

HEAVY-DUTY ENGINE OIL CLASSIFICATION PANEL
OF
ASTM D02.B0.02
June 24, 2014
JW Marriot Hotel – Indianapolis, IN

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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 Jim McGeehan at 1:35 p.m. on Tuesday June 24, 2014, in Ballroom 7 of the JW Marriot Hotel, Indianapolis, IN.
- 1.2 There were 15 members present and 76 guests present. The attendance list is included as **Attachment 2**.

2.0 Agenda

- 2.1 The agenda circulated prior (included as **Attachment 1**) was not changed.

3.0 Minutes

- 3.1 The December meeting minutes had not been circulated so were not approved.

4.0 Membership

- 4.1 There was one membership change: Josh Frederick for Thom Smith of Valvoline. The membership guidelines were discussed as the result of an additional request for membership. Membership needs to be balanced between EMA and oil/additive representatives. The Passenger Car Panel is balanced and has a system which will be used as a model. The membership list is included as **Attachment 3**.

5.0 Exit-Criteria Ballots

- 5.1 Chairman McGeehan reviewed the exit criteria ballots shown to the NCDT included as **Attachment 4** which include the comments. Carry-over tests from CJ-4 for PC-11A passed. CJ-4 carry-over tests for PC-11B had 2 negatives which is less than the 75% threshold. The 2 negatives expressed their reasons. Steve Kennedy from ExxonMobil expressed concerns about the durability of old engine tests at very low HTHS and would like reference oils at low HTHS. A category reference oil which passes all tests have not been used in the last couple of categories and is desired. Darryl Purificati of Petro-Canada indicated that low HTHS oil results from older tests have not been shown and discussed. Greg Shank of the EMA addressed that bringing PC-11B type reference oils was in the Surveillance Panels. EMA would like a category reference oil but there has been trouble

getting one supplied. There was discussion in the room in how a category reference oil gets introduced.

- 5.2 PC-11 Viscosity requirement had negatives, but is still a passing ballot. Brent Calcut of Afton expressed disagreement with setting the HTHS limit after shear. After shear should just be KV100. PetroCanada provided information that global ISO Limits don't fit within the limits proposed and could cause blending and distribution problems globally included as **Attachment 4a**. Since it is a passing ballot, the limit would remain 2.9-3.2.
- 5.3 Shear Stability of 12.8 cSt @ 100C after 90 cycles shear passed with some negatives.

6.0 NCDT Tests

- 6.1 Dennis Bachelder reviewed the NCDT action on the individual tests being developed and their matrix readiness. **Attachment 5**. The T-13 was voted ready, the CAT Aeration was voted to include the matrix, but not quite ready and the DD13 was voted not fit for purpose.

7.0 NCDT Voting on Matrix Design

- 7.1 The NCDT voted for option 3c for the precision matrix. **Attachment 6**.

8.0 NCDT MOA/Blending Reference Oils (no slide)

- 8.1 Steve Kennedy updated the funding which has been settled for a while. There is not a presentation for this. All the matrix designs were compiled with the 2.67M budget. The 12 oils will be blended in various viscosity grades. There is not enough funding to add Group III base oils. Additive companies and base oil suppliers have communicated to get oils blended and understand the urgency. The MOA is not complete yet but feedback on the draft has been received. Darryl brought forward an update to the matrix details such as run order with a deadline of July 3.

9.0 PC-11 Time line

- 9.1 Jim Moritz presented the timeline that has been shown to the NCDT. **Attachment 7**. It was modified to reflect the activities of the Interindustry Advisory Group activities. Base oil suppliers are to notify additive companies when base oils are at blending and the TMCis to let industry know when oils are received so labs can plan test starts. Dennis will get back with parties for an update.
- 9.2 The IAG activities and timeline were reviewed. **Attachment 7a**. EMA is not particularly happy with the delays and the timing. More discussion in the room about the MOA timing. Attorneys will need to review it so it may need to be sent around one more time prior to signature.

10.0 API CJ-4 Carry Over Tests

- 10.1 All engines except C13 are out of production so there may be issues down the road. The projection is through 2020. CAT 1N is out of liners with some other hardware unavailable so a sub-panel has been formed to work out improved replacements. C13 liners have some appearance differences which is being worked through CAT. The ISM will need to switch to a new cylinder head with a small scallop in the combustion chamber. ISB short term issues of some components, but need complete engines. Mack is working on improving oil consumption with new rings. Engine has been out of production since 2006. Roller Follower Wear test doesn't seem to have any issues that are known. These are summarized in **Attachment 8**.
- 10.2 Chairman McGeehan commented that replacement tests will be needed soon and the panel should start considering tests now. The life of the Sequence IIIF is limited as well through 2016 so a plan is needed for that.

11.0 Cat C-13 Aeration Up-Date

- 11.1 Hind Abi-Akar discussed task force activities since the NCDT vote and reviewed points in the presentation included as **Attachment 9**. Operational data will be reviewed and the engines will all be rebuilt and broken in the same way. Some inconsistencies in baseline densities so it will be measured 2 ways: D4052 and a new method in the micromotion used on the stand to measure change in density. The Task Force is meeting Thursday.
 - 11.2 Hind also introduced the need for a replacement for the HEUI. The HEUI reference oil is 1005 and has been used in the CAT Aeration test. Hind requested data from PC-11 oils that have been run in both tests. She also requested results from older technology oils. The TMC has 2 tests worth of the failing reference oil 1004 which will be used to help develop backward compatibility. She asked if the actions cover the concerns. There was consensus that they do.
- 12.0 The meeting was adjourned at 2:45 pm.

Tentative Agenda
ASTM SECTION D.02.BO.02
HEAVY-DUTY ENGINE OIL CLASSIFICATION PANELS

JW Marriott Indianapolis
June 24th 2014
1:30-4:00pm

Chairman/ Secretary:

Jim McGeehan/Jim Moritz

Purpose:

Review Exit-Criteria Ballots and NCDT Report

Desired Outcomes:

Preparing for PC-11

TOPIC	PROCESS	WHO	TIME
Agenda Review	<ul style="list-style-type: none"> Desired Outcomes & Agenda 	Group	1:30-1:40
Minutes Approval	<ul style="list-style-type: none"> December 10th, 2013 	Group	1:40-1:50
Membership	<ul style="list-style-type: none"> Changes: Additions 	Jim McGeehan	1:50-2:00
Exit-Criteria Ballots	<ul style="list-style-type: none"> PC-11A and PC-11B Carry-Over tests limits Review previous ballots 	Jim McGeehan	2:00-2:15
PC-11 Time line	<ul style="list-style-type: none"> PC-11 time-line all details PC-11 and GF-6 time-line (Luc Girard presentation) 	Jim Moritz Jim McGeehan	2:15-2:30
NCDT Tests	<ul style="list-style-type: none"> Voting results for Mack T-13 Voting results for Cat C13A Voting result for Daimler DD13 	Dennis Bachelder	2:30-2:45
NCDT voting on matrix design	<ul style="list-style-type: none"> Voting results for : three technologies matrix design 	Dennis Bachelder	2:45-3:00
NCDT MOA/Blending Reference oils	<ul style="list-style-type: none"> Up-date on status 	Steve Kennedy	3:00-3:15
API CJ-4 Carry Over Tests	<ul style="list-style-type: none"> Status of tests. 	Mark Cooper	3:15-3:30
Cat C-13A up-date	<ul style="list-style-type: none"> Task-Force meeting report from June 17th 	Hind Abi-Akar	3:30-3:45
Category Naming for PC-11B	<ul style="list-style-type: none"> SAE EOVC Task-Force Report 	Dan Arcy Jason Anderson	3:45-4:00
	<ul style="list-style-type: none"> 		

HDEOCP Attendance: June 24, 2014

LastName	FirstName	MiddleName	Company	Business Phone	E-mail Address
Abi-Akar	Hind		Caterpillar Inc.	309-578-9553	abi-akar_hind@cat.com
Alessi	Michael	L.	ExxonMobil R&E	856-224-2309	michael.l.alessi@exxonmobil.com
Andersen	Jason		PACCAR Technical Center	360-757-5324	jason.andersen@paccar.com
Anderson	William		Afton Chemical	804-788-5336	bill.anderson@aftonchemical.com
Ansari	Matthew		Chevron Lubricants		ansa@chevron.com
Bachelor	Dennis	L.	API	202-682-8182	bachelor@api.org
Barajas	Anthony		Southwest Research Institute	210-522-2997	anthony.barajas@swri.org
Bates	Terry		Manesty Consultant Ltd.	44-151-348-4084	batesterryw@aol.com
Belay	Mesfin		Detroit Diesel Corp.	313-592-5970	mesfin.belay@daimler.com
Birnbaumer	Laura		Chevron Oronite		labi@chevron.com
Bishop	Zack		TEI	210-877-0221	zbishop@tei-net.com
Boese	Doyle		Infineum	908-474-3176	doyle.boese@infineum.com
Bowden	Jason		OH Technologies, Inc.	440-354-7007	jhbowden@ohtech.com
Bowden	Matthew		OH Technologies	440-354-7007	mjbowden@ohtech.com
Bowman	Lyle				jbfoodie3@att.net
Brown	Mike	G.	SK Lubricants Americas	908-751-5030	mike.brown@sk-houston.com
Calcut	Brent		Afton Chemical	248-350-0640	brent.calcut@aftonchemical.com
Campbell	Bob		Afton Chemical		bob.campbell@aftonchemical.com
Carter	James	E.	Haltermann Solutions	517-347-4947	jecarter@jhaltermann.com
Cheng	Jie		Shell Global Solutions	281-544-9479	jie.cheng@shell.com
Cooper	Mark		Chevron Oronite	210-731-5606	mawc@chevron.com
Cruz	John	D.	Daimler	313-592-7469	john.cruz@daimler.com
Dasbach	Tina		Institutue of Materials	989-488-7912	tdasbach@savantgroup.com
Davis	Scott	A.	Croda Inc	773-404-2923	scott.a.davis@croda.com
DeBaun	Heather	J.	Navistar, Inc.	331-332-1285	heather.debaun@navistar.com
Dougherty	Rick		ExxonMobil Research and Engineering		richard.dougherty@exxonmobil.com
Duncan	Dave		The Lubrizol Corporation	440-347-2018	david.duncan@lubrizol.com
Esche	Carl	K.	Vanderbilt Chemicals	804-740-4635	cesche@rtvanderbilt.com
Evans	Gail		The Lubrizol Corporation		gail.evans@lubrizol.com
Farber	Frank	M.	ASTM - TMC	412-365-1030	fmf@astmtmc.cmu.edu
Ferrick	Kevin		API	202-682-8233	ferrick@api.org
Fetterman	G.	Pat	Infineum	908-474-3099	pat.fetterman@infineum.com
Fox	Brian		Chemtura Corporation	203-714-8670	brian.fox@chemtura.com
Franklin	Joseph	M.	Intertek Automotive Research	210-523-4671	joe.franklin@intertek.com
Frederick	Josh		Valvoline	859-357-2248	jrfrederick@ashland.com
Gaines	Alison		Fuels & Lubes Asia		alison@fuelsandlubes.com
Gault	Roger		EMA	312-929-1974	rgault@emamail.org
Goldblatt	Irwin		BP Lubricants	732-572-1712	irwin.goldblatt@bp.com
Goodrich	Barb		John Deere	319-292-8007	GoodrichBarbaraE@JohnDeere.com
Gray	David		Evonik Oil Additives	215-706-5826	david.gray@evonik.com
Gropp	Jerry		The Lubrizol Corporation	440-347-1223	jlg@lubrizol.com
Herzog	Steven		Evonik Oil Additives	215-706-5817	steven.herzog@evonik.com
Humphrey	Brian		PetroCanada	440-537-2851	brhumphrey@suncor.com

HDEOCP Attendance: June 24, 2014

LastName	FirstName	MiddleName	Company	Business Phone	E-mail Address
Kennedy	Steve		ExxonMobil R&E	856-224-2432	steven.kennedy@exxonmobil.com
King	Tracey		Haltermann Solutions	947-517-4107	tking@jhaltermann.com
Koglin	Cory		Afton Chemical	248-350-0640	cory.koglin@aftonchemical.com
Kuehler	Nick		ChevronPhillips Chemical Co.	806-275-5633	kuehlnl@cpchem.com
Kunselman	Michael		Center for Quality Assurance	248-234-3697	mkunselman@centerforqa.com
Kuntschik	Larry		ILMA	281-693-2410	lfkuntschik@aol.com
Lanctot	Dan		TEI	210-933.0301	dlanctot@tei-net.com
Linden	Jim		Total Lubricants, USA	248-321-5343	lindenjim@jlindenconsulting.com
Lopez	Michael		Safety-Kleen		michael.lopez@safety-kleen.com
Mann	Roy		CNH Industrial	630-267-0176	rmann6023@wowwag.com
Marty	Steve		Southwest Research Institute	210-522-5929	smarty@swri.org
McCord	James		Southwest Research Institute	210-522-3439	jmccord@swri.org
McGeehan	Jim	A.	Chevron Global Lubricants	510-242-2268	jjam@chevron.com
McMaughlin	Michael		Afton Chemical		michael.mclaughlin@aftonchemical.com
McMillan	Michael	L.	MLM Consulting, Inc.	586-677-9198	mmcmillan123@comcast.net
Moritz	Jim		Intertek Automotive Research	210-523-4601	jim.moritz@intertek.com
Moyer	Sean		Test Monitoring Center	412-365-1035	sam@astmtmc.cmu.edu
Nann	Norbert		Nann Consultants Inc.	845-297-4333	norbnann1@aol.com
Nyman	Dan		Cummins Inc.	812-447-8484	dan.a.nyman@cummins.com
Olech	Steven		Idemitsu Lubricants	248-666-2059	solech@ilacorp.com
Parry	Barb		Newalta Corp.	604-982-2307	bparry@newalta.com
Parsons	Gary		Chevron Oronite	510-242-1026	gmpa@chevron.com
Pettingill	John		Petro-Canada Lubricants	905-804-4797	jpettingill@suncor.com
Proctor	Robert		Honda R&D Americas, Inc.		rproctor@oh.hra.com
Purificati	Darryl		Petro-Canada Lubricants Inc.	519-304-2351	dpurificati@suncor.com
Rajala	Scott		Idemitsu Lubricants	248-455-1460	srajala@ilacorp.com
Raley	Greg		Motiva Enterprises, LLC	713-230-3093	gregory.raleymotivaent.com
Salguerio	Robert		Infineum	908-474-2492	bob.salguerio@infineum.com
Shank	Greg	L.	Volvo Groups Technology	301-790-5817	greg.shank@volvo.com
Sheehan	Michael	P.	ExxonMobil Chemical Company	281-834-2080	michael.p.sheehan@exxonmobil.com
Smith	Thom		Ashland Consumer Marketing	859-357-2766	trsmith@ashland.com
Smrdel	Don		The Lubrizol Corporation		donald.smrdel@lubrizol.com
Soemo	Angela		ExxonMobil Research and Engineering	856-224-3642	angela.r.soemo@exxonmobil.com
Spence	Steve		Newalta Corporation	604-982-2383	sspence@newalta.com
Stockwell	Robert	T.	GM	210-563-0785	robert.stockwell@gm.com
Swarts	Andre		Sasol North America	281-588-3749	andre.swarts@sasol.com
Tang	Haiying		Chrysler	248-512-0593	ht146@chyselt.com
Thompson	E.A.	Hap	Global PPL Standards Assc.	904-287-9596	hapjthom@aol.com
Thompson	J.	Martin	Southwest Research Institute	210-522-2906	martin.thompson@swri.org
Tung	Simon		Vanderbilt Chemicals		stung@vanderbiltchemicals.com
VanScoyoc	Jonathan		ChevronPhillips Chemical		vanscj@cpchem.com
Walker	Rodney		Safety-Kleen	281-245-7204	rodney.walker@safety-kleen.com
Wang	Jerry		Chevron Oronite	734-485-3806	jwdy@chevron.com

HDEOCP Attendance: June 24, 2014

LastName	FirstName	MiddleName	Company	Business Phone	E-mail Address
Warden	Robert		Southwest Research Institute	210-522-5621	robert.warden@swri.org
Weber	Ben		Southwest Research Institute	210-522-5911	ben.weber@swri.org
Whitacre	Shawn		Chevron Lubricants	510-242-3557	shawnwhitacre@chevron.com
Wiggins	Paula		Idemitsu Lubricants		pwiggins@ilacorp.com
Wong	Lawrence		Chevron Base Oils	510-242-1444	lwong@chevron.com

ASTM-HDEOCP Membership

	Oil and Additive Companies	OEMs
1	Jim A. McGeehan – Chevron	Greg Shank – Volvo Power Train
2	Steve Kennedy - ExxonMobil	Dan Nyman- Cummins Inc.
3	Dan Arcy - Shell	Mesfin Belay - Detroit Diesel
4	Corey Taylor - BP Castrol	Hind Abi-Akar - Caterpillar Inc.
5	Josh Frederick - Ashland	Heather DeBaun - International
6	Galen Greene - BASF	Ken Chao - John Deere
7	David Gray - Evonik	Robert Stockwell - GM Powertrain
8	Michael McLaughlin - Afton	Jason Andersen- Paccar
9	Jerry Wang - Oronite	
10	Gail Evans - Lubrizol	
11	Robert Salgueiro - Infineum U.S.A.	
12	David Taber,-ConocoPhillips	

Exit-Criteria Ballots for PC-11

James McGeehan

Chairman

Heavy-Duty Engine Oil Classification Panel

May 28th 2014



Shear Stability SAE XW-40 (Except SAE 0W-40) 12.8 cSt @ 100c After 90 Cycles Kurt Orbahn (KO) Shear All Other Viscosities Stay in Grade



Company	Representative	Affirmative	Negative	Comments
John Deere	Kenneth Chao	X		
Navistar	Heather DeBaun	X		
Daimler	Mesfin Belay	X		
Cummins	Dan Nyman	X		
Paccar	Jason Andersen	X		Comments
Volvo	Greg Shank	X		
Caterpillar	Hind Abi-Akar	X		
Lubrizol	Gail Evans		X	Comments
Oronite	Jerry Wang		X	
Afton	Jason Lagona	X		
Infineum	Bob Salgueiro	X		Comments
Evonik	Steve Herzog	X		
Shell	Dan Arcy	X		
Exxon Mobil	Steven Kennedy	X		
Chevron	Jim McGeehan	X		Comments
BP Lubricants	Corey Taylor	X		
GM	Robert Stockwell	---		Waiving
Valvoline	Thom Smith	X		



Propose PC-11 A & B Adopt Mack T-11 API CJ-4 Limit But Remove 6.7% Soot Kinematic Viscosity (KV) Requirement

Company	Representative	Affirmative	Negative	Comments
John Deere	Kenneth Chao	X		
Navistar	Heather DeBaun	X		
Daimler	Mesfin Belay		X	Comments
Cummins	Dan Nyman		X	Comments
Paccar	Jason Andersen	X		Comments
Volvo	Greg Shank		X	Comments
Caterpillar	Hind Abi-Akar		X	Comments
Lubrizol	Gail Evans		X	Comments
Oronite	Jerry Wang	X		
Afton	Jason Lagona		X	Comments
Infineum	Bob Salgueiro		X	Comments
Evonik	Steve Herzog		X	
Shell	Dan Arcy		X	Comments
Exxon Mobil	Steven Kennedy		X	Comments
Chevron	Jim McGeehan	X		
BP Lubricants	Corey Taylor	X		
GM	Robert Stockwell	X		
Valvoline	Thom Smith		X	Comments

FAILED



PC-11B HT/HS Viscosity Limit: 2.9 to 3.2 cP

Company	Representative	Affirmative	Negative	Comments
John Deere	Kenneth Chao	X		
Navistar	Heather DeBaun	X		
Daimler	Mesfin Belay	X		
Cummins	Dan Nyman	X		
Paccar	Jason Andersen	X		
Volvo	Greg Shank	X		Comments
Caterpillar	Hind Abi-Akar	X		
Lubrizol	Gail Evans	X		Comments
Oronite	Jerry Wang		X	
Afton	Jason Lagona	X		
Infineum	Bob Salgueiro	X		
Evonik	Steve Herzog	X		
Shell	Dan Arcy	X		
Exxon Mobil	Steven Kennedy	X		
Chevron	Jim McGeehan		X	Comments
BP Lubricants	Corey Taylor	X		
GM	Robert Stockwell	X		
Valvoline	Thom Smith		X	Comments

**Task-Force Formed
to Report Back to NCDT**



EXIT CRITERIA BALLOT PC-11 Viscosity Requirements

ASTM-HDEOCP Reference: Jim Mc Geehan, Chairman of Heavy Duty Engine Oil Classification Panel	Issue Date: April 30, 2014 Receipt Deadline: <b style="color: red;">May 21, 2014
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RETURN BALLOT TO: Jim McGeehan via email (preferred): jjam@chevron.com	Name: _____ Organization: _____ Date: _____ Phone No.: _____
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PC-11 Viscosity Requirements (a)	PC-11A	PC-11B
<b style="color: red;">Viscosity Grade (SAE J300)	xW-30; xW-40	xW-30
Fresh Oil HTHS Viscosity, cP at 150°C		
xW-30 Grades; minimum	3.5	2.9 (b)
maximum	n/a	3.2
xW-40 Grades	Meet SAE J300	n/a
Sheared Oil Viscosity (c)		
Kinematic Viscosity, cSt at 100°C		
xW-30 Grades	9.3 min.	9.3 min.
0W-40	12.5 min.	n/a
Other xW-40 Grades	12.8 min.	n/a
HTHS Viscosity, cP at 150°C		
xW-30 Grades	3.4 min.	2.8 min.

(a) All limits are non-critical unless specifically stated

(b) Critical limit as per SAE J300

(c) After 90 passes, ASTM D7109

Motion	Affirmative	Negative
Accept limits proposed	<input type="checkbox"/>	<input type="checkbox"/>



PC-11 Viscosity Requirements

ASTM – HDEOCP Voting Members

Company	Representative	Affirmative	Negative	Comments
John Deere	Kenneth Chao	X		
Navistar	Heather DeBaun	X		
John Deere	Barbara Goodrich	X		
Paccar	Jason Andersen	X		
Volvo	Greg Shank	X		
Oronite	Jerry Wang	X		
GM	Robert Stockwell	X		
Lubrizol	Gail Evans	X		
Chevron	Jim McGeehan	X		
ExxonMobil	Steven Kennedy	X		Comments
Shell	Dan Arcy	X		
Afton	Michael McLaughlin		X	Comments
Infineum	Robert Salgueiro	X		Comments
Detroit Diesel	Mesfin Belay	X		
Caterpillar	Hind Abi-Akar	X		
BP	Corey Taylor	X		
Valvoline	Josh Frederick	X		



PC-11 Viscosity Requirements

ASTM – HDEOCP Voting Members

Company	Representative	Affirmative	Negative	Comments
John Deere	Kenneth Chao	X		
Navistar	Heather DeBaun	X		
John Deere	Barbara Goodrich	X		
Paccar	Jason Andersen	X		
Volvo	Greg Shank	X		
Oronite	Jerry Wang	X		
GM	Robert Stockwell	X		
Lubrizol	Gail Evans	X		
Chevron	Jim McGeehan	X		
ExxonMobil	Steven Kennedy	X		Comments
Shell	Dan Arcy	X		
Afton	Michael McLaughlin		X	Comments
Infineum	Robert Salgueiro	X		Comments
Detroit Diesel	Mesfin Belay	X		
Caterpillar	Hind Abi-Akar	X		
BP	Corey Taylor	X		
Valvoline	Josh Frederick	X		



PC-11 Viscosity Requirements Non- Voting ASTM – HDEOCP Members

Company	Representative	Affirmative	Negative	Comments
Truck / EMA	Roger Gault	X		
Petro-Canada	Luc Girard		X	Comments/Presentation
Vanderbilt Chemicals	Simon C. Tung	X		
Savant Group	Ted Selby	X		
SK Lubricants	Mike Brown		X	Comments
Neste Oil	Chris Castanien	X		
Safety Clean	Rodney Walker		X	Comments



PC-11 Viscosity Requirements

Non- Voting ASTM – HDEOCP Members

Company	Representative	Affirmative	Negative	Comments
Truck / EMA	Roger Gault	X		
Petro-Canada	Luc Girard		X	Comments/Presentation
Vanderbilt Chemicals	Simon C. Tung	X		
Savant Group	Ted Selby	X		
SK Lubricants	Mike Brown		X	Comments
Neste Oil	Chris Castanien	X		
Safety Clean	Rodney Walker		X	Comments

PASSED



ExxonMobil supports the proposed limits as summarized in the ballot. For simplicity, we have a slight preference for the version of the table without the 2.9 cP minimum for PC-11B HTHS since all limits shown would be non-critical, and the minimum HTHS for PC-11B oils will be covered by the SAE grade.

Steve Kennedy - ExxonMobil



Infineum votes affirmative on the proposed PC-11 viscosity requirements however, we do want to ensure that two potential issues are fully considered by all.

The proposed PC-11A Viscosity requirements include a limit for HTHS after shear of 3.4 cP. This parameter seems redundant since PC-11 already specifies the Kinematic Viscosity after shear requirement and oils will first fall out of grade before they fail to meet the HTHS after shear limit.

The second issue is the tightness of the blending window for PC-11B. Infineum wants to ensure oil marketers are giving due consideration to the tightness of the kinematic viscosity and stay-in-grade requirements across the HTHS range for PC-11B relative to their own manufacturing capabilities.

Robert Salgueiro- Infineum USA L.P.



Afton supports the proposed 3.2 cP max HTHS limit for PC-11B.

However, Afton believes that justification to add new after shear HTHS limits is lacking. Existing oils are adequately protecting engines without after shear HTHS limits. Shear stability is primarily a customer perception concern and best addressed through kinematic viscosity rather than HTHS limits.

Michael McLaughlin- Afton Chemical



Proposed xW-40 viscosity is 12.5 and other xW-40 viscosity is 12.8. If sheared viscosity is a concern specifically due to shearing of the viscosity modifier then either the limit should be 12.8 or 12.5 with no exception.

Rodney Walker, Safety Clean



PC-11A Tests to Be Carried Over From API CJ-4 With the Same Limits

Mack T-11

Cummins ISM

Caterpillar C13

Cummins ISB

Caterpillar IN

Roller Follower Wear

*Mack T-12 ring-liner wear and oil consumption only. No merit system defined for this ballot, so it is not included in the vote.



PC-11A Tests to Carried Over From API CJ-4 ASTM – HDEOCP Voting Members

Company	Representative	Affirmative	Negative	Comments
John Deere	Kenneth Chao	X		
Navistar	Heather DeBaun	X		
Paccar	Jason Andersen	X		
Volvo	Greg Shank	X		
Oronite	Jerry Wang	X		Comments
GM	Robert Stockwell	X		
Lubrizol	Gail Evans	X		Comments
Chevron	Jim McGeehan	X		
ExxonMobil	Steven Kennedy	X		
Infineum	Robert Salgueiro	X		
Detroit Diesel	Mesfin Belay	X		
Caterpillar	Hind Abi-Akar	X		
BP	Corey Taylor	X		
Shell	Dan Arcy	X		
Vanderbilt	Simon Tung	X		Comments
Motiva	Greg Raley	X		
Neste	Chris Castanien	X		
EMA	Roger Gault	X		
Savant	Ted Selby	X		
Petro-Canada	Darryl Purificati	X		



PC-11A Tests to Carried Over From API CJ-4 ASTM – HDEOCP Voting Members

Company	Representative	Affirmative	Negative	Comments
John Deere	Kenneth Chao	X		
Navistar	Heather DeBaun	X		
Paccar	Jason Andersen	X		
Volvo	Greg Shank	X		
Oronite	Jerry Wang	X		Comments
GM	Robert Stockwell	X		
Lubrizol	Gail Evans	X		Comments
Chevron	Jim McGeehan	X		
ExxonMobil	Steven Kennedy	X		
Infineum	Robert Salgueiro	X		
Detroit Diesel	Mesfin Belay	X		
Caterpillar	Hind Abi-Akar	X		
BP	Corey Taylor	X		
Shell	Dan Arcy	X		
Vanderbilt	Simon Tung	X		Comments
Motiva	Greg Raley	X		
Neste	Chris Castanien	X		
EMA	Roger Gault	X		
Savant	Ted Selby	X		
Petro-Canada	Darryl Purificati	X		

PASSED



The PC-11 Test Redundancy Task Force has collected extensive data to show the Roller Follower Wear Test (RFWT) is not formulation setting and can be safety covered by other wear tests in this ballot. Oronite continues to hold the view that RFWT should be removed from PC-11.

Jerry Wang- Chevron Oronite LLC



Lubrizol's position on this issue has not changed since this was voted and approved at the June 2013 HDEOCP meeting in Montreal (as documented in the meeting minutes – Item 5.4).

Gail Evans- The Lubirzol Corporation



Two PC-11 sub-categories.

For the first time the PC-11 category will be split into two sub-categories. The first, PC-11A offers increased engine protection at traditional viscosities, like SAE 15W-40, at 3.5 centiPoise (cP) HTHS (high temperature high shear) or greater. These oils will be recommended by on and off-road OEMs and will be fully backward compatible.

The second, PC-11B, the so-called ‘fuel economy grade’, is designed to meet the evolving market needs for fuel economy through lower limits of HTHS (2.9 – 3.2 cP) in SAE XW-30 grades. The durability requirements will be the same for all grades to ensure these new fuel economy grades are risk-free.

Therefore these two ballots on PC-11A and B for these two split fuel economy grades will present a new set of challenges for engine oil formulators.

They must ensure the low HTHS oil still deliver the same level of engine protection as defined in current API CJ-4 engine tests and also in the upcoming PC-11 engine tests.

Simon Tung- Vanderbilt Chemicals



PC-11B Tests to Be Carried Over From API CJ-4 With the Same Limits

Mack T-11

Cummins ISM

Caterpillar C13

Cummins ISB

Caterpillar IN

Roller Follower Wear

*Mack T-12 ring-liner wear and oil consumption only. No merit system defined for this ballot, so it is not included in the vote.



PC-11B Tests to Carried Over From API CJ-4 ASTM – HDEOCP Voting Members

Company	Representative	Affirmative	Negative	Comments
John Deere	Kenneth Chao	X		
Navistar	Heather DeBaun	X		
Paccar	Jason Andersen	X		
Volvo	Greg Shank	X		
Oronite	Jerry Wang	X		Comments
GM	Robert Stockwell	X		
Lubrizol	Gail Evans	X		Comments
Chevron	Jim McGeehan	X		
ExxonMobil	Steven Kennedy		X	Comments
Infineum	Robert Salgueiro	X		
Detroit Diesel	Mesfin Belay	X		
Caterpillar	Hind Abi-Akar	X		
BP	Corey Taylor	X		
Shell	Dan Arcy	X		
Vanderbilt	Simon Tung	X		Comments
Motiva	Greg Raley	X		
Neste	Chris Castanien	X		
EMA	Roger Gault	X		
Savant	Ted Selby	X		
Petro-Canada	Darryl Purificati		X	Comments



PC-11B Tests to Carried Over From API CJ-4 ASTM – HDEOCP Voting Members

Company	Representative	Affirmative	Negative	Comments
John Deere	Kenneth Chao	X		
Navistar	Heather DeBaun	X		
Paccar	Jason Andersen	X		
Volvo	Greg Shank	X		
Oronite	Jerry Wang	X		Comments
GM	Robert Stockwell	X		
Lubrizol	Gail Evans	X		Comments
Chevron	Jim McGeehan	X		
ExxonMobil	Steven Kennedy		X	Comments
Infineum	Robert Salgueiro	X		
Detroit Diesel	Mesfin Belay	X		
Caterpillar	Hind Abi-Akar	X		
BP	Corey Taylor	X		
Shell	Dan Arcy	X		
Vanderbilt	Simon Tung	X		Comments
Motiva	Greg Raley	X		
Neste	Chris Castanien	X		
EMA	Roger Gault	X		
Savant	Ted Selby	X		
Petro-Canada	Darryl Purificati		X	Comments



The PC-11 Test Redundancy Task Force has collected extensive data to show the Roller Follower Wear Test (RFWT) is not formulation setting and can be safety covered by other wear tests in this ballot. Oronite continues to hold the view that RFWT should be removed from PC-11.

Jerry Wang- Chevron Oronite LLC



Consistent with our votes on previous exit ballots, Lubrizol supports the alignment of tests and limits for PC-11A and PC-11B.

When we voted affirmative on the June 2013 exit ballot to carry over tests and limits for PC-11, we considered the ballot as written – for both PC-11A and PC-11B. When we voted negative on the failing December 2013 exit ballot to reduce T-11 limits for PC-11B, our supporting rationale was stated with that ballot.

Gail Evans- The Lubrizol Corporation



ExxonMobil agrees in principle with the concept of setting limits for PC-11B at the same level as CJ-4/PC-11A. Although more data available indicating that low HTHS oils are capable in the carry-over tests is available, there is still concern around the precision and consistency of these tests when operating on low viscosity oils. Therefore, EM believes that it is entirely too early to commit to no changes to the limits of these tests.

It is hoped that this concern will be addressed with additional data in the period before PC-11 requirements are finalized. Additionally, it is desirable to have long-term mechanism in place to ensure that test capability with low viscosity oils is maintained. Potential approaches to accomplish this are (1) introduction of low viscosity reference oils and(2) defining a “Category Demonstration Oil” that could be available if test capability comes into question in the future. EM is also open to other concepts to address this concern.

Steven Kennedy- ExxonMobil



Two PC-11 sub-categories.

For the first time the PC-11 category will be split into two sub-categories. The first, PC-11A offers increased engine protection at traditional viscosities, like SAE 15W-40, at 3.5 centiPoise (cP) HTHS (high temperature high shear) or greater. These oils will be recommended by on and off-road OEMs and will be fully backward compatible.

The second, PC-11B, the so-called ‘fuel economy grade’, is designed to meet the evolving market needs for fuel economy through lower limits of HTHS (2.9 – 3.2 cP) in SAE XW-30 grades. The durability requirements will be the same for all grades to ensure these new fuel economy grades are risk-free.

Therefore these two ballots on PC-11A and B for these two split fuel economy grades will present a new set of challenges for engine oil formulators.

They must ensure the low HTHS oil still deliver the same level of engine protection as defined in current API CJ-4 engine tests and also in the upcoming PC-11 engine tests.

Simon Tung- Vanderbilt Chemicals



No data has been presented that would indicate API CJ-4 limits are suitable for PC-11B oils in the carry over tests listed.

Darryl Purificati- Petro-Canada



ASTM-HDEOCP Membership

	Oil and Additive Companies	OEMs
1	Jim A. McGeehan – Chevron	Greg Shank – Volvo Power Train
2	Steve Kennedy - ExxonMobil	Dan Nyman- Cummins Inc.
3	Dan Arcy - Shell	Mesfin Belay - Detroit Diesel
4	Corey Taylor - BP Castrol	Hind Abi-Akar - Caterpillar Inc.
5	Thom Smith - Ashland	Heather DeBaun - International
6	Galen Greene - BASF	Ken Chao - John Deere
7	David Gray - Evonik	Robert Stockwell - GM Powertrain
8	Michael McLaughlin - Afton	Jason Andersen- Paccar
9	Jerry Wang - Oronite	
10	Gail Evans - Lubrizol	
11	Pat Fetterman - Infineum U.S.A.	
12	David Taber,-ConocoPhillips	

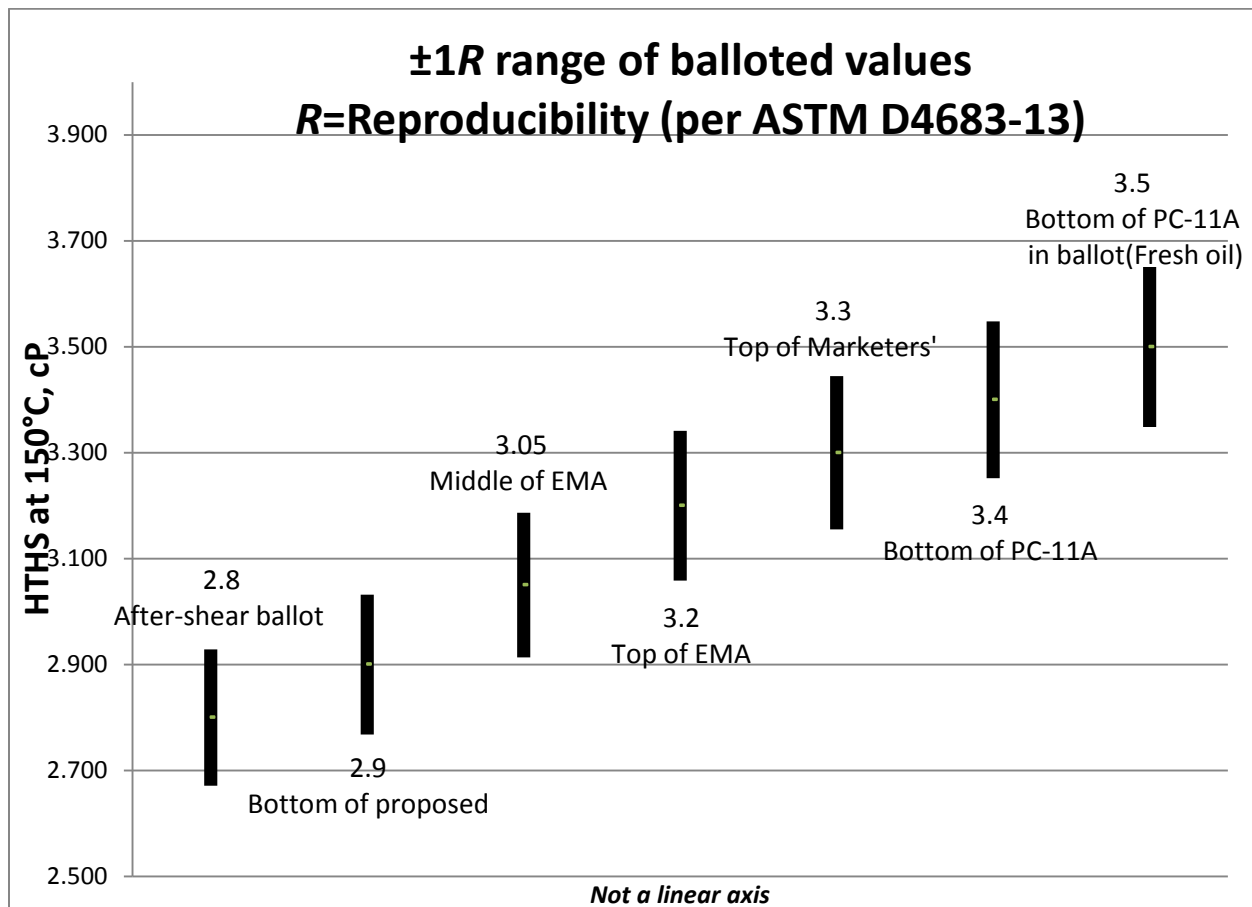
Petro Canada Exit Criteria Ballot PC-11 Viscosity Requirements

Petro-Canada established a working group to review the proposed ballot. We acknowledge that no member of this working group was/is a statistician.

We elected to return a **negative** vote after considering the following:

1. The proposed HTHS range for PC-11B is only slightly larger than one reproducibility value.

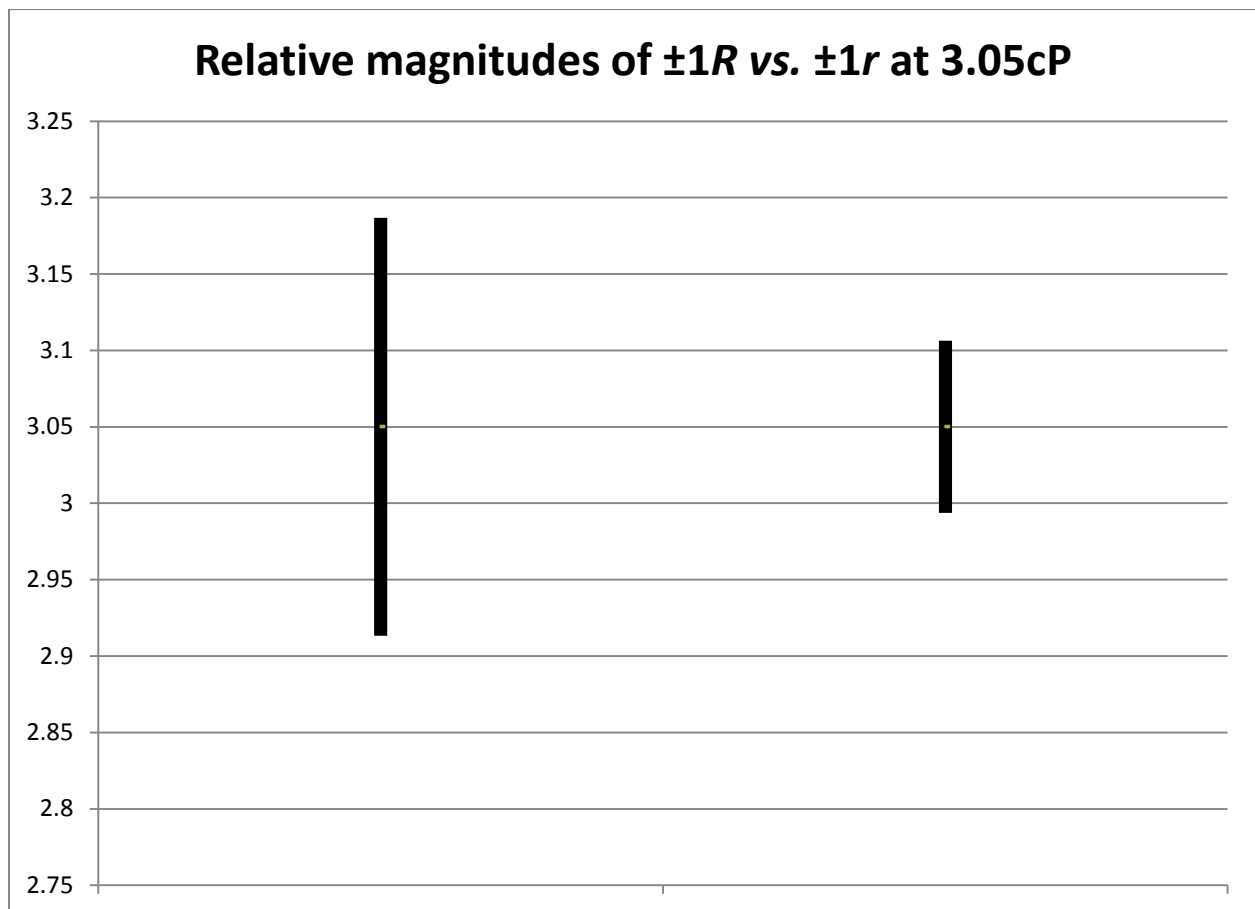
According to ASTM D4683-13 (equation 8), Reproducibility R increases linearly with HTHS value. We therefore investigated the various values of R in the ballot, and illustrate these in the following chart. The horizontal axis is NOT linear. At the $\pm 1R$ range, values of 2.9 – 3.2 cP are not readily differentiable.



Petro Canada Exit Criteria Ballot PC-11 Viscosity Requirements

- The proposed range forces the formulator to work to the centre of the range, 3.05 cP to minimize the likelihood of designing (and thereafter manufacturing) outside the range.

The repeatability r of D4683-13 is such that even if a blender does manufacture to exactly 3.05cP as a design target (see figure below to show the magnitude of R and r at 3.05cP), the 2.9-3.2 cP proposed range will lead to an unresolvable discrepancy vs. other labs approximately 30% of the time, per D3244-12. HTHS is part of some accreditation/validation programs (e.g. API's AMAP program). A 30% failure rate is likely to require undesirable re-cycling with licensees.



D4683-13's precision statements reflect the conclusions of a recent inter-laboratory study, and it is therefore unlikely that any "quantum leap" in test precision can be anticipated in the near future.

Petro Canada Exit Criteria Ballot PC-11 Viscosity Requirements

3. ISO 4259 [Often pointed to by government and international bodies for “conflict resolution” for homogeneous petroleum products]

In early 2014, Oronite circulated some salient points about ISO 4259 regarding limit-setting. These reflected a need to set a range a 4R when setting limits

At 4R, there would be no discrimination whatsoever in any of the HTHS values discussed in this ballot, and so we do not advocate such a wide limit.

However, failure to account for ISO 4259 guidelines might lead to issues regarding the use of PC-11B and/or ACEA “next generation” oils in some jurisdictions, due to the narrow range. For instance, Brazil explicitly incorporates ISO 4259 into *A Guide to Brazil’s Oil and Oil Derivatives Compliance Requirements*, available at:

http://gsi.nist.gov/global/docs/BRA_petroleum_guide.pdf ISO 4259 also appears in many specifications describing fuels to be used in fuel economy testing outside Brazil, e.g. in documents prepared by the United Nations Economic Commission for Europe.

Potential path forward

We offer the following proposal as the basis for discussion on another set of limits.

The precision statements for D4683-13 would allow reporting of information to a 2nd decimal.

In that light, we would propose:

- i) That the PC-11B fresh oil HTHS lower limit be made non-critical
- ii) That this lower limit be set to 2.85cP which, given rounding rules, would comply with a 2.9 minimum for J300 XW-30 oil
- iii) That the upper limit be set to a non-critical 3.25cP max

Luc Girard, with B. Humphrey, J. Pettingill, D. Purificati, and W. Steckle

NCDT Votes for PC-11

June 12, 2014





T13 Vote

Greg Shank made motion that T13 ready for matrix testing. Seconded by Bob Salgueiro

- **T-13 Motion: T13 ready for matrix testing**

Vote Results	
<u>NCDT Member</u>	<u>Vote</u>
<u>API</u>	
Dan Arcy – Shell, Chair	Yes
Rodney Walker - Safety Kleen	Yes
Jim McGeehan - Chevron	Yes
<u>EMA</u>	
Barbara Goodrich – John Deere	Yes
Hind Abi-Akar- Caterpillar	Yes
Dan Nyman - Cummins	Yes
<u>ACC</u>	
Bob Campbell - Afton	Yes
Gail Evans - Lubrizol	Yes
Bob Salgueiro – Infineum	Yes



Cat C13A Vote

Hind Abi-Akar made motion that C13 aeration test be included in PC-11 matrix design. Seconded by Gail Evans

- **Cat Aeration Motion: Cat C13 Aeration ready for Matrix Testing Pending Results of Cat Development Plan to address issues.**

Vote Results	
<u>NCDT Member</u>	<u>Vote</u>
<u>API</u>	
Dan Arcy – Shell, Chair	Yes
Rodney Walker - Safety Kleen	Yes
Jim McGeehan - Chevron	Yes
<u>EMA</u>	
Barbara Goodrich – John Deere	Yes
Hind Abi-Akar- Caterpillar	Yes
Dan Nyman - Cummins	Yes
<u>ACC</u>	
Bob Campbell - Afton	Yes
Gail Evans - Lubrizol	Yes
Bob Salgueiro – Infineum	Yes



DD13 Vote

John Cruz made motion that DD13 is fit for purpose and included in matrix design. Seconded by Dave Duncan

- **DD-13 Motion: DD13 is Fit for Purpose and Ready for Inclusion in Matrix Design Testing**

Vote Results	
<u>NCDT Member</u>	<u>Vote</u>
<u>API</u>	
Dan Arcy – Shell, Chair	No
Rodney Walker - Safety Kleen	No
Jim McGeehan - Chevron	No
<u>EMA</u>	
Barbara Goodrich – John Deere	Yes
Hind Abi-Akar- Caterpillar	No
Dan Nyman - Cummins	No
<u>ACC</u>	
Bob Campbell - Afton	No
Gail Evans - Lubrizol	No
Bob Salgueiro – Infineum	No



PC-11 Matrix Design Vote

Roger Gault, EMA made the motion for the NCDT to accept option 3C : Seconded by Darryl Purificati.

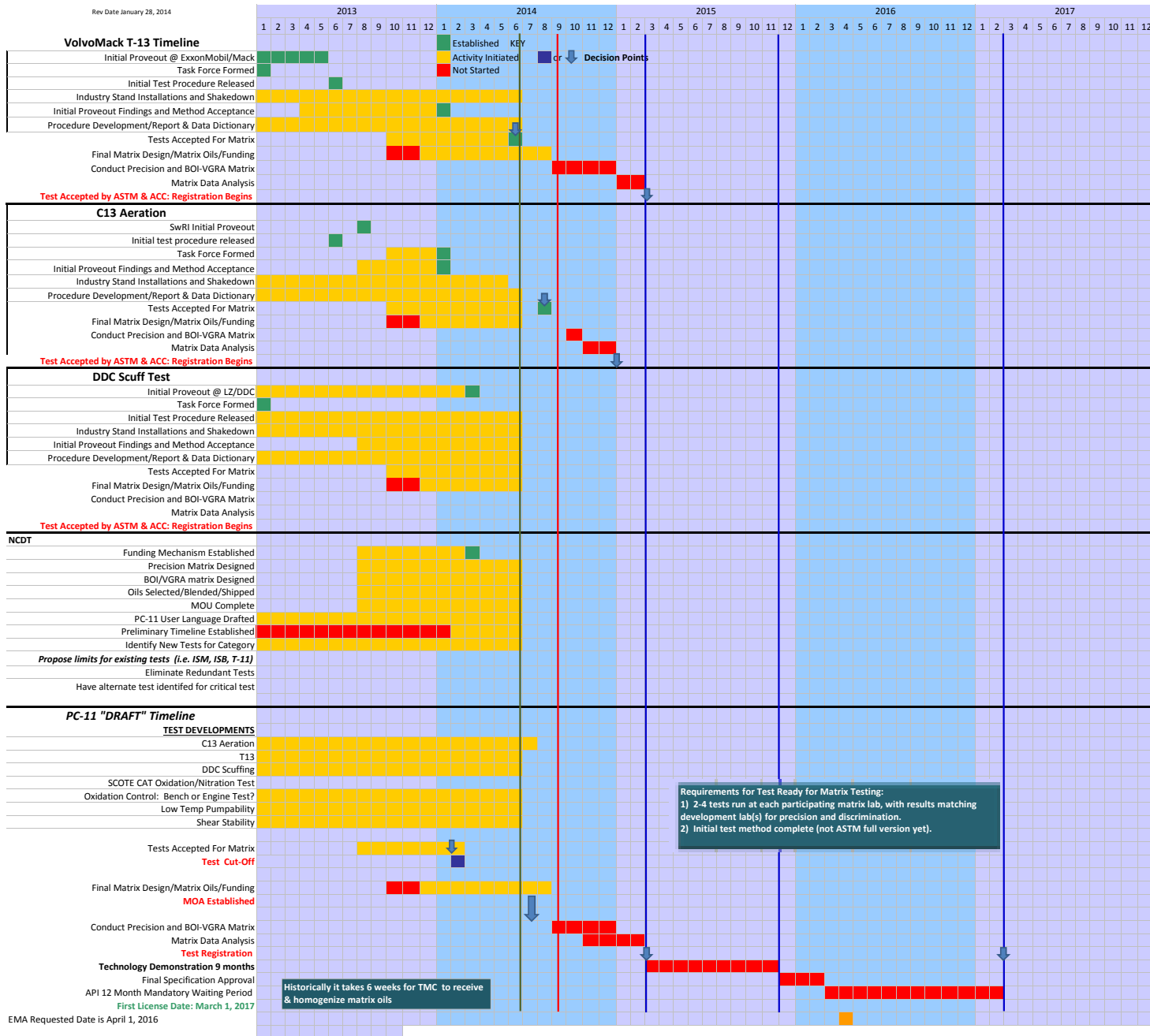
- **Matrix Design Motion: NCDT to accept Matrix Design Option 3C for test matrix as recommended by BOI/VGRA task force.**

Vote Results - Passing	
<u>NCDT Member</u>	<u>Vote</u>
<u>API</u>	
Dan Arcy – Shell, Chair	Yes
Rodney Walker – Safety-Kleen	No
Jim McGeehan - Chevron	Yes
<u>EMA</u>	
Barbara Goodrich – John Deere	Yes
Hind Abi-Akar- Caterpillar	Yes
Dan Nyman - Cummins	Yes
<u>ACC</u>	
Bob Campbell - Afton	Yes
Gail Evans - Lubrizol	Yes
Bob Salgueiro - Infineum	Yes

From the PC11 Statisticians Task Force

		Option 3c	
T13	Stands	7	The seven stands are at five labs for T13. The three stands are at three labs for Cat Aeration.
	Number of Technologies	3	
	Number of Base Oils	2	We assume two potential reference oils for T13 (six tests each) and two potential reference oils for Cat Aeration (seven tests each).
	Number of Oils	6	
	Number of Tests	28	We don't assume anything about reference oils and base oil blends for T13 versus Cat Aeration for the design.
	GpII-GpII BOI Exploration	Yes	
	Tests per Oil	6,6,4,4,4,4	
	Tests per Stand	4,4,4,4,4,4,4	
Cat Aeration	Stands	3	Someone might have a preference for the two potential reference oils for a test type to have the same or opposite base oil blends. Unless we hear of a decision we will proceed to make one design for each test type with potential reference oils having the same base oil blend and one design for each test type with potential reference oils having the opposite base oil blend.
	Number of Technologies	3	
	Number of Base Oils	2	
	Number of Oils	6	
	Number of Tests	38	We have committed to presenting the complete designs by July 3.
	GpII-GpII BOI Exploration	Yes	
	VGRA Exploration	No	
	Tests per Oil	7,7,6,6,6,6	
	Tests per Stand	13,12,13	

Rev Date January 28, 2014



Inter-Disciplinary PC-11/GF-6 Meeting

First License Date:

- PC-11 – March 1st, 2017
 - Lubricants Committee – 9 Months Between Categories
- GF-6 – December 1st, 2017



Inter-Disciplinary PC-11/GF-6 Meeting June 12, 2014



First License Date:

- PC – March 1, 2017
 - Lubricants Group – 9 Months Between Categories
- GF-6 – December 1, 2017

Availability of API CJ-4 Tests for PC-11

Test	Current Issues	Availability Through 2020*	Notes
Cat 1N	Liners, auxiliary components	Likely	1980's vintage. Some auxiliary stand components are being improved. Hardware subpanel being formed. Currently out of liners.
Cat C13	Liner questions	Likely	Production engine for some time in the future.
Cummins ISM	Evaluation of 'scalped' cylinder head	Likely	Engine production ended 2009. ISM engine now produced outside the US. Non-scalped cylinder head no longer available; other engine parts still available.
Cummins ISB	Short-term supply issues of some components	Likely	5.9L engine production ended 2009. Cummins and the CPD are working on additional engine supply.
Mack T-11	Resolving oil consumption	Possibly	Engine production ended 2006. Finite number of engine blocks. Obtaining rings from new supplier. Long-term availability depends on test parts supply and engine component supply.
Mack T-12	Resolving O/C & liner wear	Possibly	Engine production ended 2006. Finite number of engine blocks. Obtaining rings from new supplier. Long-term availability depends on test parts supply and engine component supply.
RFWT	No current issues	Likely	Long term supply of test parts at CPD. Engine P/N in RFWT no longer available. 6.5 L engine still in production at A M General. Injection pump still available – need to verify this is the correct pump.

***Difficulty projecting hardware availability more than 5 years.**

Caterpillar C13 Aeration Test Task Force Meeting Results

NCDT, June 24, 2014

ASTM meeting, Indianapolis

Task Force Actions

- Review current data
 - TMC will help review data
 - Labs will provide raw data of the recent oil tests
 - Labs will provide engine hours and break-in info

- Rebuild the engines
 - Follow the same break-in procedure
 - Monitor blowby to ensure engine stabilization
 - Test the oil for Si level

Task Force Actions

- Baseline density measurements following two approaches
 - D4052 at test facilities
 - Measure using micro-motion before start of engine test
- Review operational conditions.
 - Crankcase pressure: 102 kPa
 - Maintain 90C across the micro-motion; clear targets for T drop
- Sump temperature: Measured and recorded; ~94.5 – 95.5
 - Oil gallery is 90 C, within 0.3 C.
 - Data will be analyzed to determine sump temp impact on aeration
- Engine loading will be consistent
 - Engines will run uncoupled to ensure no parasitic loads.

Task Force Actions

- TMC: conducting data analysis
 - developed required templates and documentation

- Meeting on Thursday June 26
- Review progress
- Review test parameters and early data
- Finalize test oils (potentially 2 oils)
- Finalize timeline

HEUI Replacement Discussion, June 19, 2014

- Analyze existing HEUI Data during PC11 matrix
 - 1005 Results (Sig data) for EOAT and C13
 - Lubrizol Matrix Oil has HEUI EOAT results
- Other PC11 oils and their HEUI results??

- Potential Data Needed in addition to PC11 oils
 - 1004 Failing reference oil for HEUI EOAT or another known failing oil (above 8% by volume).
 - 1004-2 & 1004-3 are available from TMC with ~ 60 G remaining - enough for 2 C13 Tests.
- CJ4 oil B or other strong HEUI pass
- CH4 or CI4 oils