

HEAVY-DUTY ENGINE OIL CLASSIFICATION PANEL
OF
ASTM D02.B0.02
June 23, 2015

Marriot Harbor Beach Resort – Ft. Lauderdale, FL

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ACTION ITEMS

1. **Email members not in attendance with the opportunity to vote on exit criteria ballots.**

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 23, 2015, in the Caribbean V Room of the Marriot Harbor Beach Resort Hotel, Ft. Lauderdale, FL.
- 1.2 There were 12 members present and 77 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 minutes from the June 24, 2014 meeting were approved as written.

4.0 Membership

- 4.1 There was one membership change: The Valvoline member is now Josh Frederick replacing Thom Smith.

5.0 Exit-Criteria Ballots: PC-11A and PC-11B Carry-Over tests limits: **Attachment 3**

- 5.1 There is one negative ballot with a comment and 3 affirmative votes with comments. The comments generally suggested that since modern engines have less soot, that the T-11 limits be lowered for PC-11B, possibly back to CI-4 Plus levels. The negative balloter is not intending to hold up the category and has the same comment. They have an additional comment regarding the test reliability of the carry-over tests and the capability of those tests on low HTHS oils and would like a low HTHS reference oil for them.
- 5.2 The EMA discussed PC-11B issues. In regards to test redundancy, the position is to leave all tests in. The EMA will support reduced limits for T-11 in PC-11B if the panel agrees to it. Other member companies had comments and at least one needs more information before completely agreeing to them, but no one said no. Finally, EMA is not against low HTHS reference oils.
- 5.3 Discussion on the T-11 limits. Dave Duncan representing Lubrizol commented on making sure that fuel economy improvements relative to PC-11B oils stay for the life of the drain.

He indicated that OEM's want extended drains. Lubrizol wants to see HTHS run on used oils to gage soot handling and the HTHS performance as the oil ages. Lubrizol wants to see the T-11 limits stay. Pat Fetterman for Infineum basically supports Dave's comments. Oxidation will affect viscosity and now oils will stay thinner longer and soot handling will help as well. High mileage engines look great using oils with T-11 levels of soot handling. EMA asks if decision needs to be made today. EXMO comment to move for the remaining tests and resolve T-11 later. Four additive companies want to resolve it now. One negative remains but ballot could go forward. Chairman McGeehan requested a motion to vote. Dave Duncan moved that the category should move forward with CJ-4 limits for the T-11. Bob Salgueiro seconded. The motion passed unanimously with 14 votes for, zero against, and 1 waive.

6.0 Exit-Criteria Ballots: PC-11 Mack T-12 test limits: **Attachment 3**

6.1 Proposed limits were calculated and proposed. The ballot had two negatives. EXMO figured out that moving the maximums to tiered limits sets up the situation where results could fail CJ-4. Instead of tiered limits, use Multiple Test Acceptance Criteria (MTAC) and average all results. EXMO propose fixed limits. Lubrizol changes their vote to negative. Volvo and Infineum also support EXMO proposal. Jim Rutherford explained his rationale for tiered limits. Two tests on an oil could have an average that fails CJ-4. He doesn't think that would happen very often. ACC code has other approaches. The proposal is a single limit. Steve Kennedy moved for the T-12 test in PC-11 to have single test limits of 24 micrometers for Cylinder Liner Wear and 105 mg for Top Ring Weight Loss which are fixed limits and allowing a straight average for multiple test programs with no provision to discard a test result. Greg Shank seconded. The motion passed unanimously with 14 votes for, zero against, and 2 waives.

7.0 Status of Carry-Over Tests

7.1 Mark Cooper presented the availability of existing engine tests. **Attachment 4**. Single cylinder CAT's likely available through 2020. C13 should be. Engine block no longer in production. Cummins tests likely available through 2020. Possibility of new engine platforms. Mack T-11 and T-12 have oil consumption issues. New hardware may be helping. Likely available through 2020. RFWT engines are limited. There are 4 new engines remaining at AM General. That should yield 56 candidate tests in those 4 engines. There is a long term supply of parts at CPD and injection pumps are available. Surveillance Panel (SP) may have to develop a contingency for extending engine life. SP has not met for quite some time. Sequence IIIF/IIIG hardware out Aug 2016. SP looking at extending runs on blocks. IIH correlation work is being coordinated through the Category Life Oversight Group (CLOG). EOAT has one more engine so the COAT needs to correlate to it.

7.2 Discussion ensued on RFWT. Should it be in PC-11 since it won't last through the category? Some still want to keep the test in PC-11. In April 2013, the EMA supported RFWT in PC-11. There is a theory that the wear mechanism is different. Robert Stockwell is still chairman of the SP. Engines could possibly be rebuilt to extend the life of the test. SwRI has run engines to 30 tests. Some estimate there will be enough tests available with some SP action to modify the test procedure. Carry-Over Test life needs to stay on the HDEOCP agenda twice a year.

8.0 Exit- Criteria Ballots from May 27th 2014

8.1 The viscosity requirements previously passed. The shear stability requirements previously passed. The limits that remain are the T-13 and COAT. The plan is for the limits to be proposed at August 4 NCDT.

9.0 Chairman Comments

- 9.1 Chairman McGeehan announced his retirement. He is retiring from Chevron and stepping down as Chairman of HDOECP and made some remarks. Jim accepted the chairmanship in June of 1987 and as a result of that tenure the classification panel is sometimes referred to as "McGeehan's Committee". The work of this panel has saved billions of dollars by improving engine durability. When the engine that became the platform for the RFWT was introduced there were catastrophic failures in ambulances and Humvees and the test eliminated them. As issues have developed, this committee solved the problems. HD oil drain intervals have gone from 10,000 miles to as many as 50,000 miles. Jim always documented the work of the committee and issued SAE papers. He feels that CJ-4 is the best category that has been developed. The uptime improvement for trucks and vehicles is tremendous. Many times limit setting was finally resolved with: "Can you live with it?" After last minute negatives delayed some action, Jim started issuing exit criteria ballots to resolve issues sooner. Jim sees PC-12 coming soon and suggests focusing more on lowering soot levels and reducing CO2 and improving fuel economy and he feels the need to start on the next category soon. Goals and timing have always been right. Real problems have been solved by the team. Engine durability has gone from 250,000 miles to one million miles between overhauls.
- 9.2 Joe Franklin spoke. Joe's dad Tom was secretary when Joe started coming to ASTM. Joe has received one nomination for HDEOCP Chairman so far and that is Shawn Whitacre of Chevron. More can be submitted. Joe appreciated all Jim has done. Greg Shank represented the EMA and appreciates Jim's drive to get each category completed on time.

10.0 Next meetings

- 10.1 The next meeting will be at the call of the chairman.

- 11.0 The meeting was adjourned at 2:55 pm.

HDEOCP Attendance: June 23, 2015

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HDEOCP Attendance: June 23, 2015

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HDEOCP Attendance: June 23, 2015

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HDEOCP Attendance: June 23, 2015

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HDEOCP Attendance: June 23, 2015

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Exit-Criteria Ballots for PC-11

James McGeehan

Chairman

Heavy-Duty Engine Oil Classification Panel

June 23rd 2015





ASTM-HDEOCP Membership

	Oil and Additive Companies	OEMs
1	Jim 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	Eric Johnson- GM Powertrain
8	Michael McLaughlin - Afton	Jason Andersen- Paccar
9	Robert Stockwell - Oronite	Ron Romano - Ford
10	Gail Evans - Lubrizol	
11	Robert Salgueiro - Infineum U.S.A.	
12	David Taber,-ConocoPhillips	



API CJ-4 Tests to Be Carried Over To PC-11A and PC-11B Oil Categories with Same Limits Remaining the Same as API CJ-4

Mack T-11

Caterpillar C13

Caterpillar IN

Cummins ISM

Cummins ISB

Roller Follower Wear



API CJ-4 Tests to Be Carried Over to PC-11A PC-11B With Same Limits as API CJ-4

Company	Representative	Affirmative	Negative	Comments
John Deere	Kenneth Chao	X		
Navistar	Heather DeBaun	X		
Paccar	Jason Andersen	X		
Volvo	Greg Shank	X		Comments
Oronite	Robert Stockwell	X		Comments
Cummins	Dan Nyman	X		
Lubrizol	Gail Evans	X		
Chevron	Jim McGeehan	X		Comments
ExxonMobil	Steven Kennedy		X	Comments
Infineum	Robert Salgueiro	X		
Detroit Diesel	Mesfin Belay	X		
Caterpillar	Hind Abi-Akar	X		
Afton Chemical	Michael McLaughlin	X		
Shell	Dan Arcy	X		
BP Lubricants USA	Corey Taylor	X		
Total Lubricants	Jim Linden	X		
Valoline	Josh Frederick	X		
Neste	Chris Castanien	X		
EMA	Roger Gault	X		
Evonik Oil Additives	David B Gray	X		
Motiva Enterprise	Gregory Raley	X		
FPT Industrial	Pavan Manthana	X		



API CJ-4 Tests to Be Carried Over to PC-11A PC-11B With Same Limits as API CJ-4

Advanced engines that will use PC-11B oils generate much lower levels of soot in the engine oil than older engines. As such, a lower (milder) limit in the Mack T-11 test, in comparison with API CJ-4, should be considered.

Robert Stockwell, Chevron Oronite

Volvo supports CJ-4 carry over limits for PC-11A (CK-4) category.

As was our position a year ago Volvo is willing to discuss alternative less severe limits for the T11 in the PC-11B (FA-4) category. For example go back to T11 limits for CI-4 Plus. This may allow more formulation room for Fuel Economy improvement.

Greg Shank, Volvo



API CJ-4 Tests to Be Carried Over to PC-11A PC-11B With Same Limits as API CJ-4

The on-highway EPA 2010 trucks with DPF-SCR have extremely low soot levels today, in the range of 0.5 to 1.0% soot at the recommended OEM oil drains. At double the OEM recommended drains these soot levels are in the range of 1.0 to 2.0% max.

PC-11B (FA-4) will be used in new engines and is focused on fuel economy and durability. Consequently a less severe limit in Mack T-11 would be appropriate for FA-4 oil category.

Jim McGeehan, Chevron Lubricants



API CJ-4 Tests to Be Carried Over to PC-11A PC-11B With Same Limits as API CJ-4

ExxonMobil supports concept to use CJ-4 limits in these tests for the new PC-11 categories. However, it is believed there are some concerns that should be reviewed ahead of a final decisions on this issue. From EM's perspective the two issues below should be discussed.

(1) T-11 Limits for PC-11B -- there has been some previous discussion about reducing limits in this test for PC-11. It is clearly not an option for PC-11A since that category is intended to be fully backward compatible with CJ-4. On the other hand, backward compatibility of PC-11B has not been established, and will be determined by individual engine builders. With this being the case, EM believes it is worth considering less restrictive (perhaps CI-4 Plus; 12cSt @6.0% soot) T-11 limits if this is consistent with OEM plans for PC-11B applications.

The concern with simply adopting CJ-4 limits for PC-11B is that it will likely lead to any future back compatible "Fx-4" categories being at the same performance level. The high level of soot dispersancy may not be required for current and future generation engines since soot generation rates are relatively low. Therefore, EM believes EMA should provide feedback on this issue before making a final decision on T-11 limits for PC-11B.

(2) Test reliability with low HTHS oils -- although the industry has been gaining experience with PC-11B viscosity in CJ-4 engine tests, there is still some question regarding the capability of these tests with low HTHS oils. EM believes there is long-term benefit to identify low viscosity reference oils for some of the carry-over tests. This should be considered for wear tests in particular. EM does not consider this to be a requirement to move forward with category development, but would like to see some definitive plans in place to address this issue.

Steve Kennedy, Exxon Mobil



PC-11 Mack T-12 Limits

Proposed Multiple Test Limits

	Proposed Limit	Standard Deviation	1 Test	2 Test	3 Test
Mack T12 PC11					
Liner Wear (microns)	24.0	1.6	24.0	24.8	25.1
Top Ring Weight Loss	105	24.9	105	117	122

No limits for Lead or Oil Consumption

Reference Table Only

TABLE A5.2 Mack T-12 Merit System

	Cylinder Liner Wear, μm	Top Ring Mass Loss, mg	Delta Lead, Final mg/kg	Delta Lead, (250-300) h mg/kg	Oil Consumption, g/h
Weight (Total = 1000)	250	200	200	200	150
Maximum	24.0	105	35	15	85.0
Anchor	20.0	70	25	10	65.0
Minimum	12.0	35	10	0	50.0



PC-11 Mack T-12 Limits

Company	Representative	Affirmative	Negative	Comments
John Deere	Kenneth Chao	X		
Navistar	Heather DeBaun	X		
Paccar	Jason Andersen	X		
Volvo	Greg Shank		X	Comments
Oronite	Robert Stockwell	X		
Cummins	Dan Nyman	X		
Lubrizol	Gail Evans	X		
Chevron	Jim McGeehan	X		
ExxonMobil	Steven Kennedy		X	Comments
Infineum	Robert Salgueiro	X		
Detroit Diesel	Mesfin Belay	X		
Caterpillar	Hind Abi-Akar	X		
Afton Chemical	Michael McLaughlin	X		
Shell	Dan Arcy	X		
BP Lubricants USA	Corey Taylor	X		
Total Lubricants	Jim Linden	X		
Valvoline	Josh Frederick	X		
Neste	Chris Castanien	X		
EMA	Roger Gault	X		
Evonik Oil Additives	David B Gray	X		
Motiva Enterprises	Gregory Raley	X		
FPT Industrial	Pavan Manthana	X		



Mack T-12 Limits Comments

ExxonMobil agrees with the proposed 1 test limits, but does not support the 2 and 3 test limits. The issue is that multiple test programs run under proposed PC-11 protocol could allow an oil that fails the T-12 requirement for CJ-4 requirement to pass PC-11.

For example, an oil run 2 times with a TRWL of 115 mg would be acceptable in this parameter for PC-11. However, that oil run in a 2 test program for CJ-4 could generate more than 1000 merits, but would be a fail because the TWRL parameter generates negative merits based on the averaged results.

An alternate approach is to have a single limit for multiple tests and use the average of the individual results.

Steve Kennedy, Exxon Mobil



Mack T-12 Limits Comments

Volvo agrees with the proposed 1 test limits. The 2 and 3 test limits have been challenged. The concern is the test run under the PC 11 proposal could allow an oil that fails the T-12 requirement for CJ-4 requirement to pass PC-11.

Volvo supports the ExxonMobil alternate approach to have a single limit for multiple tests and use the average of the individual results.

Greg Shank, Volvo

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.**