

**HEAVY-DUTY ENGINE OIL CLASSIFICATION PANEL**  
OF  
ASTM D02.B0.02  
December 6, 2005  
Marriot Waterside Hotel – Norfolk, VA

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**ACTION ITEMS**

- 1. ISB and ISM ballot negative voters work with Cummins to resolve differences.**
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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 1:30 p.m. on Tuesday, December 6, 2005, in the Hampton II Room of the Marriot Waterside Hotel – Norfolk, VA.
  - 1.2 There were 18 members present and 54 guests present. The attendance list is shown as Attachment 2.
- 2.0 Agenda
- 2.1 The agenda is included as Attachment 1.
- 3.0 Minutes
- 3.1 The minutes from the October 27, 2005 meeting were approved as written.
- 4.0 Membership
- 4.1 There were no membership changes.
- 5.0 Chairman Comments and Summary of Activity
- 5.1 Chairman McGeehan provided an update and summary of activity during the last 6 months. See Attachment 3. The API said CJ-4 will be the specification identifier for PC-10. Subcommittee B ballots were approved for the equivalent limits of the M11-EGR to ISM and the T-9 to T-10 and the T-6 to T-10. The CAT 1P test has been added to the category. The Sequence IIIF at API CI-4 limits will be required or the Sequence IIIG at limits to be defined will be allowed. There are 3 piston deposit tests: 1N, 1P, and C13 and 3 valve train wear tests: ISM, ISB and RFWT. This category will have 10 fired engine tests and 6 bench tests. The sulfated ash limit changed to a non-critical limit at 1.0%. Exit criteria ballots had been issued for the T-12 and the ISB. The results for the T-12 are 13 affirmative votes and 5 negative votes. The results for the ISB are 8 affirmative votes and 11 negative votes. See Attachment 4.
- 6.0 Mack T-12

- 6.1 The T-12 ballot negative vote reasons were reviewed. The reasons included uncertainty over the mention of adding IR by peak height and the lack of stability and the apparent increased severity of the Top Ring Weight Loss (TRWL) parameter, the desire to have a full set of limits for all of the tests since an oil will have to pass all of the tests, concern that oil consumption appears to be related to engine build issues and not oil quality, concern that FTIR is not very selective and that the Sequence IIF should cover oxidation.
- 6.2 Greg Shank presented modifications to the limits. See Attachment 5. Greg has had conversations with the additive companies and taken another look at the merit system limits. Greg indicated that he thinks oil consumption is not build related and that it can be influenced by the oil. The maximum oil consumption value was raised though. The values for TRWL were raised somewhat. The maximum for cylinder liner wear (CLW) was raised. The lead values are good protection against oxidation, but the maximum values were raised slightly as well. The FTIR by peak height will be removed.
- 6.3 In response to the changes, the negative voters indicated acceptance of the limits, but would still like to have the full slate of limits settled for all the tests. The limits will be left as is for now as "provisional approval".

## 7.0 Cummins ISB

- 7.1 The ISB ballot negative vote reasons were reviewed. The reasons included dissatisfaction with the soot and torque correction factors, particularly the torque correction (The Cummins Surveillance Panel removed the torque correction after the ballot was issued). Other concerns are that matrix oil 830-2 had adequate wear performance but would fail 80% of the time at the proposed limits and the limits are too restrictive, and the viscosity stay-in-grade requirement is redundant with the T-11 and appears unattainable.
- 7.2 Dave Stehouwer presented the Cummins response. See Attachment 6. Cummins did not get much data comparing the T-11 and ISB soot and viscosity after their request, so the viscosity limit was added. The matrix stats and originally proposed limits were shown for background. The cam wear limit was based on a very incomplete data set of Adcole cam measurements to compare techniques. Cummins have agreed to drop the viscosity limit from the ISB and Mack will add a low limit in the T-11. The T-11 limit will be a minimum of 3.5% soot at 4 cSt increase from the sheared viscosity. The matrix labs sent the matrix camshafts to Cummins for evaluation with the Cummins rating method. Cummins has a visual rating method with an acceptable limit of 2.0. A 2.0 correlates to an 80 by the Adcole which correlates to a 50 Mitutoyo. At this limit, one 830 run is a fail. The Tappet Weight Loss limit was raised to 100 mg. At this limit, one 830 run is a fail and two PC-10B runs are fails. The ISB will not have a merit system, so MTAC limits will be used.
- 7.3 Many of the original negative votes would be switched to affirmative at these limits with the viscosity requirement removed, but there are still two major negative votes. The companies staying with a negative vote are to work directly with Cummins to resolve. There is still a desire to have the whole package of limits for the all the tests as a whole.

## 8.0 Mack T-11

- 8.1 Greg Shank had an update on the T-11 limits proposal. See Attachment 7. The current T-11 limit is a 6.0% soot minimum at a 12 cSt increase from the sheared viscosity. Volvo has discussed adding a slope requirement to the latter part of the test. The proposal is now a 6.7% soot minimum at a 15 cSt increase from the sheared viscosity. Cummins and Volvo had discussions between them to remove the viscosity requirement from the ISB and add a 3.5% soot minimum at a 4 cSt increase from the sheared viscosity. A statement was made that the 3.5% soot minimum at 4 cSt increase limit does not address Cummins' original problem with oils that don't stay in grade. Cummins stated that they wanted T-11 and ISB data and didn't get it. The 4 cSt limit will catch a few oils that have exceeded 22 cSt at low levels of soot. Cummins will address the stay in grade flagging from the field. Greg Shank **motioned** that the T-11 limits proposal be issued for exit ballot. Dave Stehouwer seconded. The **motion passed** on a unanimous voice vote.

## 9.0 Cummins ISM

- 9.1 Dave Stehouwer gave a presentation on revised limits for the ISM. See Attachment **8**. A brief history lesson of 830 as oil E in the PC-9 matrix was shown. Using M11EGR tiered limits from the PC-9 matrix, 40% of matrix runs would fail, but the data might not have been soot corrected. The original proposed limits were shown. Anchors are slightly above the mean for 830-2 in the ISM and the maximum is 1 sigma above the anchor. TRWL is removed from the merit system but is left in with a maximum limit of 100 mg. The weighting factors have been adjusted to account for the removal of TRWL. With the new limits, oil 1004 fails 100% of the time. The average merit for 830 is around 1200. One test was not good enough overall and failed and one exceeded the cap for OFDP. Dave Stehouwer **motioned** that the new proposal be accepted as the limits for the ISM in PC-10. Robert Stockwell seconded.
- 9.2 Discussion: 830-2 is not oil E, it is a second re-blend. 830-2 averages 13.8 mg crosshead weight loss (CHWL) in the M11EGR. It never fails crosshead weight loss. Average Injector Adjusting Screw Weight Loss (AIASWL) is still too tight, the maxima are picked from 1 sigma of the data, set CHWL so that the maximum is 7.5 mg as for CI-4 plus. That would use a higher sigma. There is a problem with bringing this as a motion since the full slate of limits is not available and there were many negatives on the ISM exit criteria ballot. Other negatives: this is moving in the right direction but wants more time to check and study these limits but another exit criteria ballot would be the right way and feels that the values are about right. This is worth going through an exit ballot. The data might not be soot adjusted correctly. Still concerned about CHWL and AIASWL. All the merit system weighting removed from the rings was put on the wear and with all the wear tests there are, that is not necessary. Should put some more weight on the sludge. Cummins is very concerned about the injector adjusting screws. The panel has not seen any data showing the screw problem from the field. Oil ISMA has adjusting screws with too much weight loss. Concern that another exit ballot might yield another 6 or 9 negatives which is no progress. Might make faster progress discussing directly with Cummins. The companies that are still against the new limits are to work directly with Cummins to resolve. The ballot must state that values will be soot corrected. The recent reference oil data from one lab has not been soot corrected. The motion was **withdrawn**.

## 10.0 C13

- 10.1 Elisa Santos presented a summary of the C13 results. See Attachment **9**. This is a summary of analyses presented before. The correlation of Delta Oil Consumption (OC) with deposits is weak. The Ep is greater than 1 for TLC, around 0.9 for TGC and around 0.60 for OC. There was no MAD survey for Carbon on the Top Side of the 2<sup>nd</sup> Ring (R2TCA). Base oil has an effect on OC, Top Groove Carbon (TGC), Top Land Carbon (TLC) and R2TCA. There is detail of the correlations and the precision. Most analyses are on the 24 test matrix data set. The 32 test data set includes the mini-matrix. R2TCA has been analyzed even though there are some problems with the original ratings.
- 10.2 Abdul Cassim gave his presentation. See Attachment **10**. The parameters in the merit system are OC, TLC, TGC, and R2TCA. The other pass/fail parameter is no hot stuck rings. Piston, ring, or liner distress (scuffing) will be non-interpretible if it occurs. The merit system should provide clear separation of Oil A and Oil D/PC-10G as failing and passing oils with values that are acceptable to CAT. The original merit proposal has been changed. TLHC was replaced with TLC and UWD was replaced with R2TCA. R2TCA parameter limits are set because heavy carbon is not desirable. The cap is set such that 100% light carbon will still pass. The weighting is the smallest at 15% of the total. There is support to retain the parameter. A merit system should have more than 3 parameters, so 4 parameters will be used. Some of the issues about rating the R2TCA: some labs did not rate heavy carbon, some labs rated the chamfers on the back of the ring and some did not. Some labs rated polished carbon as light since it did not have any depth. The Surveillance

Panel has agreed on a final rating method and is in the process of conducting a round robin and acquiring rings to have a rating workshop soon. The limits will be set so that very poor oils PC-10F and PC-10C will fail. The merit system values have been changed to reduce the weight of the R2TCA and to allow a slightly higher value before it fails. The Surveillance Panel selected oil PC-10B as the reference oil. Abdul Cassim **motioned** to accept the C13 with the merit system shown for an exit ballot for inclusion in PC-10. Greg Shank seconded.

- 10.3 Chairman McGeehan expressed concern about the variability and lateness of the rating. Abdul said that it wouldn't improve the rating to include it as a rate and report only. The rating was not properly rated during the matrix, but the only oils that had heavy carbon were run at labs that properly rated heavy carbon. It will improve as we go forward and the limit is set pretty high. There is concern over setting a limit based on faulty data. The value is set high enough such that it is a failsafe for now. CAT will have to introduce this in their own spec if it is not included now. There has not been an exit ballot yet for the C13 and it is needed. Need to make sure that all parameters are included on the ballot. A workshop will help the rating, but that doesn't work to set the limit based on the faulty data. How will existing tests be handled with the rating since it was performed differently? An allowance may have to be made for older tests that may not have ring rating data or was rated with the different methods. How much will the values change when all labs start rating heavy carbon? Probably less than double. The independent labs ran most of the tests and rated the rings properly. A rating workshop will help indicate what the matrix data would have looked like. The **motion passed** on a unanimous voice vote to issue the exit ballot.
- 10.4 Abdul announced that Mike Quinn has retired.

#### 11.0 ACC Report

- 11.1 Lew Williams provided a summary of provisional test registrations. See Attachment **11**. There have been 9 registered C13 tests so far at a cost of over \$1M. A total of 153 tests for PC-10 have been provisionally registered so far including retroactive registrations. 46 tests have been registered for the ISB, T-12 and C13 tests.
- 11.2 The C13 BOI/VGRA Guidelines have been sent for ballot. The task force recommended the guidelines to the API Lubes Committee (LC) and the LC authorized issuing a letter ballot. The ballot is to close 12/16/05. The ballot is included as Attachment **12**.
- 11.3 There are still PC-10 timing concerns. PAPTG desires nine months from the passing ballot until first API licensing. The exit ballot process has worked well to bring forward the concerns. The HDEOCP needs to complete exit ballot reviews and move to a complete ballot ASAP. The ACC wants more meetings to complete the balloting process. It is desirable to have OEM specs at or shortly after the completion of the HDEOCP PC-10 ballot. ACC continues to review the spec to determine the critical path, but is not able to determine the completion date yet.
- 11.4 Some tentative dates for future meetings were proposed. January 10<sup>th</sup> with exit ballots due back by January 5<sup>th</sup>. A meeting in February also with the date to be determined.
- 11.5 Steve Kennedy described the details of the BOI resolution. See Attachment **13**. The task force worked to develop a progressive BOI using properties of base oil mixture, not the traditional groups. It covers a limited number of viscosity grades (15W-40, 10W-30, and 10W-40). A single test can be used to read to similar base oil mixtures, or a range can be defined from two tests. The VGRA proposal is similar to existing CAT single cylinder tests.
- 11.6 What about the ISB and T12 group III tests? The contracts are signed but tests not run yet. This program is highly desirable, but not holding anything up.

#### 12.0 Time-Line

- 12.1 Bill Runkle showed the time line. See Attachment **14**. The time line has been adjusted based on the information from the last meeting. Using 9 months from January 26 gets to October 26. The EMA can allow October 15<sup>th</sup>. Now the difference is a few weeks, not months.

### 13.0 Next Meetings

- 13.1 January 10<sup>th</sup> in San Antonio at SwRI
- 13.2 January 26<sup>th</sup> in Chicago at the Embassy Suites
- 13.3 A time in February. Date to be determined.

### 14.0 Viscosity task Force

- 14.1 Andrew Jackson gave a presentation on the SAE J300 viscosity task force. See Attachment **15**. There were meetings and an open forum meeting to discuss what to do with the viscosity standard. Discussed scope of SAE J300. There were many presentations made at the open forums. The task force is having a meeting on Wednesday afternoon of ASTM week.

### 15.0 CAT ECF-2

- 15.1 Abdul Cassim gave a presentation on ECF-2. See Attachment **16**. Caterpillar are introducing two new oil specifications. CAT remains committed to the API system. The new specs address off-highway and on-highway needs. The specs have not been completely finalized. ECF-2 replaces ECF-1 for use off-highway and pre-2007 truck engines. Worldwide use through 2011+. Removal of ash maximum with a minimum of 1.0%. Will include a C13, but the limits could be different from CJ-4. The new spec is ECF-3 and is for 2007 truck engines in the US. Implemented in two phases: interim version prior to CJ-4 licensing with a subset of CJ-4 tests and the full version concurrent with CJ-4 licensing and based on final CJ-4. There will be many field trial engines that need a suitable oil. The customers need a guideline for what oil to use during field trials before CJ-4 oils are available. ECF-2 and ECF-3 will be mutually exclusive specifications. ECF-2 and ECF-3 interim draft specs should be ready January 16, 2006, finalized February 17, 2006 and implemented June 5, 2006. ECF-3 final will be introduced throughout 2006. ECF-1 will be retired by the 3<sup>rd</sup> quarter of 2006 and there will be a registration system with a published list for ECF-2 and ECF-3. ECF-3 interim should have oils in the field by June 5, 2006. CAT will try to stay flexible on the Sequence IIIF and IIIG. ECF-3 includes the PC-10 chemical box. There is a concern that there won't be enough test capacity to run all the tests needed for ECF and CJ-4.

### 16.0 Detroit Diesel Specifications

- 16.1 Detroit Diesel will issue a spec for natural gas engines.
- 16.2 Detroit Diesel will issue a spec for the NAFTA region which will be CH-4 and may include tests from DHD-1 at the same limits.

### 17.0 Two-Cycle Diesel

- 17.1 Patrick Lai announced that the 6V92 stand might not have been available. A survey indicated that there is some demand for a calibrated 6V92. There is still a calibrated 6V92 stand available at Imperial as a result of the survey.

### 18.0 The meeting was adjourned at 5:00 pm.