

**HEAVY-DUTY ENGINE OIL CLASSIFICATION PANEL**  
OF  
ASTM D02.B0.02  
December 4, 2007  
Hyatt Regency Phoenix – Phoenix, AZ

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**ACTION ITEMS**

**1. CAT to request and ACC to provide 1P to C13 correlation data.**

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**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 10:05 a.m. on Tuesday, December 4, 2007, in the Ellis Room of the Hyatt Regency Phoenix, Phoenix, AZ.
- 1.2 There were 13 members present and 50 guests present. The attendance list is shown as Attachment 2.

2.0 Agenda

- 2.1 The agenda shown is included as Attachment 1.

3.0 Minutes

- 3.1 The minutes from the June 19, 2007 were approved as written.

4.0 Membership

- 4.1 There was one membership change. Dan Arcy replaces Matt Urbanek for Shell.

5.0 PC-10 Task Force Report

- 5.1 Lew Williams presented a summary of the work to date of the task force. See Attachment 3. Lew followed up on question 8. The group compiled thoughts by email. Membership was a cross section of parties. Background is that engine tests need to be available for all active C categories. Availability can be by 2 methods: keep the old test or an alternative test at equivalent limits. The current approach to determine equivalent limits in new tests was reviewed. Some issues with this are: the process usually started after issues arise, old test is kept longer than need be, limited data volunteered, and data often generated on similar chemistry, not identical chemistry.
- 5.2 This is a work in process, not a final report. A way forward is to run old reference oils in new tests which would likely result in more testing. Need to keep a supply of all old reference oils until API Lubricants Committee declares a category obsolete. Make sure the reference oils are near the limits.

- 5.3 Patrick Lai reminded the group that CF-2 is still a category and the 6V92 has low activity levels. EMA discussed the 6V92 and the 1M-PC and will discuss at a future DEOAP meeting.
  - 5.4 The other PC-10 improvement issues will be reported separately.
  - 5.5 Chairman Mc Geehan showed the SAE paper on the CJ-4 category he compiled that was "authored" by many.
  - 5.6 A few members will meet to begin discussions on the next category.
- 6.0 Ken Henderson of ASTM
- 6.1 Ken joined the meeting to present an Award of Appreciation to Don Marn of Lubrizol. Don has been very active and made many contributions. Don did not expect this and only attended to say good-bye as he is retiring at the end of 2007.
  - 6.2 An Award of Excellence was presented to Lew Williams of Lubrizol for his many years of service and contributions to the industry. Lew started in 1969 and was asked to improve the sulfated ash test and recently worked on it again which was a career spanning task.
- 7.0 Supply of 500 ppm fuel sulfur
- 7.1 Scott Cobb of ChevronPhillips gave an update on the availability of PC-9 and PC-10 fuel. There was not a presentation. PC-9 orders are being shipped on time. The desired safety stock is 100,000 gallons. Currently below that, but should be back by January 2008. 500 ppm sulfur will be available. ChevronPhillips are investing in separate lines to secure 500 ppm feedstocks through 2015. They are also in the process of securing a 3<sup>rd</sup> supplier.
  - 7.2 PC-10 orders are being shipped and are currently above the safety stock. A tank inspection is scheduled, but shouldn't affect supplies. Working on a 1M gallon batch.
- 8.0 Action item from June 2007 meeting on Cat support
- 8.1 Hind Abi-Akar gave an update on the C13 in place of 1P and the 1M-PC. See Attachment 4. The C13 is different than the 1P. Cat is asking for data to determine if they will accept a C13 in place of a 1P. A request will be sent to ACC to provide data on oils that ran in both tests. If a relationship between the two can be created, CAT will agree to allow a C13 to substitute for a 1P. This will only apply in cases where both tests are needed. ACC is meeting next week, so if the request can be sent by then, the ACC will consider.
  - 8.2 Pat Fetterman said this doesn't really address the concern. CJ-4 is to be backward compatible. If modern chemistry is used to generate a CJ-4 oil, then that oil won't have a 1P, but shouldn't have to run one to claim CI-4 or CI-4+ if it passes the C13. A category for category review has been completed, but not a test by test. If all tests, except the ISB, are complete and passing for CJ-4 then go back and allow CI-4 without a 1P. Since a 1P can be run in place of a 1R, then this would cover CI-4, CI-4+, and CH-4. Hind and Pat will discuss off-line.
  - 8.3 Hind would still like to see the data. ACC will include related chemistries in addition to exact pairs.
  - 8.4 1P liners are now available.
  - 8.5 1M-PC parts availability. The 1M-PC is only in CF and CF-2. There was a liner availability issue in the recent past. CAT proposed supporting the 1M-PC through 2009. The head will be available on a made to order (MTO) basis. The price for the head will be slightly above double the current price and will take around 2 months. CAT proposes stopping support in 2009. An option is to replace with an equivalent test. There is not an obvious replacement.
  - 8.6 EMA discussed this some and will continue discussions.
- 9.0 EMA position on 2010
- 9.1 Greg Shank, as EMA, first thanked Don and Lew. He presented a status on EMA needs. See Attachment 5. EMA has serious concerns on B20. Fuel dilution increases with B20

and the EMA considered a post injection engine to develop a test around. The NBB and EMA have agreed to conduct a C13, T12, and ISB on B20 with some additional oil analysis and hardware inspection. Some of the additional tests are CAT methods to characterize oxidation. Since the engine tests selected are high temperature tests, fuel dilution may not occur at elevated levels, but still may see deposits or wear. Further testing may be needed at lower temperatures to determine fuel dilution effects.

- 9.2 A request could be sent to ACEA to see if they have low temperature post injection tests and data.
- 9.3 Infineum has reported results at the NPRA meeting on 1N testing with E6 oils and CJ-4 oils. B30 made no difference compared to #2 diesel. Then the oil was doped with 5% B30 resulting in a bad fail on crown land deposits.
- 9.4 CJ-4 field performance is still a question mark. EMA received some data recently. EMA is asking for data by March 1, 2008.
- 9.5 Additional performance requirements. EMA is still interested in characterizing oxidation further. A turbo deposit test is being developed in Europe. Fuel economy is still an important subject. EMA would like a task group to investigate fuel economy. At this point, no reason to change chemical limits through 2010. EMA reviewed test redundancy and they will look at it again since there is more experience and data.

#### 10.0 API CH-4

- 10.1 Shawn Whitacre started the discussion by reviewing some history on the correlation of the ISM back to the M11HST. Cathy Devlin showed an update to Afton's offer to run TMC 1005 in the ISM. See Attachment 6. The differences between the limits were reviewed. Afton conducted an ISM test on TMC 1005 which was a M11HST reference oil. A qualitative summary matrix highlights some differences in performance. Afton suggests that the Surveillance Panel review the data presented and thinks that the data suggests the tests are different. Afton will change their negative vote to an abstention with comment. Shawn is willing to let the Surveillance Panel discuss, but is trying to move it forward. There was only one negative which has since been changed to a waive with comment. Since that is the case, this could be forwarded to Subcommittee B.
- 10.2 Chairman McGeehan asked for a confirming motion for the limits that have been discussed and balloted. **Pat Fetterman moved and Shawn Whitacre seconded. This was a voice vote with no negatives and 2 waives.** This will be sent to Subcommittee B.

#### 11.0 New or old business

- 11.1 Joe Franklin of Subcommittee B is asking to move the B meeting to Tuesday afternoon since meetings are short right now. Some time is needed to prepare reports from the classification panels to B. Joe will also probably remove the 3 HD Surveillance Panel meetings from the schedule. Rather than the default be that the panels meet, the default will be that the panels will not meet. This will be tried in to see if it works.

#### 12.0 The meeting was adjourned at 11:30 am.

**Final Agenda**  
**ASTMSECTION D.02.BO.02** Attachment 1; Page 1 of 1  
**HEAVY-DUTY ENGINE OIL CLASSIFICATION PANELS**

**Hyatt Regency Phoenix**  
**December 4<sup>th</sup> 2007**  
**10:00 am-12:00 noon**

**Chairman/ Secretary:**

**Jim Mc Geehan/Jim Moritz**

**Purpose:**

**Support API HDMO categories**

**Desired Outcomes:**

**Preparing for 2010-2012 Oil Categories**

TOPIC	PROCESS	WHO	TIME
Agenda Review	<ul style="list-style-type: none"> <li>• Desired Outcomes &amp; Agenda</li> </ul>	Group	10:00-10:05
Minutes Approval	<ul style="list-style-type: none"> <li>• June 19<sup>th</sup>, 2007</li> </ul>	Group	10:05-10:10
Membership	<ul style="list-style-type: none"> <li>• Changes: Additions</li> </ul>	Jim Mc Geehan	10:10-10:15
PC-10 Task-Force Report	<ul style="list-style-type: none"> <li>• Learning Look-Back: Lessons Learned</li> </ul>	Lewis Williams	10:15:-10:30
Supply of 500 ppm fuel sulfur	<ul style="list-style-type: none"> <li>• Supply of 500 ppm after 2010 to support oil categories.</li> <li>• PC-9/PC-10 Supply up-date</li> </ul>	Mark Cooper Scott Cobb	10:30-10:45
Action item from June 2007 meeting on Cat support	<ul style="list-style-type: none"> <li>• Up-date on Caterpillar C13 in place of Cat IP</li> <li>• Caterpillar support for IM-PC after 2010.</li> </ul>	Hind Abi-Akar	10:45-11:00
EMA position on 2010	<ul style="list-style-type: none"> <li>• Bio-diesel</li> <li>• Fuel Economy Oils</li> <li>• Turbo-Deposit Test</li> <li>• Discussion</li> </ul>	Greg Shank	11:00-11:30
API CH-4	<ul style="list-style-type: none"> <li>• Up-date on limits for API CH-4 in Cummins ISM</li> </ul>	Shawn Whitacre Cathy Devlin	11:30-11:45
New or old business			11:45-12:00

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# PC-10 Lessons Learned Question 8

How do we generate the data needed in a timely way to correlate old to new tests so we have fewer active tests?

# Team Members

- Pat Fetterman
- Jim Moritz
- Charlie Passut
- Matt Urbanak
- Ben Weber
- Shawn Whitacre
- Lew Williams

# Background

- Engine tests for all active API C categories need to be available to continue licensing.
- Test can be available by two methods:
  - The original test can be maintained.
  - An alternative test at limits equivalent to the original limits can be substituted.
- Maintaining fewer tests and establishing equivalent limits may be more cost effective for our industry than maintaining all older tests.
- In many cases older tests can not be maintained due to hardware and fuel issues.

# Current Approach to Determining Equivalent limits in New Tests

- A trade association or company makes a proposal to use a different test to support an older category, for example the T-10 to replace the T-6.
- The need to replace the old test is based on the desire to keep an older API C category, for example API CF-4, licensable.
- The request is often prompted by the inability to run the old test because of parts, fuel, or lack of test capacity.
- Data is volunteered by interested parties to support equivalent limits. The HDEOCP reviews the data and if there is enough support a ballot is issued.
- The ballot is handled thru the normal ASTM process.


# Issues with the Current Process

- Process usually started only after issues arise with older tests.
- Equivalent limits established long after introduction of new test so old test is maintained far longer than necessary.
- Limited data generated by volunteers.
- Data often generated by candidate testing and not focused on the question of substituting tests.



# Way Forward

- No change to HDEOCP process to review/ballot substitution of new tests for old tests at equivalent limits.
- Run ref oils from old tests in new test precision/BOI/VGRA matrix to determine if new test can replace an old test and at what equivalent limits. Maintain robustness of precision/BOI/VGRA matrix; do not sacrifice precision estimate. Will likely require more testing.
- Cost of industry cooperative testing to be built into industry matrix costs.
- Request that the submitter of new ref oils provide data (field, dyno, bench, and/or predicted tests) on relevant old and new tests to supplement the industry precision data. Places additional requirements on ref oil suppliers.
- Request TMC co-ordinate with the ref oil suppliers to assure all ref oils are maintained until the API LC declares a category obsolete.
- Request TMC maintains documentation for historical ref oils; medians, means, transformations, and number of observations.
- Review the TMC ref oils to determine if we have oils with performance on both sides of the pass/fail limits in all engine tests. This will facilitate setting limits in new tests which are equivalent to the limits in the old test. May require additional testing on an expanded number of ref oils.
- Replacement testing required between upgrades to continue under current process.



# Update: Caterpillar Support of Industry Engine Tests

Heavy-Duty Engine Oil  
Classification Panel

ASTM Section D.02.BO.02

Phoenix, Dec 4, 2007

# C13 in place of 1P



Cat C13  
Multi-cylinder Engine test  
Piston deposits  
Oil consumption

Required in API CJ-4 oil category

Required in Cat ECF-2, applicable to CI-4 oils

Cat 1P  
Single-cylinder Engine test  
Piston deposits  
Oil consumption

Required in API CH-4 oil category

A second 1P test is required in Cat ECF-1-a, applicable to CH-4 oils if ash content is >1.3%

# C13 in place of 1P

Attachment 4; Page 3 of 6

## Proposal:

- ❑ For API CH-4 oils, if an oil passes a C13, it does not have to run a 1P

## Required:

- ❑ Need data to support this proposal
- ❑ Cat will request from ACC: provide data on oils that ran on both tests
  - Determine a C13/1P pass/fail matrix

Pending establishment of Pass/Fail matrix, Cat would agree to allow a C13 to substitute for a 1P test

## 1P Parts availability:

- Liner parts P/N 1Y3997 were made available this year.
- Liner parts can supplement the industry for 3 years.

# Cat 1M-PC – Parts Availability

1M-PC supports API CF and CF-2 oils

- Previously: Cylinder liner availability issues
  - Resolution: Using production parts 5H-5657
- Cat proposed supporting 1M-PC for 5 years from 2004
  - Support period ends 2009

Currently: Issues with availability of 1M-PC Head, P/N 1Y-7943

- The Head will be available on an MTO basis (made to order)
- This part is only made for the 1M-PC engine test
- A price increase is expected. Increase is about double. The price difference will be incurred by the industry.
- Expected lead time is around 2 months after sending the PO

# Cat 1M-PC – Proposal



- Proposal: Cat to stop supporting 1M-PC Jan 2009
- Meantime: Head to be ordered on an MTO basis
- Cat continue to support other parts

Option: consolidate engine tests and replace 1M-PC with an equivalent test



Questions?

# EMA – Biodiesel Status

- **B20 Effects on Engine Oil**

- **Performance Concerns**

  - Oxidation**

  - Deposits**

  - Corrosion**

  - Oil Drain Interval**

  - After Treatment**

  - Fuel Dilution**

    - Post Injection Test?**

    - Discussing Bio Spike of Engine Oil**

- **NBB / EMA Engine Oil Test**

  - **C13**

  - **ISB**

  - **T12**

  - **Test Run with Reference Oil**

  - **Test to Include Additional Oil Analysis & Hardware Insp.**

  - **Test Have Not Started TBD**



# EMA CJ-4 / 2010 Status

- **CJ-4 Oil Field Performance?**

**Request Industry Data to be Submitted  
to EMA      March 1 2008**

- **Additional Performance Requirements**  
**Oxidation – IIIF-IIIG SL-SM      Robo?**  
**Turbo Deposits**  
**Fuel Economy      Task Group?**
- **Chemical Limits - TBD**
- **Review Test Redundancy**

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# Correlation of ISM to M11HST for use in API CH-4

ASTM HDEO Classification Panel

December 4, 2007



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## Test Comparison

	M11 HST	ISM
% Soot	5.0%	6.5%
EGR	No	Yes
Oil Filter Media	Microglass media Remay polyester and nylon overlay	Stratapore polyester media Remay polyester overlay
OFDP Hours	200	150
Bypass in Oil Filter Head	Open	Blocked



## TMC 1004 Test Comparison

	M11 HST		ISM	
	TMC 1004	CH-4 Limit	TMC 1004	Proposed Limit
Xhd Wt. Loss	20.5 mgs	6.5 mgs	8.6 mgs	7.5 mgs
OFDP	83 kPa	79 kPa	56 kPa	79 kPa
Sludge	8.75	8.7	8.97	8.1
n size	4		3	

-  OFDP performance changes from borderline fail to solid pass
  -  2 of 3 ISM results less than half of pass limit (24, 35, 110)
-  Sludge performance changes from borderline pass to solid pass



## Oil A Test Comparison

	M11 HST		ISM	
	Oil A	CH-4 Limit	Oil A	Proposed Limit
Xhd Wt. Loss	6.5 mgs	6.5 mgs	5.8 mgs	7.5 mgs
OFDP	42 kPa	79 kPa	265 kPa	79 kPa
Sludge	8.8	8.7	8.2	8.1

- OFDP performance changes from solid pass to very high fail
- Other parameters compare favorably to limits



# TMC 1005 Test Comparison

TMC 1005 is M11 HST Reference Oil

	M11 HST		ISM	
	TMC 1005	CH-4 Limit	TMC 1005	Proposed Limit
Xhd Wt. Loss	4.53 mgs	6.5 mgs	6.7* mgs	7.5 mgs
OFDP	122 kPa	79 kPa	123 kPa	79 kPa
Sludge	8.4	8.7	8.9	8.1
	Ref Oil Targets		* After Industry Correction Factor	

- OFDP performance is similar in ISM and M11 HST
- Sludge performance changes from a solid fail to a solid pass



## Qualitative Summary

	1004			Oil A			1005	
	HST	ISM		HST	ISM		HST	ISM
<b>Xhd Wear</b>	Solid Fail	Fail		Borderline Pass	Pass		Solid Pass	Solid Pass
<b>OFDP</b>	Borderline Fail	Solid Pass		Solid Pass	Solid Fail		Solid Fail	Solid Fail
<b>Sludge</b>	Borderline Pass	Solid Pass		Borderline Pass	Borderline Pass		Solid Fail	Solid Pass



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## Summary

- ▲ As agreed, Afton has run an ISM test on TMC 1005 (M11 HST reference oil) to generate data from a 3<sup>rd</sup> oil
  - ▲ All data to be used by the Surveillance Panel to either generate appropriate targets (if they exist) or deem the tests (or specific parameters) non-comparable
  - ▲ If the proposed limits are correct, TMC 1005 should have clearly failing OFDP, clearly passing Xhd wear, and failing sludge.
    - Above criteria were met with one exception; passing sludge was generated.
- ▲ The data suggests that these three oils perform differently in the ISM versus the M11HST. Engine design and soot level may account for the oil performance differences between these tests.
- ▲ While Afton is hesitant to endorse the proposed ISM limits, we will abstain with comment on the proposed CH-4 limits ballot.