

HEAVY-DUTY ENGINE OIL CLASSIFICATION PANEL

OF

ASTM D02.B0.02

September 29, 2004

The DoubleTree Hotel, Rosemont, Illinois

THIS DOCUMENT IS NOT AN ASTM STANDARD; IT IS UNDER CONSIDERATION WITHIN AN ASTM TECHNICAL COMMITTEE BUT HAS NOT RECEIVED ALL APPROVALS REQUIRED TO BECOME AN ASTM STANDARD. IT SHALL NOT BE REPRODUCED OR CIRCULATED OR QUOTED, IN WHOLE OR IN PART, OUTSIDE OF ASTM COMMITTEE ACTIVITIES EXCEPT WITH THE APPROVAL OF THE CHAIRMAN OF THE COMMITTEE HAVING JURISDICTION AND THE PRESIDENT OF THE SOCIETY. *COPYRIGHT ASTM, 100 BARR HARBOR DRIVE, WEST CONSHOHOCKEN, PA 19428-2959.*

ACTION ITEMS

- | | |
|--|------------------------|
| 1. Present 1P vs. 1K/1N data for next meeting. | All who have data |
| 2. Recommend T-10 limits for T-9 performance. | Mack Surv. Panel & EMA |
-

MINUTES

1.0 Call to Order

1.1 The HDEOCP meeting of September 29, 2004 was called to order by Chairman Jim McGeehan at 8:08 a.m., in the Mr. Lincoln room of the DoubleTree Hotel of Rosemont, Illinois. There were 18 members present or represented and there were approximately 18 guests present. The attendance list is shown as Attachment 2.

2.0 Agenda

2.1 The published agenda (Attachment 1) was reviewed and provision made for discussion of the T-9 test.

3.0 Previous Minutes

3.1 The minutes of the June 22, 2004 meeting in Salt Lake City were approved as distributed and posted on the TMC web site.

4.0 Membership

4.1 There were no membership changes.

5.0 PC-10 Timeline

5.1 Bill Runkle reviewed the last NCDT meeting (Attachment 3) and noted he planned to take the PC-10 timeline (Attachment 4) to the API Lubes Committee in November.

5.2 Lew Williams moved and Pat Fetterman seconded a motion that the HDEOCP endorses the proposed timeline, which has provision for about six months of technology demonstration followed by about nine months of product qualification prior to API first license date. This puts the first license date now at the beginning of the fourth quarter of 2006. The motion passed with 16 for, 0 against and 0 abstain.

6.0 PC-10 Matrix Design and Funding

- 6.1 Steve Kennedy reported on the matrix design and funding task force activities (Attachment 5). Data on four additive technologies have been submitted to EMA. EMA will select two technologies to use in blending the matrix test oils. The BOI-VGRA task force wants three base oils to be used, but so far, no Group I base oils have been offered. There have been three Group III base oils and one Group II base oil offered for use in the matrix.
 - 6.2 A request has been made to have a separate "Memorandum of Agreement" (MOA) for each test type in the matrix so that if something happened to one of the tests (like the 1Q experience), the other tests would not be effected.
- 7.0 PC-10 Test Development
- 7.1 Mack T-12
 - 7.11 Greg Shank presented a T-12 update (Attachment 6) and indicated Mack may want to try to separate top ring face and side wear. He also said they would be willing to accept T-10 read across guidelines for the T-12. Mack has shipped seven T-12 conversion kits.
 - 7.2 Cummins ISM / ISB
 - 7.21 Dave Stehouwer gave an ISM / ISB update (Attachment 7) and indicated Cummins is concerned about some unexpected viscosity increases they have seen. The panel suggested they make sure the T-8 viscosity procedure is being used since with the soot levels generated by the test, sample history just prior to the viscosity measurement is very important.
 - 7.22 Pat Fetterman expressed concern about using reference oil 830 in setting limits for M-11 EGR replacement.
 - 7.23 Dave stated that Cummins is looking seriously at using a merit system for the ISM.
 - 7.3 Caterpillar C13
 - 7.31 Abdul Cassim reported on C13 development progress (Attachment 8) and indicated they might move away from the no scuffing / no bore polish requirement since they have not seen any problems in that area.
 - 7.32 The CAT Surveillance Panel agreed to move toward use of production 1M-PC liners during its last meeting. Caterpillar (Attachment 9) seeks agreement from the HDEOCP in this regard and Abdul indicated CAT is prepared to continue supplying all the other necessary engine parts for the 1M-PC for the next five years. Abdul moved acceptance of using production cylinder liners for the 1M-PC and Bill Kleiser seconded the motion. The motion passed with 15 for, 0 against, 1 abstain (Abdul).
 - 7.33 With regard to the controversy concerning inclusion of a 1K/1N test as well as a 1P test in the requirements for PC-10, Oronite and Afton agreed to present data at the November panel meeting. Lubrizol and Infineum will consider presenting data. The question is, do oils that pass the 1P always pass the 1K/1N.
 - 7.4 Sequence IIIF or IIIG
 - 7.41 Lew Williams is to ask Bill Nahumck to write a letter to the HDEOCP on hardware availability for the Sequence IIIF.
 - 7.42 Concern with requiring the Sequence IIIG in PC-10 stems from the additional ashless anti-oxidant that would be required and / or more Group II base oil. The additive suppliers were evenly split with half favoring use of the IIIF and half favoring use of the IIIG.

7.5 Seals Test

- 7.51 Jim McGeehan inquired about the incorporation of the Vamac material into the seals compatibility tests. John Zalar indicated Vamac is currently being tested and data is available on the TMC web site. An update from the seals surveillance panel will be requested for the next meeting.

7.6 Test Proposed for PC-10

- 7.61 Jim McGeehan reviewed the list of proposed tests (Attachment 10).

8.0 Mack Surveillance Panel

- 8.1 Greg Shank, standing in for Wim Van Dam, presented the Mack Surveillance Panel report (Attachment 11).
- 8.2 ACEA has requested use of the T-10 test run with ultra low sulfur fuel (ULSD), see Attachment 12. As indicated in the surveillance panel report, the surveillance panel has agreed to this use of calibrated T-10 stands. A TMC Information Letter (IL04-2) (Attachment 13) has been drafted and will be part of the next "B" ballot. Lew Williams requests that it be recorded that the surveillance panel action and subsequent information letter are in no way an ASTM endorsement of this test as fit for purpose.
- 8.3 The T-10 bearing issue has been settled and an Information Letter (IL04-3) distributed. See Attachment 14.
- 8.4 Jim McGeehan reminded everyone that the TMC stopped monitoring the T-9 as of September 1, 2004. IF the T-9 becomes officially "unavailable", then categories CF and CH-4 disappear. So, the Mack Surveillance Panel is hereby asked to establish T-10 limits that would qualify oils at the T-9 performance level. Pat Fetterman suggested that there may be some data from the PC-9 matrix oils giving both T-9 and T-10 performance.

9.0 Next Meeting

- 9.1 The next meeting is set for November 11, 2004 at the DoubleTree Hotel in Rosemont, IL.

10.0 Adjournment

- 10.1 This meeting was adjourned at 10:55 a.m. on September 29, 2004.

Submitted by:

Jim Wells
Secretary to the HDEOCP

Final Agenda
ASTMSECTION D.02.BO.02
HEAVY-DUTY ENGINE OIL CLASSIFICATION PANELS

Double-Tree Hotel, 540 North River Road (847-292-9100)
September 29th 2004
8:00 am-1:00 pm

Chairman/ Secretary:**Jim Mc Geehan/Jim Wells****Purpose:****PC-10****Desired Outcomes:****PC-10 timing, tests, matrix oils funding.**

TOPIC	PROCESS	WHO	TIME
Agenda Review	<ul style="list-style-type: none"> • Desired Outcomes & Agenda 	Group	8:00-8:05
Minutes Approval	<ul style="list-style-type: none"> • June 22nd , 2004 	Group	8:05-8:10
Membership	<ul style="list-style-type: none"> • Changes: Additions • Comments 	Jim Mc Geehan	8:10-8:20
PC-10 Timing	<ul style="list-style-type: none"> • Review • Vote 	Bill Runkle	8:20-8:45
Funding	<ul style="list-style-type: none"> • Status of funding. • API/ACC/EMA positions 	Steve Kennedy	8:45-9:15
Matrix Oils	<ul style="list-style-type: none"> • Oils selected • Timing of availability 	Steve Kennedy	9:15-9:30
Coffee break	<ul style="list-style-type: none"> • Collect money for room coffee. 		
PC-10 Test Development report	<ul style="list-style-type: none"> • Mack T-12 • Cummins ISB • Cummins ISM • Caterpillar C13 • Seq IIIG-or IIIF for oil oxidation. • Vacam seal progress • Review all the tests in category • Exit-Criteria ballot date on PC-10 tests: status 	Greg Shanks Dave Stehouwer Abdul Cassim Jim Mc Geehan	9:45-11:00
Mack T-10 Ultra-Low Sulfur fuel tests for ACEA	<ul style="list-style-type: none"> • Back-ground on ACEA request and surveillance panel vote. • PC-10 test fuel • Discussion • Vote 	Win Van Dam	11:00-11:30
Mack T-10 bearing status	<ul style="list-style-type: none"> • Review progress in Mack T-10 surveillance 	Wim Van Dam	11:30-12:00

TOPIC	PROCESS	WHO	TIME
Caterpillar IM-PC	<ul style="list-style-type: none"> • Back-ground: on liners • Options/discussion/ vote 		12:00-1:00
Next meeting	<ul style="list-style-type: none"> • November 11th at Double Tree (\$129) 		
New/Old business			

HDEOCP Attendance List

September 29, 2004

ATTACHMENT 2, Page 1 of 4

Belay, Mesfin
Detroit Diesel Corp.
13400 W. Outer Dr., K15
Detroit, MI 48239-4001
313-592-5970, FAX 313-592-5952
mesfin.belay@detroitdiesel.com

Bond, Stacy
Perkin-Elmer
5404 Bandera Road
San Antonio, TX 78238
(210) 523-4604, FAX (210) 523-4607
stacy.bond@perkinelmer.com

Burnett, Don
ChevronPhillips Chemical Co. LP
10601 Six Pines Dr.
The Woodlands, TX 77308
832-813-4859, FAX
burnede@cpchem.com

Carter, James E.
Haltermann Products
1201 South Sheldon Rd., P.O. Box
Channelview, TX 77530-0429
517-347-4947, FAX 517-347-1024
jecarter@dow.com

Cassim, Abdul H.
Caterpillar Inc.
Bldg. H3000 - Dk 13
RT#29 @ Old Galena Rd.
P.O. Box 4000
Mossville, IL 61552-0610
309-578-9096, FAX 309-578-1485
cassim_abdul_h@cat.com

Chao, Kenneth K.
John Deere
P.O. Box 8000
Waterloo, IA 50704-8000
319-292-8459, FAX 319-292-8441
chaokennethk@jdcorp.deere.com

Couch, Mel C.
ChevronTexaco Global Lubricants
100 Chevron Way
Richmond, CA 94802-0627
510-242-3368, FAX 510-242-3758
mcou@chevrontexaco.com

DeBaun, Heather J.
International Truck & Engine Corp.
10400 West North Ave.
Melrose Park, IL 60160
708-865-3788, FAX 708-865-4229
heather.debaun@nav-international.com

Devlin, Cathy C.
Afton Chemical
500 Spring St.
Richmond, VA 23219
804-788-6316, FAX 804-788-6388
cathy.devlin@aftonchemical.com

Duncan, Dave
Lubrizol
29400 Lakeland Blvd.
Wickliffe, OH 44092-2298
440-347-2018, FAX 440-347-1733
dadu@lubrizol.com

HDEOCP Attendance List

September 29, 2004

ATTACHMENT 2, Page 2 of 4

Evans, Joan
Infineum
1900 E. Linden Ave.
Linden, NJ 07036
908-474-6510, FAX
joan.evans@infineum.com

Fetterman, G. Pat
Infineum USA, LP
P.O. Box 735
Linden, NJ 07036
908-474-3099, FAX 908-474-3363
pat.fetterman@infineum.com

Franklin, Thomas M.
PerkinElmer
5404 Bandera Rd.
San Antonio, TX 78238
(210) 647-9446, FAX (210) 523-4607
tom.franklin@perkinelmer.com

Frick, John
CITGO Petroleum Corp.
6100 South Yale Ave.
P.O. Box 3758
Tulsa, OK 74102
918-495-5929, FAX 918-495-5022
jfrick@citgo.com

Gault, Roger
EMA
2 North LaSalle St.
Suite 2200
Chicago, IL 60602
312-827-8742, FAX
rgault@emamail.org

Harold, Scott
Ciba Spec. Chemicals
540 White Plains Rd.
Tarrytown, NY 10591
914-785-4226, FAX 914-785-4249
scott.harold@cibasc.com

Jones, Ron
ChevronPhillips Chemical Co., LP
3027 Glenloch Circle
Dublin, OH 43017
614-266-5065, FAX
jonesro@cpchem.com

Kennedy, Steve
ExxonMobil R&E
Billingsport Rd.
Paulsboro, NJ 08066
856-224-2432, FAX 856-224-3613
steven.kennedy@exxonmobil.com

Kleiser, Bill
Chevron Oronite Technology
100 Chevron Way
Richmond, CA 94802
510-242-3027, FAX 510-242-3173
wmkl@chevrontexaco.com

Knight, John W.
Test Engineering, Inc.
12718 Cimarron Path
San Antonio, TX 78249
(210) 690-1958, FAX (210) 690-1959
jknight@tei-net.com

HDEOCP Attendance List

September 29, 2004

ATTACHMENT 2, Page 3 of 4

Laroo, Chris
US EPA
2000 Traverwood Dr.
Ann Arbor, MI 48105
734-214-4937, FAX 734-214-4055
laroo.chris@epa.gov

Lynskey, Mike
BP
9300 Pulaski Highway
Baltimore, MD 21220
410-682-9484, FAX 410-682-9408
lynskem@bp.com

Mayer, Richard J.
Chevron Oronite Co. LLC
100 Chevron Way
P.O. Box 1627
Richmond, CA 94802-0627
510-242-2538, FAX 510-242-3173
rmay@chevrontexaco.com

McGeehan, Jim
Chevron Global Lubricants
100 Chevron Way
Richmond, CA 94802
510-242-2268, FAX 510-242-3758
jjam@chevrontexaco.com

Passut, Charles A.
Afton Chemical Co.
500 Spring St.
P.O. Box 2158
Richmond, VA 23218-2158
804-788-6372, FAX 804-788-6388
charlie.passut@aftonchemical.com

Place, William E.
Oronite
1315 E. Michigan Ave., #194
Saline, MI 48176
(734) 222-0890, FAX (734) 222-4065
wepl@chevrontexaco.com

Pridemore, Dan
Afton Chemical Co.
2000 Town Center, Suite 1750
Southfield, MI 48075
248-350-0640, FAX 248-350-0025
dan_pridemore@ethyl.com

Runkle Jr., William A.
Valvoline Company
LA-GN
P.O. Box 14000
Lexington, KY 40512-4000
(859) 357-7686, FAX (859) 357-7610
wrunkle@ashland.com

Shank, Greg L.
Mack Trucks, Inc.
13302 Pennsylvania Ave.
Hagerstown, MD 21742-2693
301-790-5817, FAX 301-790-5815
greg.shank@macktrucks.com

Stehouwer, David M.
Stehouwer Technical Services
5034 Countess Drive
Columbus, IN 47203
812-378-9825, FAX
dmstehouwer@comcast.net

HDEOCP Attendance List

September 29, 2004

ATTACHMENT 2, Page 4 of 4

Stockwell, Robert T.
General Motors Corporation
GM Powertrain Engineering Center
Mail Code 483-730-322
823 Joslyn Rd.
Pontiac, MI 48340
810-492-2268, FAX 810-575-2732
robert.stockwell@gm.com

Urbanak, Matthew
Shell Global Solutions US
Westhollow Technology Center
(L-109C)
P.O. Box 1380
Houston, Texas 77251-1380
281-544-9227, FAX 281-544-8150
matthew.urbanak@shell.com

Wells, James M.
Southwest Research Institute
PO Drawer 28510
San Antonio, TX 78228-0510
(210) 522-5918, FAX (210) 523-6919
james.wells@swri.org

Williams, Lewis A.
The Lubrizol Corporation
29400 Lakeland Blvd.
Wickliffe, OH 44092
440-347-1111, FAX 440-944-8112
lawm@lubrizol.com

Zalar, John
ASTM TMC
6555 Penn Ave.
Pittsburgh, PA 15206
(412) 365-1005, FAX (412) 365-1047
jlz@astmtmc.cmu.edu

Zechiel, Scott
Detroit Diesel Inc.
13400 W. Outer Drive
Detroit, MI 48239-4001
313-592-7995, FAX 313-592-5906
scott.zechiel@detroitdiesel.com

PC-10 NEW CATEGORY DEVELOPMENT TEAM (NCDT)

August 17, 2004

Embassy Suites Hotel Chicago O'Hare-Rosemont

5500 North River Road

Rosemont, IL 60018

Summary

1. EMA UPDATE

The EMA representatives took turns updating the team on the proposed PC-10 tests:

2. Caterpillar Single Cylinder Tests in PC-10

EMA believes PC-10 needs an aluminum piston deposit test and proposed the NCDT add the Cat 1P to the PC-10 requirements. Team members questioned the need for the test and asked if it would be used in place of the Cat 1K or 1N. Members also suggested that more data supporting the need for the test be brought forward. After some discussion, the team conducted a straw vote on adding the 1P to the current list of PC-10 tests based on the support put forward by EMA and voted [**4 for, 4 against, and 6 waive**].

Following the straw vote, EMA concluded that it needed to clarify its request for the addition of the 1P. NCDT members asked for more data to justify adding the test and for more information on Caterpillar's plans for supporting the 1K and/or 1N tests.

ACTION: EMA will clarify its request for adding the 1P to the list of PC-10 tests.

3. EMA reported that two additive technologies and two base oils had been submitted for the PC-10 matrix. Members hoped that a third additive technology would be submitted and agreed to extend the submission deadline until August 27.

ACTION: Kevin Ferrick notified interested parties that the deadline for submitting base oil and additive technologies for consideration for the PC-10 matrix has been extended to August 27, 2004.

3. PC-10 MATRIX

Steve Kennedy updated the Team on the progress made by the PC-10 Matrix Design Task Force.

Steve Kennedy noted that the PC-10 Matrix Funding Task Force continued its discussions on funding and agreed it would likely need to pursue an arrangement similar to the one followed for PC-09. The task force had started discussing what constitutes in-kind contributions from the test sponsors, but more work is needed on the proposal.

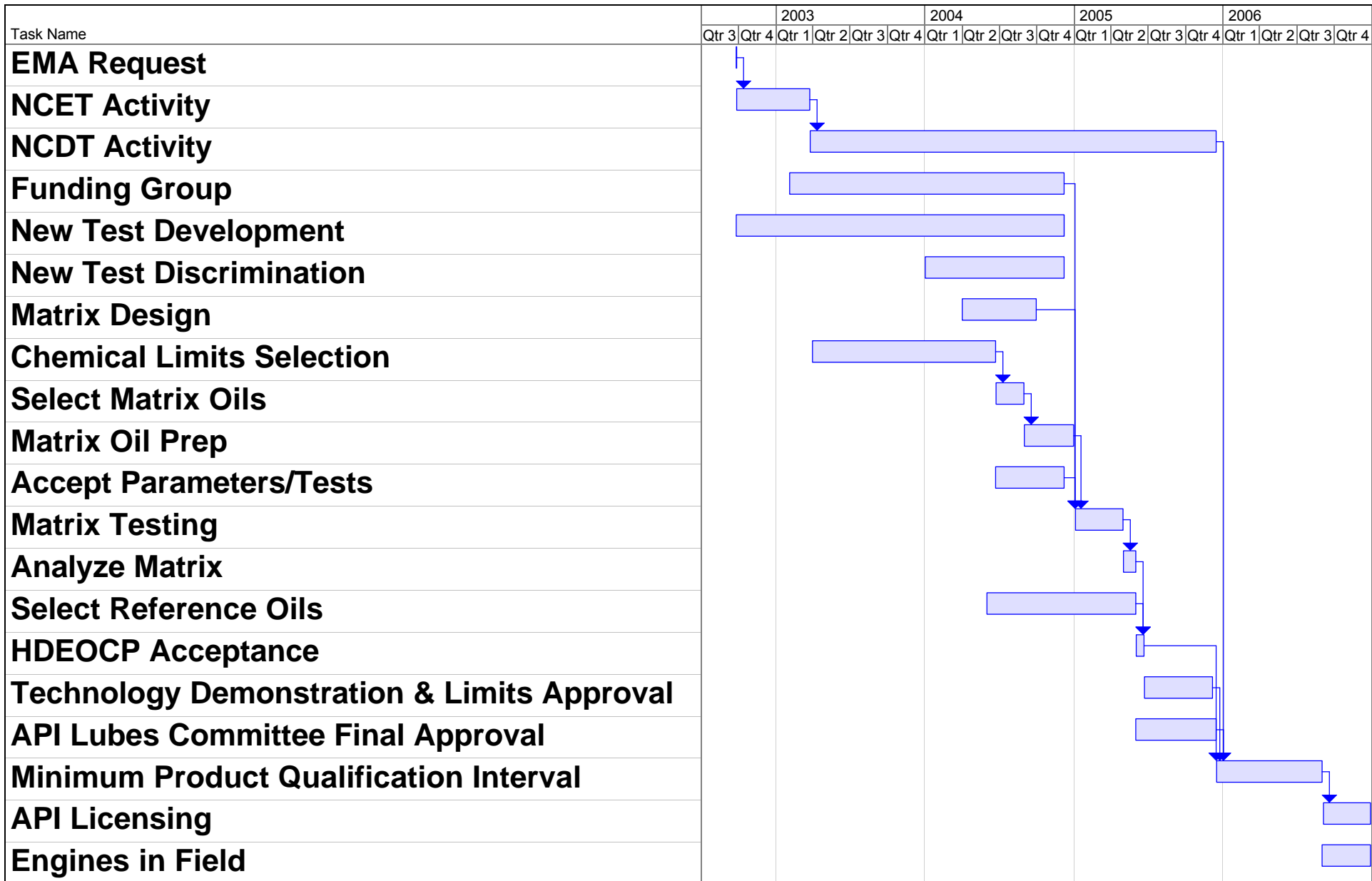
4. PC-10 BACK-UP ENGINE TESTS

Bill Runkle asked the OEM test sponsors whether other tests could be used in place of proposed tests if they cannot be ready within the PC-10 timeline. Greg Shank responded that Mack might be able to use the T-10 if some issues were resolved. Dave Stehouwer reported that there is no back-up for the Cummins ISB. Abdul Cassim added that Caterpillar would need a back-up, perhaps the 1P, if the C13 is not ready.










5. ACTION ITEMS/NEXT STEPS

Members reconfirmed the action items noted above and also agreed that the API Lubricants Committee should be asked to endorse the timeline that includes the 9-month product qualification interval.

ACTION: Bill Runkle will ask the Lubricants Committee to approve at its next meeting the PC-10 timeline that includes the 9-month product qualification interval.



Project: PC-10 ACC-1 09212004
Date: Tue 9/21/04

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	

PC-10 Matrix Funding & Design TF
ASTM HDEOCP Meeting
September 29, 2004
Chicago, IL

PC-10 Engine Test Matrix

Funding Group

- **ACC & API have agreed to match up to \$1MM EMA cash & in-kind contributions for PC-10 Precision & BOI matrix testing**
- **Three million dollars from trade associations will not fully fund the PC-10 matrix (C13, ISB, T-12)**
 - ❖ **Precision only = \$4.6MM total / 1.5MM funded (18 tests)**
 - ❖ **Precision + BOI = \$6.6MM total / 3.6MM funded (26 tests)**
- **Significant issues related to conditions and details of trade association contributions must be resolved**
 - ❖ **EMA cash & in-kind contributions must be established**
 - ❖ **Determine impact of ACC positions on minimum number of matrix runs per stand & maximum number of calibration tests**
 - ❖ **Funding meeting planned for week of October 11**

PC-10 Engine Test Matrix

Areas of Progress

- **Calibration criteria established by test development groups**
 - ❖ Two for first stand in a lab
 - ❖ One for additional stands
- **Recommendations for additive & base oil to be used in Precision-BOI matrices accepted**
 - ❖ Two additive technologies; EMA reviewing submissions
 - ❖ Three base oils spanning a wide range of saturates & viscosity index (Groups I, II, and III)
- **Generic matrix designs developed for many potential Precision-BOI and Precision only scenarios**

PC-10 Engine Test Matrix

Preliminary Precision / BOI Matrix Designs (9)

Matrices	15	16	17	18	16a	16b	16c	C-13	C-13
	1	2	3	4	5	6	7	8	9
No. of Stands	3	4	6	8	5	6	7	7	7
No. of Labs	2	2	5	6	3	4	5	5	5
No. of Oils	6	6	6	6	6	6	6	4	4
Total No. of Tests	20	20	20	20	20	20	20	26	26
No. of Tests/Oil	6,2	6,2	6,2	6,2	6,2	6,2	6,2	8,5	9,4
Detectable Difference in s of variable and using t Comparing reference oils only	2.89	2.91	2.98	3.09	2.94	2.98	3.02	1.97	2.08
	2.89	2.94	3.08	3.33	3.00	3.08	3.19	2.17	2.05
No. of Tests/Stand	7,6,7	5	4,3,4,3,3,3	4*2 4*3	4	4,3,4,3,3,3	3,3,3,3,3,2	4,3,4,3,4,4,4	4,3,4,3,4,4,4
Detectable Difference in s of variable and using t	1.97	2.25	2.78	3.45	2.55	2.78	3.38	2.64	2.64
Detectable Difference in s of variable taking the multiple comparison into account for several sample size combinations	2.30	2.89	4.08	5.75	3.50	4.08	5.26	3.77	3.77
	2.21		3.77	5.14		3.77	4.71	3.49	3.49
			4.36	6.30		4.36		4.03	4.03
No. of Tests/ Lab	13, 7	10, 10	7,4,3,3,3	4,4,3,3,3,3	8,8,4	7,7,3,3	6,6,3,3,2	7,7,4,4,4	7,7,4,4,4
Detectable Difference in s of variable and using t	1.66	1.59	2.52	2.89	2.20	2.52	3.02	2.17	2.17
Detectable Difference in s of variable taking the multiple comparison into account for several sample size combinations	1.66	1.59	3.50	4.41	2.60	3.28	4.27	2.88	2.88
			3.18	4.08	2.12	2.54	3.02	2.45	2.45
			3.87	4.71		3.88	3.70	3.24	3.24
Degrees of Freedom									
Oil	5	5	5	5	5	5	5	3	3
Stand(Lab)	1	2	1	2	2	2	2	2	2
Lab	1	1	4	5	2	3	4	4	4
Mean	1	1	1	1	1	1	1	1	1
Error	12	11	9	7	10	9	8	16	16
Total	20	20	20	20	20	20	20	26	26
95% CI for Sigma, Width^	0.93	0.99	1.14	1.37	1.06	1.14	1.24	0.78	0.78

PC-10 Engine Test Matrix

Preliminary Precision Matrix Designs (24)

Matrices	2	3	3*	6	7	7a	9	10	12	14	21	22	23	21a	22a	23a	3a	3b	3c	24	25	26	ISB	T-12
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
No. of Stands	3	4	4	4	4	5	5	5	6	6	5	6	7	5	6	7	5	6	7	7	7	7	6	7
No. of Labs	2	2	2	3	3	3	4	4	5	5	3	4	5	3	4	5	3	4	5	5	5	5	4	5
No. of Oils	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Total No. of Tests	12	16	12	12	16	16	12	15	18	24	20	24	28	18	20	22	16	16	16	14	21	23	22	26
No. of Tests/Oil	6	8	6	6	8	8	6	7.8	9	12	10	12	14	9	10	11	8	8	8	7	10,11	12,11	11	13
Detectable Difference in s of variable and using t	2.14	1.78	2.18	2.18	1.78	1.80	2.24	1.89	1.68	1.41	1.56	1.41	1.29	1.67	1.57	1.49	1.80	1.82	1.85	2.08	1.53	1.45	1.48	1.35
No. of Tests/Stand	4	4	3	3	4	4,2,4,2,4	3,3,2,2,2	3	3	4	4	4	4	4,4,4,4,2	4,4,4,4,2,2	4,4,4,4,2,2,2	4,3,3,3,3	3,3,3,3,2,2	3,2,3,2,2,2,2	2	3	4,3,3,4,3,3,3	4,3,4,3,4,4	4,3,4,3,4,4,4
Detectable Difference in s of variable and using t	2.62	2.52	3.09	3.09	2.52	3.12	3.55	2.98	2.91	2.43	2.47	2.43	2.41	3.06	3.04	3.02	2.75	3.33	3.38	3.89	2.87	2.65	2.65	2.62
Detectable Difference in s of variable taking the multiple comparison into account for several sample size combinations	3.12	3.23	4.12	4.12	3.23	4.29	5.26	4.14	4.16	3.35	3.30	3.35	3.40	4.14	4.27	4.37	3.78	4.87	5.26	6.47	4.17	3.81	3.68	3.71
						3.50	4.70							3.38	3.49	3.57	4.04	4.36	4.71			3.53	3.41	3.44
						4.95	5.76								4.93	5.04		5.34	5.77			4.07	3.94	3.97
No. of Tests/Lab	8,4	8,8	6,6	6,3,3	8,4,4	6,6,4	6,2,2,2	6,3,3,3	6,3,3,3,3	8,4,4,4,4	8,8,4	8,8,4,4	8,8,4,4,4	8,8,2	8,8,2,2	8,8,2,2,2	7,6,3	6,6,2,2	5,5,2,2,2	4,4,2,2,2	6,6,3,3,3	7,7,3,3,3	7,7,4,4	7,7,4,4,4
Detectable Difference in s of variable and using t	2.27	1.78	2.18	2.67	2.18	2.32	3.17	2.58	2.52	2.11	2.14	2.11	2.09	2.79	2.78	2.76	2.48	2.98	3.10	3.37	2.87	2.40	2.18	2.15
Detectable Difference in s of variable taking the multiple comparison into account for several sample size combinations	2.27	1.78	2.18	3.21	2.56	2.74	4.33	3.88	3.44	2.79	2.49	2.64	2.74	3.27	3.52	3.69	2.93	3.88	4.38	4.99	3.86	3.19	2.74	2.84
				3.71	2.96	2.45	5.30	3.88	3.97	3.22	2.03	2.16	3.17	2.30	2.23	2.34	3.00	2.74	3.31	4.07		3.78	2.34	2.42
												3.05	2.03		4.46	4.67	2.36	4.75	5.23	5.76			3.09	3.20
Degrees of Freedom																								
Oil	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Stand(Lab)	1	2	2	1	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Lab	1	1	1	2	2	2	3	3	4	4	2	3	4	2	3	4	2	3	4	4	4	4	3	4
Mean	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Error	8	11	7	7	11	10	6	9	11	17	14	17	20	12	13	14	10	9	8	6	13	15	15	18
Total	12	16	12	12	16	16	12	15	18	24	20	24	28	18	20	22	16	16	16	14	21	23	22	26
95% CI for Sigma, Width^	1.24	0.99	1.37	1.37	0.99	1.06	1.56	1.14	0.99	0.75	0.84	0.75	0.68	0.93	0.89	0.84	1.06	1.14	1.24	1.56	0.89	0.81	0.81	0.72

PC-10 Engine Test Matrix

Next Steps

- **Agree on plan to fund matrix testing; finalize MOA for each new test type**
- **Decision on Precision-BOI versus Precision only for each test; agree on BOI if appropriate**
- **Determine the number of labs and stands participating in the new test matrices**
- **Identify suitable Precision-BOI or Precision only designs for each new test**
- **Final selection & blending of matrix oils**



Mack PC10 Engine Test Update

ASTM HDEOCP

September 29, 2004



Ring & Liner Wear (Corrosive), Bearing Corrosion / Oxidation / Oil Consumption

- Mack T-12
- Based on Mack T10 & Mack T11
- With ULSD Fuel ??
- Length - ~ 300 Hours
- Two Phase Test
- Phase 1 100 hr (4.3 % Soot)
- Phase 2 200 hr (EOT 5.5- 6 % Soot)
- Phase 2 260 F Oil Sump Temp
- Increased EGR Flow (Heavy EGR)
(35% Phase 1 – 15 % Phase 2)
- Determine Ring Face & Side Wear
- Precision Matrix Required



Mack / Volvo Powertrain T12 Test

- Hardware (External)
Same as T10 Except – VGT Turbo replaces
small T10 Turbo
2 Production EGR Coolers (Breadboard) Replaces Tube Cooler
EGR on/off Valve
- Hardware (Internal)
Same as T11 Power Cylinder & Heads
New Nozzles & Spray Angle
- Hardware T12 Conversion Kit Shipped wk of Sept 20th
- Formed T12 TASK FORCE Sept 10th
- First Teleconference Sept 23rd
- 2nd Teleconference Oct 1st
- Meeting & Lab Visits Late October in San Antonio
- Draft Test Procedure - October
- Test Procedure for Matrix Testing - December



T12 PC10 Engine Oil Test

			July	August	September	October	November	December
EGR Mapping			█	█				
Soot Mapping				█				
TBN Depletion Mapping					█			
Demonstration Testing					█	█		
Discrimination Testing							█	█
Deliver Draft Procedure						█		
Deliver Procedure for Matrix Testing								█

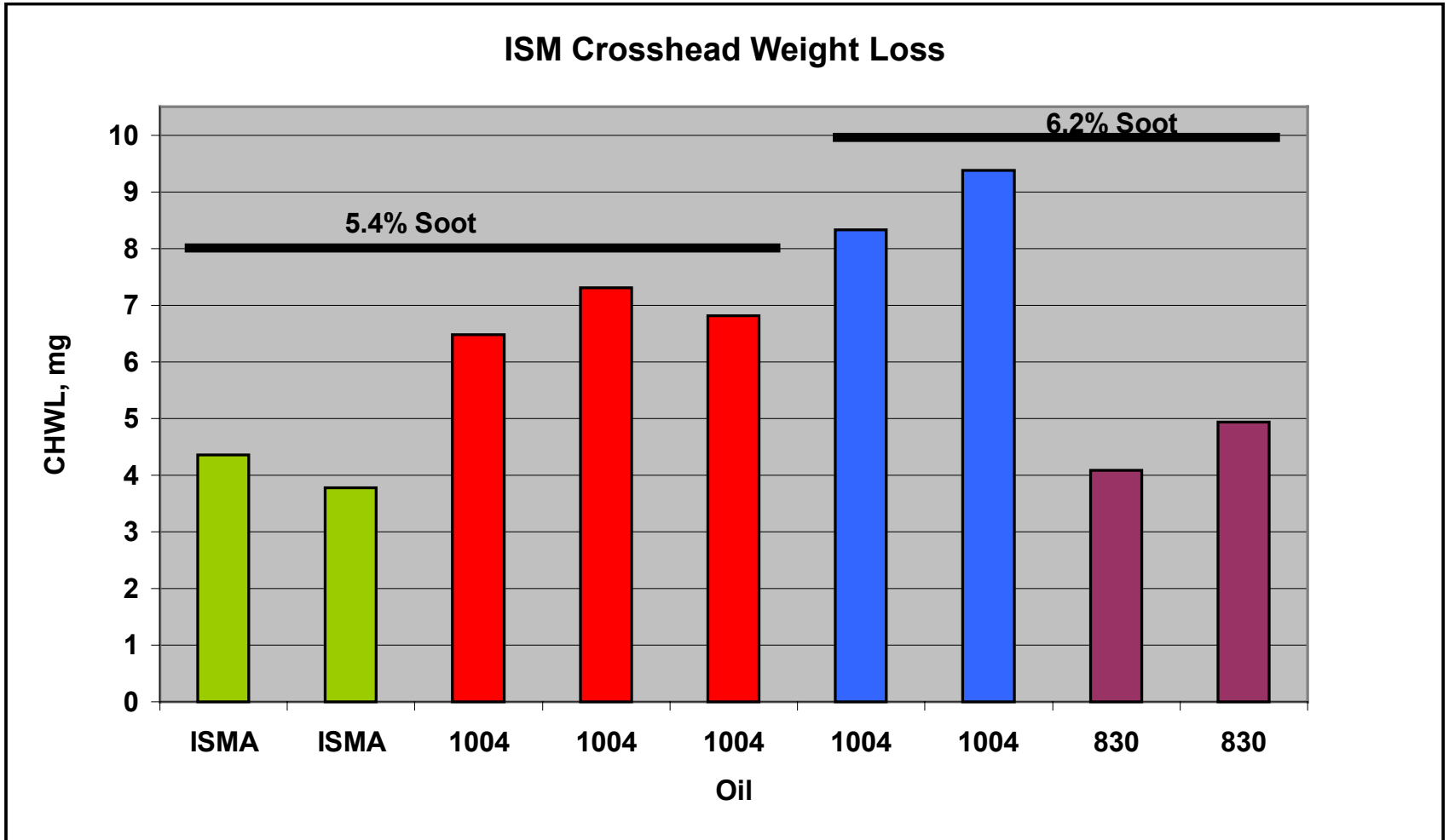
Overview of status of Test Development

- **Initial phase of matrix testing complete.**
- **Additional data generated on two tests run to 300 hours.**
- **Statistical data review of the initial phase of matrix is complete.**
- **Test shows discrimination on CHWL, but other parameters unclear.**
- **Phase II of matrix underway.**

Developments since June '04

- **Soot Target changed to 6.5% at 150hrs**
- **Phase II of test matrix modified.**
 - **3 labs (stands) – Lubrizol, Perkin Elmer, SwRI**
 - **2 oils (1004 and 830)**
 - **Total of six tests planned as matrix runs**
 - **Additional data to be supplied by Afton.**
- **Now running with non-coated intake manifolds**
- **Referencing requirements for labs debated and passed on to Surveillance Panel for action.**
 - **First stand 2 runs**
 - **Second stand 1 run**

ISM Crosshead Weight Loss



ISM Status as M11 EGR Replacement

- **CHWL discrimination established**
 - Soot correction data to be studied from matrix runs
 - Limits to be set based on 830
- **OFDP data correction process under review**

ISM PC-10 Requirements

- **Valvetrain Wear**
 - **Crosshead + Adjusting Screw Weight Loss**
- **Top Ring Weight Loss**
- **Oil Filter Plugging**
- **Sludge**
- **Viscosity Increase**
 - **Some oils in field showing unexpected increases**
 - **Correlate ISM with T11**
- **Possibility of developing a merit system**

ISB Status

- Procedure established
- As many as 7 stands could be installed
- 4 test discrimination matrix in progress

- Cummins will use data from ISM and ISB for determining suitability for field testing
 - Cummins will NOT review any candidate data until matrix testing is done.

Caterpillar C13 Test Criteria

500 hour – Steady State Test Cycle with CCV

Test Pass/Fail Criteria:

1. No Loss of Oil Consumption Control
<50% (based on average of EOT vs SOT)
2. Last 150 hours stable Oil Consumption
3. No stuck rings/Loss of ring side clearance
4. No Liner Scuffing or Bore Polish
5. CCV pass/fail to be assessed



Caterpillar C13 Test Status

Status Test Development:

- 1) Test Cycle Completed
- 2) C13 Test engines installed – 11
- 3) C13 Test engines provided to date - 13
- 4) CCV Pseudo system defined and being tested



Caterpillar C13 Test Status

Status Hardware:

- 1) Close tolerance Production Liners, Piston and rings supplied to all labs
 - Initial Oil Consumption studies on-going
- 2) Low reference Ref Oil supplied to all labs
- 3) Three Potential High reference oils being assessed
- 4) Complete test by end Oct '04



Caterpillar C13 Test Update

Three C13 tests completing this week – two Low Ref
and 1 Potential High Ref oils

Repeat of one, two or three tests as required.

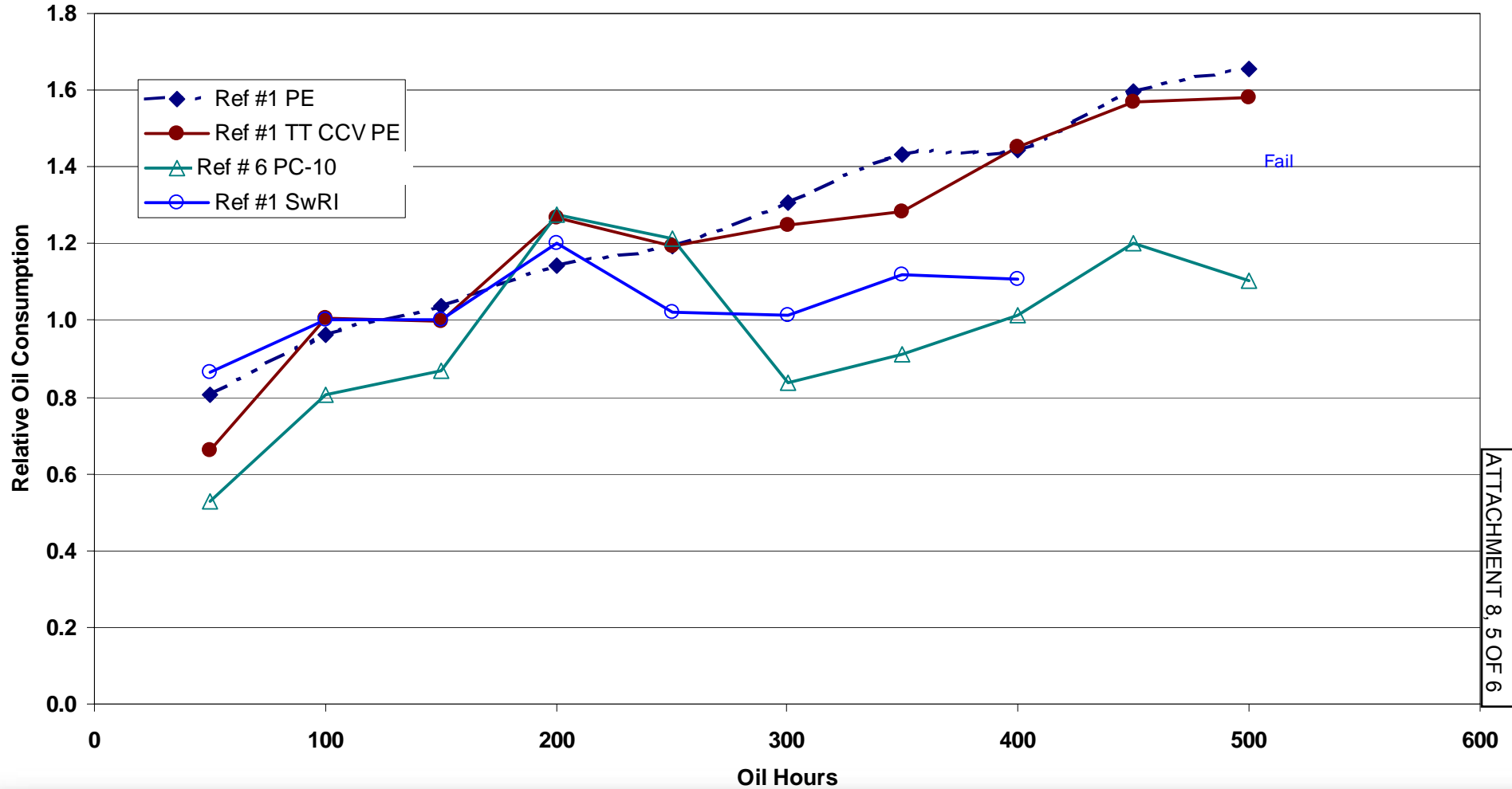
One test showed loss of oil consumption.

CCV Pseudo system not affecting deposits

No noticeable effect of fuel sulfur on test



C13 Normalized Oil Consumption



ATTACHMENT 8, 5 OF 6



Caterpillar SCOTE PC-10 Position

C13 and 1P tests deemed the best protection for CAT in PC-10

1K/1N would ONLY be supported in addition to C13/1P if required by other OEMs.

IM-PC Liner decision to use production hardware accepted/supported by Surveillance Panel (Richmond Sept 4, 04)





Caterpillar Inc.

100 NE Adams Street
Peoria, Illinois 61629

August 10, 2004

To Members of the Heavy Duty Engine Oil Classification Panel (HDEOCP):

This letter is being sent for your information and in preparation for discussion at the next HDEOCP meeting on September 29, 2004.

Issues and Options for continued support of the Caterpillar 1M-PC SCOTE engine.

Caterpillar has identified that there is a manufacturing and supply issue with the current 1M-PC cylinder liner (1Y3995). The tooling for the manufacture of this liner is no longer functional and continued supply will require new tooling. The cost to manufacturers for new tooling will be in the range of \$150,000 to \$300,000. It is likely that ASTM will require the new liners to be referenced, which is also a cost that will have to be addressed.

The oil categories supported by the 1M-PC engine test includes the API CF and CF-2 categories, mainly in support of pre-chamber diesel engines and 2-stroke Detroit Diesel engines. Other markets that use the 1M-PC engine or API CF category include the Automotive, Railroad, Japan and older Marine engines.

Caterpillar has identified three possible solutions and would like to state that no matter which course of action the industry takes, Caterpillar will support this engine for a maximum of five more years.

Work with the HDEOCP/EMA/ASTM/CPD or outside companies to fund the purchase of a lifetime supply of liners to cover tests over the next five years. It is estimated that the total investment required by manufacturers would be about \$ 600,000, which includes tooling and procurement. The price of the finished liners would be determined by who ever agrees to pay for the tooling and purchase of the liners. The industry would also have to work through funding for any reference testing required. Caterpillar would continue to supply other 1M-PC parts.

2. Use a current production part 5H5657, which is available from any Caterpillar Dealer. The referencing and conformity of these parts will be entirely relying on the production manufacturing process. The cost of this liner is in the region of \$132 per liner.
3. Caterpillar stops supporting the 1M-PC test on January 1, 2005.

Under options 1 and 2 listed above, Caterpillar would not supply the 1Y3995 liner but would continue to support the 1M-PC with other parts in inventory for an estimated five-year period, after which the remaining parts would be sold or scrapped thus bringing to an end the support of this engine by Caterpillar. No more parts will be manufactured except consumables, pistons and rings. Caterpillar estimates a five-year life for parts between what is in inventory and what can be cannibalized from existing engines.

Caterpillar asks that the HDEOCP debate and recommend which of the three above options its members favor. Caterpillar welcomes any suggestions from members of the HDEOCP, EMA, ASTM, CPDs and test laboratories in the resolution of the 1M-PC liner issue. We will require an answer no later than October 15, 2004, after which our only option will be to stop supporting the 1M-PC test.

PC-10 Performance Requirements and Engine Tests



Performance Criteria	Fuel Sulfur, Wt %	Test	PC-10 2006
Aluminum Piston Deposits, Oil Consumption	0.05	Caterpillar 1N	X
Viscosity Increase Due to Soot at 6.0%	0.05	Mack T-11	X
Roller-Follower Valve Train Wear	0.05	GM 6.5-Liter PC – Diesel	X
Aeration	0.05	Navistar HEUI 7.3-Liter EOAT	X
Foam	–	Bench Test Sequence I, II, III	X
Volatility	–	Noack D 5800 or Distillation D 2887	X
Used Oil Viscometrics at Low Temperature	–	J300 Bench Tests MRV TP-1 Soot	X
Elastomer Compatibility		D-471, Ref. Oils	X
High Temperature/High Shear		Bosch Injector	X
Valve Train Wear, Filter Δ P and Sludge	.05	Cummins ISM	X
Valve Train Wear	15 ppm	Cummins ISB	X
Oil Consumption and Piston Deposit	15 ppm	Caterpillar C-13	X
Ring, Liner Bearing Wear & Oil Consumption	15 ppm	MackT-12	X
Oil Oxidation	0.10	See III G	X
Shear Stability – 90 Cycles	–	Bosch Injector ASTM D 3945	X
<i>Total Number of Engine and Bench Tests</i>			15

Mack Surveillance Panel

September 10, 2004

Scope and Objectives

- The Mack Test Surveillance Panel is responsible for the Mack T-6, T-7, T-8A, T-8, T-8E, T-9, T-10, T-10A, and T-11 test procedures. The Panel works with the ASTM Test Monitoring Center to monitor test operations, test statistics, test severity and test precision for the T-8A, T-8, T-8E, T-10, and T-11 tests. The Mack T-6, T-7, and T-9 tests are no longer monitored by the TMC. Overall improvements in the test operation and test monitoring are accomplished with the cooperation of the test developer, the Test Monitoring Center and ASTM Subcommittee B0.02.

Scope and Objectives

- Develop an official ASTM test method for running the Mack T-10 with ultra-low sulfur fuel in support of the use of this test method in ACEA Lubricant Specifications.
- Develop an ASTM engine test method for the evaluation of a lubricant's capability to control piston ring and liner wear, using Mack post 2003 engine hardware. This engine test is intended to be included in the 2007 PC-10 specification for Heavy Duty Diesel Engine Oils.
- Evaluate any correlations between the different generations of engine tests measuring the same parameter(s), to support a possible replacement of older tests.
- Evaluate alternative viscosity measurement methods for use with engine tests in future categories.

Implementation of New Bearings for the Mack T-10

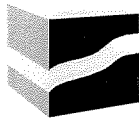
- Adopted method for calculating 0-300h Pb and 250-300h Pb at the September 10, 2004 MSP Meeting
- Stands that are on calibration period extensions will have to run a reference test
- Stands that are still calibrated may continue to run the old bearings
- Reference tests starting after 9/10/04 have to be run with new bearings

Mack T-12 Development Timeline

- Hardware selection to be completed before the end of September
- Formation of T-12 Task Force 9/10/04
- Try-out test to be run in October
- Task Force Meeting mid-October
- Discriminating testing to be completed in November
- Surveillance Panel Meeting end of November ?
- Test procedure and discrimination test results to be presented at the December ASTM Meetings

Mack T-10 ULSD

- TMC has issued an Information Letter (IL04-2) about inclusion of non-mandatory information in an Appendix of the Test Procedure
 - Informs about use of the T-10 test with Ultra Low Sulfur Diesel fuel, designated as the T-10 ULSD by ACEA, for possible inclusion in the ACEA E6/E7 categories
 - Includes a ULSD fuel Specification
- The Mack Surveillance Panel unanimously accepted the Information Letter
- The Information Letter will be included in a Subcommittee B ballot for early acceptance



European
Automobile
Manufacturers
Association

Brussels, 2 September 2004

To:
Jim McGeehan, HDEOCP Chairman
Wim Van Dam, Mack Surveillance Panel Chairman
Tom Franklin, ASTM Subcommittee B Chairman

cc.
Greg Shank, EMA Engine Lubricants Committee Chairman

Re.: ULSD in Mack T10 testing

ACEA is currently developing new engine oil specifications for Euro 4 engines, ACEA E6 and ACEA E7. A critical test requirement in these is Mack T10 but since there are some performance conflicts with the detergency requirements dictated by the DaimlerChrysler test OM441LA (CEC L-52-T-97), in particular in the E6 category, ACEA has agreed to accept the request from ATC and ATIEL (European Additive and Lubricant Manufacturers organizations) to allow ULSD in Mack T10 for E6 and/or E7 approvals. This will facilitate the formulation of cost effective high performance engine oils intended for Euro 4 engines. These engines will be sold on markets with secured supply of ULSD.

ACEA sees no need for a new ASTM method for this, a variant of the current procedure is fully acceptable. However, the variant used, standard Mack T10 or Mack T10 with ULSD, must be clearly distinguishable in any kind of data reporting.

ACEA neither sees a need to generate severity/precision data using ULSD and we fully accept that approval tests are run in test stands calibrated according to the standard procedure. We will fully rely on severity/precision monitoring that is regularly done for the standard Mack T10 procedure.

However, the ULSD fuel must be properly specified. The proposed PC-10 ULSD will for example suffice.

I hope this gives you the necessary background to the request to include ULSD as a fuel option in the Mack T10 procedure.

Best regards

for Bengt Otterholm
ACEA WG-FL HDEO Task Force Chairman

ACEA
Association des
Constructeurs
Européens
d'Automobiles g.i.e.
Rue du Noyer 211
B-1000 Bruxelles
Tel (32 2) 732 55 50
Fax (32 2) 738 73 10



Test Monitoring Center

6555 Penn Avenue
Pittsburgh, PA 15206-4489
(412) 365-1000

T-10 INFORMATION LETTER 04-2
Sequence No. 7

September 17, 2004

ASTM consensus has not been obtained on this information letter. An appropriate ASTM ballot will be issued in order to achieve such consensus.

TO: Mack Mailing List

SUBJECT: T-10 with Ultra-low Sulfur Diesel Fuel

At the September 10, 2004 Mack Surveillance Panel meeting, a motion was approved to add information regarding the European Automobile Manufacturer's Association use of the T-10 test procedure with an alternate fuel. Accordingly, Appendix X1, detailing the fuel specification for a T-10 test on ultra-low sulfur diesel fuel, has been added to Test Method D 6987. This appendix is attached.

A handwritten signature in cursive script that reads "Greg Shank".

Greg Shank
Senior Staff Engineer
Mack Division
Volvo Powertrain

A handwritten signature in cursive script that reads "John L. Zalar".

John L. Zalar
Administrator
ASTM Test Monitoring Center

Attachment

c: ftp://ftp.astmtmc.cmu.edu/docs/diesel/mack/procedure_and_ils/T-10/il04-2.pdf

Distribution: Email

(Revises D 6987-03 as amended by Information Letter 04-1)

APPENDIXES

(Nonmandatory Information)

X1. T-10 with Ultra-Low Sulfur Diesel Fuel (ULSD)

X1.1 The European Automobile Manufacturers Association (ACEA) uses results from T-10 tests run on ultra-low sulfur diesel fuel, designated by ACEA as the T-10 ULSD. Ranges for such a fuel are provided in Table X1.1. This test method makes no attempt to quantify precision or discrimination between results for T-10 tests run with this or any other alternate fuel.

Table X1.1 ULSD Fuel Specification

Property	Specification	Test Method
Additives	Lubricity additive only	
Distillation Range, °C		
90%	293 – 332	ASTM D 86
Specific Gravity	0.840 – 0.855	ASTM D 4052
API Gravity	34 – 37	ASTM D 4052
Corrosion, 3 h at 50 °C	1 max	ASTM D 130
Sulfur, mass ppm	7 – 15	ASTM D 5453
Flash Point, °C	54 min	ASTM D 93
Pour Point, °C	-18 max	ASTM D 97
Cloud Point, °C	Report	ASTM D 2500
Viscosity at 40 °C, cSt	2.0 – 2.6	ASTM D 445
Ash, weight %	0.005 max	ASTM D 482
Carbon Residue on 10% Bottoms	0.35 max	ASTM D 524
Net Heat of Combustion	Report	ASTM D 3338
Water and Sediment, volume %	0.05 max	ASTM D 2709
Total Acid Number	0.05 max	ASTM D 664
Strong Acid Number	0 max	ASTM D 664
Cetane Index	Report	ASTM D 976
Cetane Number	43 – 47	ASTM D 613
Accelerated Stability, mg/100 mL	1.5 max	ASTM D 2274
Composition		
Aromatics, wt %	26 – 31.5	ASTM D 5186
Olefins, vol %	Report	ASTM D 1319
Saturates, vol %	Report	ASTM D 1319
SLBOCLE, g	3100 min ⁴	ASTM D 6078 ⁴

⁴ May be altered to be consistent with CARB or ASTM diesel fuel specifications.



T-10 INFORMATION LETTER 04-3
Sequence No. 8

September 20, 2004

ASTM consensus has not been obtained on this information letter. An appropriate ASTM ballot will be issued in order to achieve such consensus.

TO: Mack Mailing List

SUBJECT: Implementation of New Connecting Rod Bearing Batch and Correction Equations

At the September 10, 2004 Mack Surveillance Panel meeting, the use of a new connecting rod bearing batch was approved. This new bearing batch produces lead results at a different severity level than the original bearing batch. Therefore the use of the new bearing batch is coupled with correction equations that adjust the lead results back to the original severity level. Accordingly, Sections 11.6.4.3 and 11.6.5.1 of Test Method D 6987 have been modified and Sections 11.6.4.4, 11.6.4.5, 11.6.5.2, and 11.6.5.3 have been added. All applicable sections are attached. The use of the new bearings and the correction equations is effective September 10, 2004.

Greg Shank
Senior Staff Engineer
Mack Division
Volvo Powertrain

John L. Zalar
Administrator
ASTM Test Monitoring Center

Attachment

c: ftp://ftp.astmtmc.cmu.edu/docs/diesel/mack/procedure_and_ils/T-10/il04-3.pdf

Distribution: Email

(Revises D 6987-03 as amended by Information Letters 04-1 and 04-2)

11.6.4.3 For connecting rod bearing batch codes A through G, calculate Δlead according to the following:

$$\Delta\text{lead} = (\text{lead}_{300} - \text{lead}_{\text{NEW}}) \times (\text{OABWLU} / \text{ABWLU}) \quad (2)$$

where:

lead_{300}	=	lead content of the 300 h oil sample, mass ppm,
lead_{NEW}	=	lead content of the new oil sample, mass ppm,
ABWLU	=	as measured upper rod bearing weight loss, mg, and
OABWLU	=	outlier screened upper rod bearing weight loss, mg.

11.6.4.4 For connecting rod bearing batch code J and beyond, calculate Δlead according to the following:

if $\text{OABWLU} \leq 245 \text{ mg}$

$$\Delta\text{lead} = e^{(0.603 + 0.029 \text{ OABWLU} - 0.000061(\text{OABWLU})^2)} \quad (3)$$

if $\text{OABWLU} > 245 \text{ mg}$

$$\Delta\text{lead} = 58 \quad (4)$$

where:

OABWLU	=	outlier screened upper rod bearing weight loss, mg.
-----------------	---	---

11.6.4.5 Report the calculated Δlead at EOT value on the appropriate forms.

11.6.5.1 For connecting rod bearing batch codes A through G, calculate the ΔLead 250 to 300 h by subtracting the lead value at 250 h from the lead value at 300 h.

11.6.5.2 For connecting rod bearing batch code J and beyond, calculate the ΔLead 250 to 300 h according to the following:

$$\Delta\text{Lead 250 to 300 h} = -5.9 + 0.062(ir_{300} - ir_{250}) + 0.083 \text{ OABWLU} \quad (5)$$

where:

Ir_{300}	=	oxidation value of the 300 h oil sample
Ir_{250}	=	oxidation value of the 250 h oil sample
OABWLU	=	outlier screened upper rod bearing weight loss, mg.

11.6.5.3 Report the results on the appropriate forms.