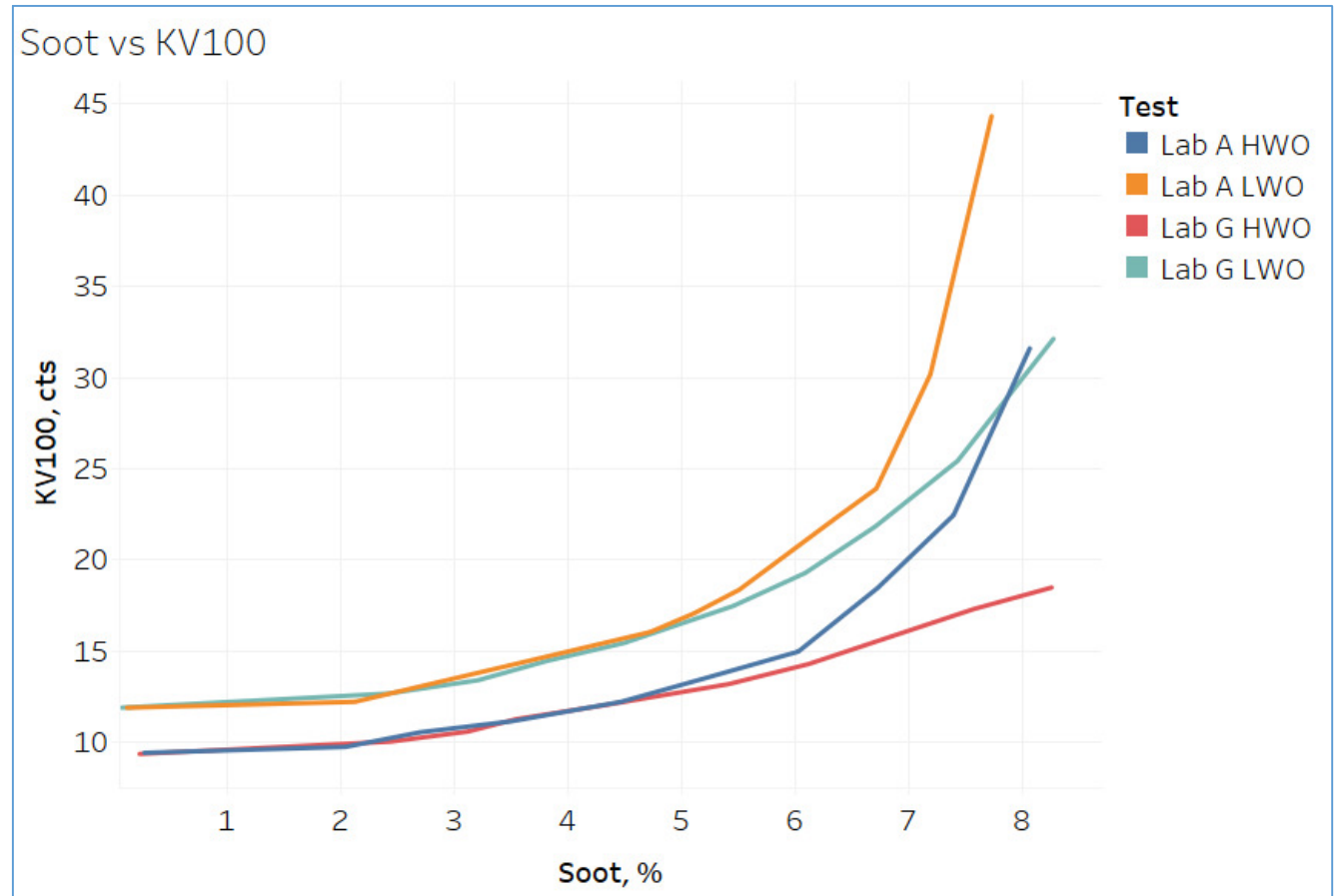


6.7 VTW Test Development Next Steps

- Resolved Soot Window Tolerances.
 - Revisit after Precision Matrix.
- Determine Statistical Model for Pass/Fail Criteria. ECD: Dec 2019
- Develop Precision Matrix. ECD: February 2020
 - Funding.
 - Memorandum of Understanding.
 - Task Force needed.
 - Determine how many oils/fuels.
- ASTM Test procedure with report forms and data dictionary are planned to be complete by year end.

Test Development Data: Soot Content vs Viscosity

- Results with regard to Oil Viscosity to % TGA Soot.
- Labs consistent with soot vs Viscosity including HWO & LWO up to ~6% soot.



FIXED LIMITS FOR EOEC

Joe Franklin

12/10/2019





CURRENT LIMITS BASED ON TMC 1006

Note—These are the *unadjusted specification limits* for elastomer compatibility. Candidate oils shall, however, conform to the *adjusted specification limits*, the calculation of which is described in [Annex A4](#).

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, —3)	(+7, —5)	(+10, —TMC 1006)	(+10, —TMC 1006)
Silicone (VMQ)	(+TMC 1006, —3)	(+5, —TMC 1006)	(+10, —45)	(+20, —30)
Polyacrylate (ACM)	(+5, —3)	(+8, —5)	(+18, —15)	(+10, —35)
Fluoroelastomer (FKM)	(+5, —2)	(+7, —5)	(+10, —TMC 1006)	(+10, —TMC 1006)
Vamac G	(+TMC 1006, —3)	(+5, —TMC 1006)	(+10, —TMC 1006)	(+10, —TMC 1006)

Note—TMC 1006 is the designation for the reference oil used in this test method. This designation represents the original blend or subsequent approved re-blends of TMC 1006.



PROPOSED FIXED LIMITS BASED ON LAST 3 YEARS OF 1006-2 DATA

Note—These are the *unadjusted specification limits* for elastomer compatibility. Candidate oils shall, however, conform to the *adjusted specification limits*, the calculation of which is described in [Annex A4](#).

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, —3)	(+7, —5)	(+10, —38)	(+10, —59)
Silicone (VMQ)	(+37, —3)	(+5, —24)	(+10, —45)	(+20, —30)
Polyacrylate (ACM)	(+5, —3)	(+8, —5)	(+18, —15)	(+10, —35)
Fluoroelastomer (FKM)	(+5, —2)	(+7, —5)	(+10, —71)	(+10, —69)
Vamac G	(+32, —3)	(+5, —17)	(+10, —17)	(+10, —33)

Note—~~TMC 1006 is the designation for the reference oil used in this test method. This designation represents the original blend or subsequent approved re-blends of TMC 1006.~~



TABLES THAT WOULD NEED TO BE UPDATED IN D4485

- CI-4 Bench tests (No VAMAC)
- CJ-4 Bench tests
- CK-4 Bench tests
- FA-4 Bench tests



APPENDIX: ALL TABLES FOR REFERENCE

CI-4

Note—These are the *unadjusted specification limits* for elastomer compatibility. Candidate oils shall, however, conform to the *adjusted specification limits*, the calculation of which is described in [Annex A4](#).

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, -3)	(+7, -5)	(+10, -TMC 1006)	(+10, -TMC 1006)
Silicone (VMQ)	(+TMC 1006, -3)	(+5, -TMC 1006)	(+10, -45)	(+20, -30)
Polyacrylate (ACM)	(+5, -3)	(+8, -5)	(+18, -15)	(+10, -35)
Fluoroelastomer (FKM)	(+5, -2)	(+7, -5)	(+10, -TMC 1006)	(+10, -TMC 1006)

Note—TMC 1006 is the designation for the reference oil used in this test method. This designation represents the original blend or subsequent approved re-blends of TMC 1006.

CK-4

Note—These are the *unadjusted specification limits* for elastomer compatibility. Candidate oils shall, however, conform to the *adjusted specification limits*, the calculation of which is described in [Annex A4](#).

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, -3)	(+7, -5)	(+10, -TMC 1006)	(+10, -TMC 1006)
Silicone (VMQ)	(+TMC 1006, -3)	(+5, -TMC 1006)	(+10, -45)	(+20, -30)
Polyacrylate (ACM)	(+5, -3)	(+8, -5)	(+18, -15)	(+10, -35)
Fluoroelastomer (FKM)	(+5, -2)	(+7, -5)	(+10, -TMC 1006)	(+10, -TMC 1006)
Vamac G	(+TMC 1006, -3)	(+5, -TMC 1006)	(+10, -TMC 1006)	(+10, -TMC 1006)

Note—TMC 1006 is the designation for the reference oil used in this test method. This designation represents the original blend or subsequent approved re-blends of TMC 1006.

CJ-4

Note—These are the *unadjusted specification limits* for elastomer compatibility. Candidate oils shall, however, conform to the *adjusted specification limits*, the calculation of which is described in [Annex A4](#).

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, -3)	(+7, -5)	(+10, -TMC 1006)	(+10, -TMC 1006)
Silicone (VMQ)	(+TMC 1006, -3)	(+5, -TMC 1006)	(+10, -45)	(+20, -30)
Polyacrylate (ACM)	(+5, -3)	(+8, -5)	(+18, -15)	(+10, -35)
Fluoroelastomer (FKM)	(+5, -2)	(+7, -5)	(+10, -TMC 1006)	(+10, -TMC 1006)
Vamac G	(+TMC 1006, -3)	(+5, -TMC 1006)	(+10, -TMC 1006)	(+10, -TMC 1006)

Note—TMC 1006 is the designation for the reference oil used in this test method. This designation represents the original blend or subsequent approved re-blends of TMC 1006.

Recommendation: Limits CBT from HTCBT

Joe Franklin

12/10/2019

Background

- CBT (D5968) is last referenced in C?? (not in D4485 any longer)
- CBT test demand is nearly gone
- HTCBT and CBT use almost all the same hardware and coupons
- Differ primarily in Bath Temperature
- Only 2 labs have been participating in Calibration
 - Next 2 slides show a comparison of reference rates (from SP report 12/09/19)



CBT (D5968)

Test Distribution by Validity

• Accepted for Calibration	AC	2
• Rejected	OC	3
• Hardware Run – N Coupons	NI	4
• Unacceptable Hardware Run–N coupons	MI	2
• Invalid Hardware Run – N coupons	RI, LI	6
• Total		17



Test Distribution by Validity

• Acceptable Calibration Test	AC	248
• Unacceptable Calibration Test	OC	25
• Invalid Calibration Test	LC	8
• Invalid by TMC Calibration Test	RC	1
• Aborted Calibration Test	XC	3
• Acceptable Shakedown Run	NN	7
• Unacceptable Shakedown Run	MN	8
• Invalid Shakedown Run	LN	2
• Hardware Run –N coupons	NI	14
• Unacceptable Hardware Run – N coupons	MI	2
• Invalid Hardware Run – N coupons	LI, RI	8
• Total		<u>326</u>

Proposal

- Would be simple if they had the same reference oil.- not available
- Propose that the SP run a performance study on the CBT reference oils in the HTCBT test.
- Would include other oils with know CBT performance if data available.
- Once completed then the CBT test would no longer need support.
- Motion: Request the SP to develop a set of equivalent limits based on the data from a study of current reference oils and other available oils.