100 Barr Harbor Drive ■ PO Box C700 ■ West Conshohocken, PA 19428-2959
Telephone: 610-832-9500 ■ Fax: 610-832-9555 ■ e-mail: service@astm.org ■ Website: www.astm.org

Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

Chairman: W. JAMES BOVER, ExxonMobil Biomedical Sciences Inc, 1545 Route 22 East, PO Box 971, Annandale, NJ 08801-0971, (908) 730-1048, FAX: 908-730-1197, EMail: wjbover@erenj.com
First Vice Chairman: KENNETH O. HENDERSON, Cannon Instrument Co, PO Box 16, State College, PA 16804, (814) 353-8000, Ext: 0265, FAX: 814-353-8007, EMail: kenohenderson@worldnet.att.net
Second Vice Chairman: SALVATORE J. RAND, 221 Flamingo Drive, Fort Myers, FL 33908, (941) 481-4729, FAX: 941-481-4729
Secretary: MICHAEL A. COLLIER, Petroleum Analyzer Co LP, PO Box 206, Wilmington, IL 60481, (815) 458-0216, FAX: 815-458-0217, EMail: macvarlen@aol.com
Assistant Secretary: JANET L. LANE, ExxonMobil Research and Engineering, 600 Billingsport Rd, PO Box 480, Paulsboro, NJ 08066-0480, (856) 224-3302, FAX: 856-224-3616, EMail: janet_l_lane@email.mobil.com
Staff Manager: DAVID R. BRADLEY, (610) 832-9681, EMail: dbradley@astm.org

December 14, 2001

Reply to: Frank Farber
ASTM Test Monitoring Center
6555 Penn Avenue
Pittsburgh, PA 15206
Phone: 412-365-1031
Fax: 412-365-1047
Email: fmf@tmc.astm.cmri.cmu.edu

Unapproved Minutes of the November 15, 2001 Joint Sequence IIIF Surveillance Panel Meeting held in San Antonio, Texas

The meeting was called to order at 8:00 am by Chairman Nahumck. A membership list was circulated for members & guests to sign in. It's shown in Attachment 1.

Agenda Review

Ben Weber is Action & Motion recorder.

The Agenda was accepted as attached (Attachment 2).

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Membership Changes
Bill Buscher's company is now Buscher Consulting Services.
Charlie Leverett will be the Perkin Elmer representative.
Remove Mike Yowell as Perkin Elmer employee.

Meeting Minute Status
May 23, 2001 Approved.
September 27, 2000 Approved.

Action Item Review
All action items from last meeting have been addressed or will be addressed at this meeting.
GM is still interested in receiving camshafts and lifters from high ACLW tests for review.

TMC Sequence IIIF Semi-Annual Report
See TMC ftp site for report :
ftp://tmc.astm.cmri.cmu.edu/docs/gas/sequenceiii/semiannualreports/

All reference tests that failed because of ACLW also failed on unscreened ACLW this period.
Average delta/s results are as follows:

Industry Severity Summary			
Parameter	Average Δ/s	Pooled standard deviation (degrees of freedom)	Average Δ, in reported units
PVIS	0.250	0.017 (df=31)	35.0% Viscosity Increase[1]
APV	0.260	0.171 (df=31)	0.04 merits
WPD	-0.300	0.640 (df=31)	-0.19 merits

[1] At the GF-3 Pass Limit of 275% Viscosity Increase

Percent Viscosity Increase Severity had 5 mild alarms this period. In general Severity and Precision for most of the period were in control.

Average Weighted Piston Deposit Severity and Precision were in control this period.

Average Piston Skirt Varnish Severity had one-single point alarm. In general, severity and precision are in control.

Weighted Piston Deposits Severity and Precision remained in control the entire period.

1006-2 has been distributed to laboratories and has not been introduced at this point.

Reference oil target review: New 1006 targets are to be implemented and effective 12/1/2001. Introduce 1006-2 by simultaneously scheduling 5-tests by shortening and extending calibration periods so that targets can be calculated to determine stand calibration. The timeframe for introduction is mid-December. Update targets at 10, 20 and 30 tests.

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Percent Viscosity Increase @60 hours targets approved as presented with an effective date of 11/15/2001.

600 gallons of the 5W30 category reference oil are to be obtained.

The TMC will start to assigned reference oil 433-1 again. This oil was temporarily not being assigned by the TMC because of a few failing results.

There was an error in Information Letter 01-1 concerning sample 236ml replacement on the Oil Level and Consumption Form. GM will supply a corrected form to the TMC.

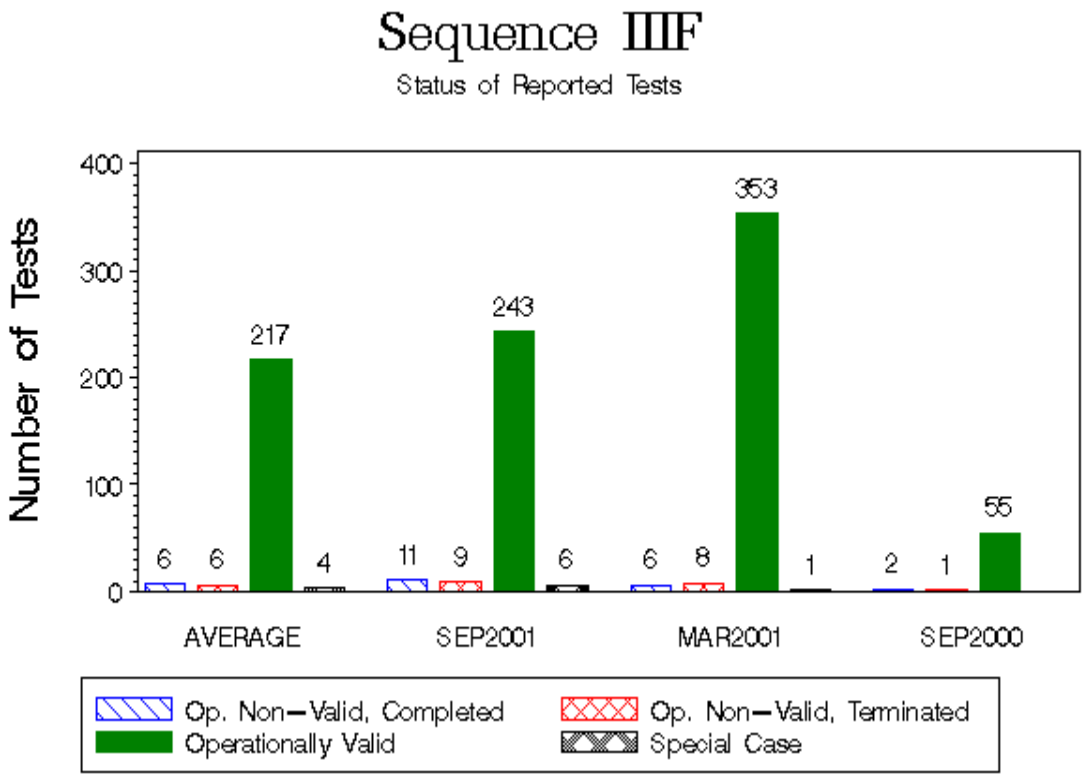
TMC to issue a memo to state screened ACLW correction factor is 0.000.

RSI Report

Rick Oliver presented the following. Attachment 3 shows the complete report.

RSI Sequence IIIF Semi-Annual Report
Six-Month Period Ending September 30, 2001

STATUS OF REPORTED TESTS		
STATUS	**N**	**PERCENT**
Operationally Non-Valid, Terminated	9	3.3%
Operationally Non-Valid, Completed	11	4.1%
Operationally Valid	243	90.3%
Special Case	6	2.2%
Total Reported Tests	*269*	*100.0%*
CAUSES FOR LOST TESTS	N	
Down Time	1	
Oil Consumption	3	
Control Problems	10	
Engine Mechanical Problems	4	
Support Equipment Problems	2	
Sponsor Request	2	
Miscellaneous	1	



No IIIFHD registrations have been made. However RSI is ready for the process to start.

ACC has not released any wear data to the panel at this point. The chairman will be refining the request to ACC so that this data can be made available.

Fuel Supplier Report

Bob Rumford presented fuel batch analysis sheets for Detroit and Channelview EEE fuel batches (Attachments 4 and 5, respectively). EEE Channelview inventory as of 10/31/2001 was 73,854 gallons. No fuel shortage is a concern at this point. Report was accepted.

Don Burnett still has supplies of GMR-995 fuel and is requesting that industry procure if needed. Otherwise the fuel will not be held for Sequence IIIF testing. The Panel agreed to instruct Phillips that supplies of GMR-995 no longer needed to be held for Sequence IIIE use.

O&H Report

Pat Lang presented Attachment 6.

A procedural review meeting was held in October resulting in numerous procedural clean-ups. The panel directed the TMC is to issue an information letter as soon as possible requiring the use of the new Draft 4 version.

Pat reported that industry standardization of the fluid control rack has not been achieved using the Kundinger racks. Various components such has flowmeters, line lengths and valving differ from one Kundinger rack to another. Also, laboratories have found it necessary to replace components on current racks because of failures and control issues. Pat recommend that each lab submit a spreadsheet listing rack components and a schematic to Pat by March 15, 2002. The O&H Subpanel will then develop a spreadsheet of components usable for fluid control with a system schematic. Appropriate procedural modifications will then be made.
(*Note: O&H Report Interrupted*)

LDRTF Report

Zack Bishop stated that a Sequence IIIF rating workshop was conducted on October 10,2001 with the help of the TMC (Attachment 7). The Light Duty Rating Task Force (LDRTF) met that same day to review procedural items as shown in Attachment 8.

Zack motioned to incorporate all changes into procedure. Motion passed; 12 for, 0 against, 0 waives. Zack made a recommendation that the TMC take over the Light Duty Rating Task Force Chairmanship in light of Zack retiring early next year. The Panel agreed. Sid Clark acknowledged Zack Bishop's retirement and the unheralded contributions that Zack has made over the years to the industry. The panel acknowledged Zack's contributions and wished him well on his retirement.

Frank Farber presented a proposal to the panel concerning round robin piston ratings (Attachment 9). The TMC has procured from the Sequence IIIF rating workshop several pistons where the raters have determined targets for Weighted Piston Deposits. The TMC offered to circulate these pistons in an attempt to collect data that would be reviewed by the panel. The panel agreed that this was a meaningful task. The TMC is to report results back to the panel when sufficient data is obtained.

Other O &H Topics:

All labs shall use the 2-bolt Mass Air Flow sensor, GM P/N 24508238. Throttle body part numbers are listed in the Engine Assembly Manual. The PCV port must be blocked off in throttle body.

Oil filter bypass/temperature control items

- Remove oil cooler flow spec
- OHT is to weld shut oil cooler bypass
- Effective upon receipt of modified oil cooler or no later than 12/15/2001. 11 for, 0 against, 1 waive.

Loss of oil temperature control because of bypass concerns for unknown reasons during the test has been evident at several labs. The above steps will allow labs the ability to avoid loss of temperature control.

All of the O&H subpanels recommendations were accepted.

Dwight Bowden mentioned concerns regarding oil filter anti-drainback valve elastomer hardening. OHT contracted to have bench tests run to investigate elastomer hardening on TMC reference oil. Test results can be obtained upon request.

Dwight also presented a motion to revise the Engine Build Manual for (Attachment 10):

Camshaft Part Number Change
Camshaft Bolt replacement
Confirmation of Thread Form of Cam and Cam Bolt, Including Cleaning and Lubrication
Torque Specification Change

Motion was accepted.

Charlie Leverett made a presentation regarding the replacement of the PF-47 oil filter with a Racor filter (Attachment 11). GM did not support this recommendation. The panel did not adopt the recommendation.

CPD Report

Attachment 12 shows the CPD report. Attachment 13 shows the IIIF CPD Technical Memo addressing dipstick calibration and camshaft bearing journal, surface finish revisions.

OHT sponsored two tests at Southwest Research Institute and Perkin Elmer in an attempt to investigate high single position wear results on 433-1. The cam & lifter wear results of these tests are shown below.

	SR-42145			PE-40358		
Position	Cam	Lifter	Cam+Lifter	Cam	Lifter	Cam+Lifter
1	101	16	117	0	19	19
2	0	12	12	0	16	16
3	113	17	130	0	19	19
4	0	15	15	0	21	21
5	0	19	19	0	20	20
6	0	13	13	0	17	17
7	0	14	14	0	20	20
8	14	16	30	0	21	21
9	76	11	87	0	20	20
10	100	11	111	0	23	23
11	51	9	60	0	17	17
12	64	11	75	0	19	19
Average	43	14	56.9	0	19	19.3

All wear results in μm

Attachment 14 shows build configuration for these tests. Dwight noted that the Southwest Research test required three start attempts before going on test conditions. In addition, the SR test was placed on test ~20 hours after engine build-up, whereas the Perkin Elmer test was started immediately after buildup. Charlie Leverett presented an overhead showing the condition of the Racor filter at EOT (Attachment 15). Perkin Elmer will be analyzing the material on the filter shortly. The Perkin Elmer test has initial FE 8 ppm , SR test has initial FE of 21 ppm. The Racor indicator light for the Perkin Elmer test was on indicating that the filter was in bypass mode. During the SR test, the bypass indicator was flickering. The reports for the two test results will be posted to the OHT website for review.

OHT conclusions:

Something adverse to wear is occurring very earlier on in the test. Air starters could be a potential item for review. It was suggested that acceleration differences should be reviewed by the panel. A suggestion on having labs record speed on startup to investigate stand-to-stand differences was made.

OHT believes changing the metallurgy of camshaft will not solve the problem. OHT is willing to sponsor additional tests to solve the wear problem. OHT is dedicated to solving this problem and bringing value to the industry. OHT discussed changing D-values as a possible direction to pursue. Dwight stated that he believed that this data was showing that something fundamentally wrong exists with the Sequence IIIF test and suggested that the panel do whatever it could to determine the root cause for the single position failures

CPD report was accepted.

GMR Report

Sid Clark opened the GMR report by presenting Attachment 16 "Tribolgy 101".

CWC and GM Powertrain metallurgical studies indicate no problems with carbide levels and Rockwell hardness values. Metrology investigations are continuing to investigate geometry influences on wear.
As a result of investigations into wear during the development of the Sequence IIIG, GM is recommending that the Sequence IIIF Surveillance Panel adopt building Sequence IIIF engines with test oil instead of EF411. Also, GM recommends that the use of screened average camshaft and lifter wear be used.

Sid presented a bar chart (Attachment 17) non-reference test ACLW results showing tests after September 8,2001 using MB camshafts built with candidate oil indicate much lower results that MB runs made with EF411 build-up oil. No information on viscosity grades was provided.

Dwight Bowden stated limited linear inspection data obtained may indicate that MB camshafts are to the low side of the specification vs. limited data obtained on LC camshafts. However, all measurements taken indicate both batches are within print specification.

Sid Clark presented information on the Sequence IIIG development process (See Attachment 18). Test length will be 100 hours with 20 hour oil levels. With coolant temp of 115 °C vs 122 °C and 150 ° vs 155 ° oil temperatures. Ten runs to date have been made. Indications are that 433-1 yields ACLW wear results in the 25-40 μm range. Reference oil 403 (reformulated) yielded 10-20 μm results. Three low phosphorus oils were also tested (see Attachment 18). Sid mentioned that if companies wish to have their formulations run they need to contact Bob Olree. GM will be conducting additional tests on 0Wxx and 5W20 grade oils. The TMC agreed that Sequence IIIF calibration would not be effected when Sequence IIIG runs are made during a calibration period. However the Sequence IIIG run would count as one run.
Sid's report was accepted.

November 15, 2001 San Antonio, TX

Test Part Supplier Report

Sid Clark's report is shown as attachment 19. Report was accepted.

Review Scope and Objectives

Attachment 20 shows the scope and objectives. Objective 8: The introduction of the category reference oil was added to the list.

New Business

Frank Farber presented a DCC request to develop an extended test length report packet (Attachment 21). Frank asked if there was any desire to address an extended length Sequence IIIF test within ASTM. No company supported this action. After some discussion the panel felt that extended test length report packet issues were best left with the individual labs to address.

Motions & Action Items
Sequence IIIF Surveillance Panel
November 15, 2001
As Recorded at the Meeting by Ben Weber

1. The following action item #16 from the previous meeting is still open. [Action Item] The labs are to contact their clients regarding high ACLW results and see if they would be interested in sending the cams and lifters to GM for further hardware testing.
2. The TMC, RSI & fuel supplier reports were accepted as presented.
3. Motion by Mike Kasimirsky and seconded by Carl Stephens to use the test targets presented for 60-hour severity adjustments. Effective today. Passed unanimously.
4. Motion by Dave Glaenzer and seconded Carl Stephens to have the TMC bring in 1006-2 using 5 labs in the industry all at the same time. 1006-2 targets will be updated at 10, 20 & 30 results. Targeted to be started around mid-December. Passed unanimously.
5. Motion by Bill Nahumck and seconded by Mike K to update 1006 to the limits presented at this meeting. Effective December 1, 2001. Passed unanimously.
6. The TMC will request 600 gallons (a 5-year supply) of the new GF-3 category calibration oil from the supplier. This will be introduced around mid-year of 2002. This will also be added to the Scope & Objectives. Usage rates of all the reference oils will also be discussed prior to the introduction of the GF-3 category calibration oil.
7. The SP will inform Phillips that there is no need to keep anymore of the GMR995.
8. O&H will generate a general fluid module (Kundinger Rack) schematic and performance specifications. Alternate components are allowable if they meet the future defined performance specifications. This task is planned to be completed by January 15, 2002. Each lab is encouraged to submit a spreadsheet of their hardware for their system. The performance specifications are already done and they are the time response and quality index specifications listed in the test method. It is up to the labs to prove the performance of alternate parts with no prior panel approval to the TMC during lab visits.
9. Motion by Pat Lang and seconded by Charlie Leverret to accept all 9 substantial change items from the IIIF Procedural Review Task Force report. Effective January 15, 2002. Passed unanimously.
10. Zack Bishop's report on the rating changes and updates was accepted unanimously.

11. All labs shall be using the GM the 2-bolt MAF sensor, GM P/N 24508238. In addition, the PCV port must be blocked off in throttle body.

12. Motion by Pat Lang and seconded by Charlie Leverett to remove the oil cooler flow specification and OHT will tack-weld shut the oil cooler bypass flap and exchange the oil coolers at the testing laboratories at no cost. Effective upon receipt of the modified oil coolers, but no later than December 15, 2001. Make a note in the comment section for all tests until completion of the first reference when this occurred. Passed 11-0-1.
13. Motion made by Dwight Bowden and seconded by Sid Clark to change the engine rebuild manual (section 3) camshaft torque spec to 100 Nm plus 90 degrees using a new camshaft bolt P/N 24501366 for each torque lubricated with EF-411 and making sure the thread is clean and free of damage. Also confirm that the camshaft is drilled and tapped to ½-20 thread and the form is clear of all debris using a class 2B bottoming tap. Again, clean and lubricate with EF-411. This shall be used in conjunction with a 0.1520 inch thrust plate. Effective no later than December 15, 2001. Make a note in the comment section for all tests until completion of the first reference when this occurred. Passed unanimously. (Parts are to be exchanged with OHT ASAP.)
14. Pat Lang's O&H report was accepted as presented.
15. Dwight Bowden's CPD report was accepted as presented.
16. Sid Clark's parts supplier report was accepted as presented.
17. Recommended that the TMC take over the light-duty rating workshop.
18. TMC will distribute parts from the rating workshops in a blind manner. TMC will collect the data and report to the surveillance panel. Rater calibration could evolve if the data suggests this.

A motion for adjournment was made and accepted.

Attachment	1
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Reference	

ASTM SEQUENCE IIIF LIST

November 15, 2001 San Antonio, Texas

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
Ed Altman Ethyl Petroleum Additives, Inc. P.O. Box 2158 Richmond, VA 23218-2158 USA	804-788-5279 804-788-6358 ed_altman@ethyl.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Beto Araiza Test Engineering, Inc. 12718 Cimarron Path San Antonio, TX 78249 USA	210-690-1958 210-690-1959 baraiza@testeng.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☑ O&H Mailing List	Present
Zack Bishop Oronite Global Technology 4502 Centerview Drive Suite 210 San Antonio, TX 78228 USA	210-731-5605 210-731-5699 zrbi@chevron.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present
Dwight H. Bowden OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 USA	440-354-7007 440-354-7080 dhbowden@ohtech.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Donald Bryant The Lubrizol Corporation 28400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2159 440-943-9004 debr@lubrizol.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present

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November 15, 2001 San Antonio, Texas

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
Don Burnett Phillips Chemical Company 896 AB Bartlesville, OK 74004 USA	918-661-7601 918-661-8379 deburne@ppco.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
William A. Buscher, Jr. ~~Texaco Inc.~~ Buscher Consulting Services P.O. Box 112 Hopewell Jet, NY 12533 USA	845-897-8069 845-897-8069 buschwa@aol.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present
Sid Clark GM R&D Center Building 1-6 Chemical & Environmental Science 12 Mile & Mound Roads Warren, MI 48090-9055 USA	810-986-1929 810-986-2094 sidney.l.clark@gm.com Test Sponsor Rep	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Francis R. Duffey DaimlerChrysler 800 Chrysler Road CIMS 482-00-13 Auburn Hills, MI 48236-2757 USA	248-576-7476 248-576-7490 fd13@daimlerchrysler.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
Frank Farber ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1030 412-365-1047 fmf@tmc.astm.cmri.cmu.edu	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present

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November 15, 2001 San Antonio, Texas

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
Gordon R. Farnsworth Infineum P.O. Box 735 Linden, NJ 07036 USA	908-474-3351 908-474-3637 gordon.farnsworth@infineum.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present GRF
Frank Fernandez Oronite Global Technology 4502 Centerview Drive Suite 210 San Antonio, TX 78228 USA	210-731-5603 210-731-5699 ~~ffer@chevron.com~~ ffer@chevrontexaco.com PCEOCP Chair	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present Frank Fernandez
Joseph Franklin PerkinElmer Automotive Research, 5404 Bandera Road San Antonio, TX 78238 USA	210-523-4671 210-681-8300 joe.franklin@egginc.com	☐ IIIF SURV PANEL ☐ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
David L. Glaenzer Ethyl Petroleum Additives, Inc. 500 Spring Street P.O. Box 2158 Richmond, VA 23218-2158 USA	804-788-5214 804-788-6358 dave_glaenzer@ethyl.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present
Larry Hamilton The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2326 440-347-4096 ldha@lubrizol.com	☐ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present

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November 15, 2001 San Antonio, Texas

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
Barry J. Jecewski Ford Motor Company 21500 Oakwood Boulevard POEE Building, MD #34 P.O. Box 2053 Dearborn, MI 48121-2053 USA	313-594-6943 303-845-0613 bjecewsk@ford.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Michael T. Kasimirsky ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1033 412-365-1047 mtk@tmc.astm.cmri.cmu.cdu	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present Michael T. Kasimirsky
Brian Kundinger Kundinger Controls 1771 Harmon Road Auburn Hills, MI 48326 USA	248-391-6100 248-391-6900 bkundinger@kundnger.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Patrick Lai Imperial Oil Limited 453 Christina Street Research Department P.O. Box 3022 Sarnia, Ontario N7T7MI CANADA	519-339-5611 519-339-5866 patrick.k.lai@esso.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
Patrick Lang Southwest Research Institute 6220 Culebra Road P.O. Box 28510 San Antonio, TX 78228 USA	210-522-2820 210-684-7523 plang@swri.edu O&H Subpanel Chairman	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present Pat Lang

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November 15, 2001 **San Antonio, Texas**

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
Charlie Leverett PerkinElmer Automotive Research, 5404 Bandera Road San Antonio, TX 78238 USA	210-647-9422 210-523-4607 charlie.leverett@perkinelmer.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Vince Livoti Ciba Specialty Chemicals 540 White Plains Road P.O. Box 2005 Tarrytown, NY 10591-9005 USA	914-785-4494 914-785-4249 vincent.livoti@cibasc.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
Mike McMillan GM R&D Center Building 1-6 Chemical & Environmental Science 12 Mile & Mound Roads Warren, MI 48090-9057 USA	810-986-1935 810-986-2094 micheal.l.mcmillan@gm.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present
John Moffa Castrol International Technology Centre Whitchurch Reading, RG8 7QR ENGLAND	00441189765263 00441189841131 John_Moffa@burmahcastrol.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Alfredo Montez Chevron Oronite 4502 Centerview Drive #210 San Antonio, TX 78228 USA	210-731-5604 210-731-5694 AMMN@chevron.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present

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November 15, 2001 San Antonio, Texas

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
Mark Mosher Mobil Technology Company Billingsport Road Paulsboro, NJ 08066 USA	856-224-2132 856-224-3628 mark.r.mosher@exxonmobil.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
William M. Nahumck The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2596 440-347-4096 wmn@lubrizol.com Surveillance Panel Chair	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Rick Oliver Registration Services Inc. 2805 Beverly Drive Flower Mound, TX 75022 USA	972-724-2136 210-341-4038 crickoliver@home.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
Robert Olree GM Powertrain 30500 Mound Road m/c 480-106-160 Warren, MI 48090-9055 USA	810-947-0069 810-986-2094 robert.olree@gm.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present
John Pandosh Infineum USA LP 4335 Piedras West Suite 101 San Antonio, TX 78228 USA	210-732-8132 210-732-8480 John.Pandosh@Infineum.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present

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November 15, 2001 **San Antonio, Texas**

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
Robert H. Rumford Specified Fuels & Chemicals, LLC 1201South Sheldon Road ~~P.O. Box 429~~ Channelview, TX 77530-0429 USA	281-457-2768 281-457-1469 rhrumford@~~specified1.com~~ dow.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present
Jim Rutherford Chevron 100 Chevron Way Richmond, CA 94802 USA	510-242-3410 510-242-1930 jaru@chevron.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
Philip R. Scinto The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2161 440-347-9031 prs@lubrizol.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
Carl R. Stephens Ashland Oil Inc. 22nd & Front Streets Ashland, KY 41101 USA	606-329-5198 606-329-3009 ~~crstephens~~ CStephens@ashland.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Ben Weber Southwest Research Institute 6220 Culebra Road P.O. Box 28510 San Antonio, TX 78228 USA	210-522-5911 210-684-7530 bweber@swri.edu Sub-Committee D02.B01 Chair	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present

SEQUENCE IIIF SURVEILLANCE PANEL MEETING

GUEST LIST

November 15, 2001
San Antonio, Texas

Attachment	1
Page	8
Reference	

1/2

NAME/ADDRESS	PHONE/FAX/EMAIL	SIGNATURE
JO MARTINEZ CHEVRON ORONITE CO. LLC 100 CHEVRON WAY RICHMOND, CA 94802	Phone: (510) 242 5563 Fax: (510) 242 1930 Email: jogm@chevrontexaco.com Notifying IIIF Mailing List	
Jason H. Bowden OH TECHNOLOGIES, INC. 9300 Progress Pkwy. P.O. Box 5039 Mentor, OH 44061-5039	Phone: 440-354-7007 FAX: 440-354-7080 Email: jhbowden@ohtech.com	
James E. Carter Haltermann Products	email JE Carter@dow.com	JEC
Tom Boschert Ethyl Corporation 2000 TOWN CENTER, SUITE 1750 SOUTHFIELD, MI 48075	Phone: (248) 350-0640 FAX: (248) 350-0025 EMAIL: Tom_Boschert@ethyl.com	
Michael Yowell 19307 Havasu Hills San Antonio TX 78256	cell (210)-723-9949 210-698-2873	
HALTERMANN PRODUCTS Jim CARTER 3520 OKEMOS RD, #6 OKEMOS, MI 48864-5943	PH 517-347-4947 FX 517-347-1024 JECARTER@dow.com	

Add to IIIF MAILING LIST

Add to IIIF Mailing List

Add To IIIF MAILLIST

AGENDA

SEQUENCE IIIF SURVEILLANCE PANEL MEETING

EMBASSY SUITES HOTEL, SAN ANTONIO, TEXAS

November 15, 2001

Attachment	2
Page	1
Reference	

1. APPOINTMENT OF MEETING SECRETARY AND RECORDER OF ACTIONS/MOTIONS
2. AGENDA REVIEW
3. MEMBERSHIP CHANGES
4. APPROVAL OF MINUTES FROM MAY 23, 2001
5. REVIEW OF ACTION ITEMS FROM 5-23-01

SEQUENCE IIIF

1. TMC SEMI-ANNUAL REPORT
   - A. Review of Information Letter Highlights; 01-1, 01-2
   - B. Revision to 01-1, Oil Consumption Worksheet Calculation
   - C. Industry Correction Factor for Screened ACLW
2. RSI SEMI-ANNUAL REPORT
   - A. Status of IIIFHD Registrations
   - B. Status of Request for Wear Data
3. FUEL SUPPLIER REPORT (IIIF)
   - A. Last call for IIIE fuel, GMR995
4. REPORT ON STATUS OF TEST PARTS – GMR AND OHT
5. O&H SUBPANEL UPDATE – PAT LANG
   - A. Report from the Procedure Review Task Force - PAT LANG
     1. Presentation from Zack Bishop – IIIF Ratings
   - B. Review of Throttle Body Part Numbers and Modifications - SID CLARK
   - C. Camshaft Bolt Torque – Dwight Bowden
   - D. Oil Filter Temperature Control Concerns
   - E. Variations in the Kundinger Racks
6. UPDATE ON THE CAMSHAFT WEAR INVESTIGATION – SID CLARK
7. SEQUENCE IIIG DEVELOPMENT UPDATE – SID CLARK
8. OLD BUSINESS
   - A. Scope & Objectives
   - B. Status of the IIIF-HD Test
9. NEW BUSINESS
   - A. Presentation of data from two IIIF tests sponsored by OHT
   - B. Data Communication Committee request for the panel to derive an extended test length IIIF report form packet
   - C. Consideration to disband Surveillance Panel Week
   - D. Revised LTMS manual on the TMC website

ADJOURNMENT

Attachment 3
Page 1
Reference

RSI Sequence ~~IIIF Semi-Annual Report~~
Six-Month Period Ending September 30, 2001

STATUS OF REPORTED TESTS		
STATUS	**N**	**PERCENT**
Operationally Non-Valid, Terminated	9	3.3%
Operationally Non-Valid, Completed	11	4.1%
Operationally Valid	243	90.3%
Special Case	6	2.2%
Total Reported Tests	*269*	*100.0%*

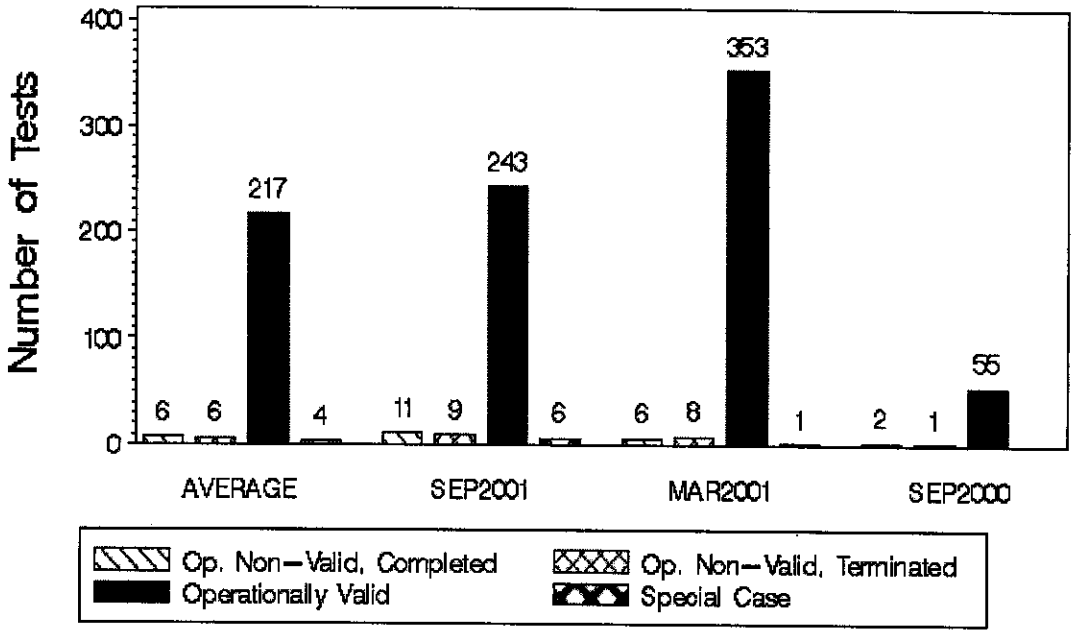
CAUSES FOR LOST TESTS	**N**
Down Time	1
Oil Consumption	3
Control Problems	10
Engine Mechanical Problems	4
Support Equipment Problems	2
Sponsor Request	2
Miscellaneous	1

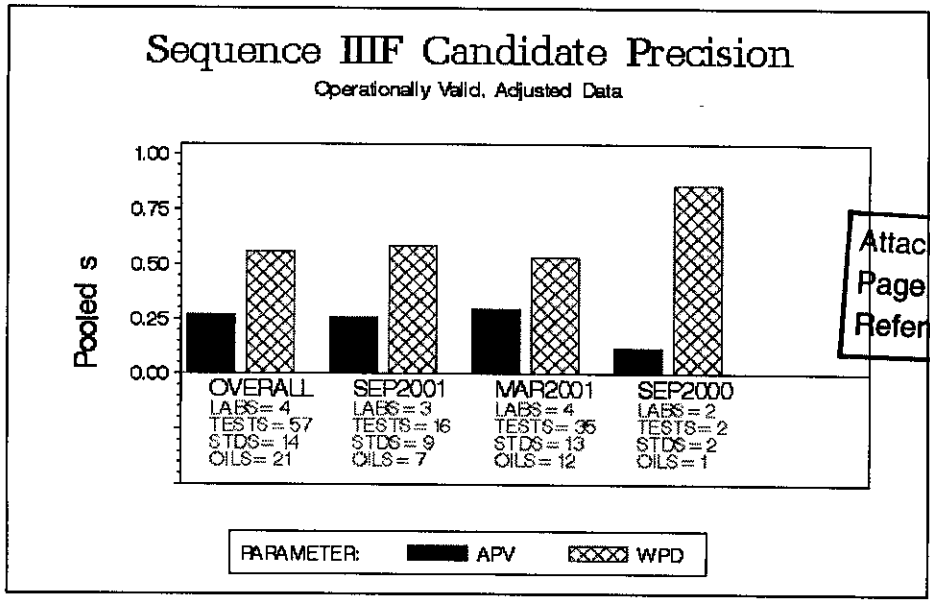
SEQUENCE IIIF PRECISION		
COMPONENTS OF REPLICATED DATA BASE	**N**	
Number of Tests	16	
Number of Oils	7	
Number of Labs	3	
Number of Stands	9	
Number of Severity Adjusted Avg C+L Wear Tests	0	
Number of Severity Adjusted Avg Piston Varnish Tests	2	
Number of Severity Adjusted % Vis Inc. Tests	1	
Number of Severity Adjusted Weighted Piston Deposit Tests	0	
VARIABLE	**Pooled s**	**R**
Percent Vis Increase, Adjusted	0.026	0.073
Avg Piston Varnish, Adjusted	0.254	0.711
Weighted Piston Deposits, Adjusted	0.582	1.629
Avg Cam + Lifter Wear, Adjusted	3.290	9.211
Percent Vis Increase, Non-Adjusted	0.027	0.076
Avg Piston Varnish, Non-Adjusted	0.237	0.665
Weighted Piston Deposits, Non-Adjusted	0.582	1.629
Avg Cam + Lifter Wear, Non-Adjusted	3.290	9.211

Attachment	3
Page	2
Reference	

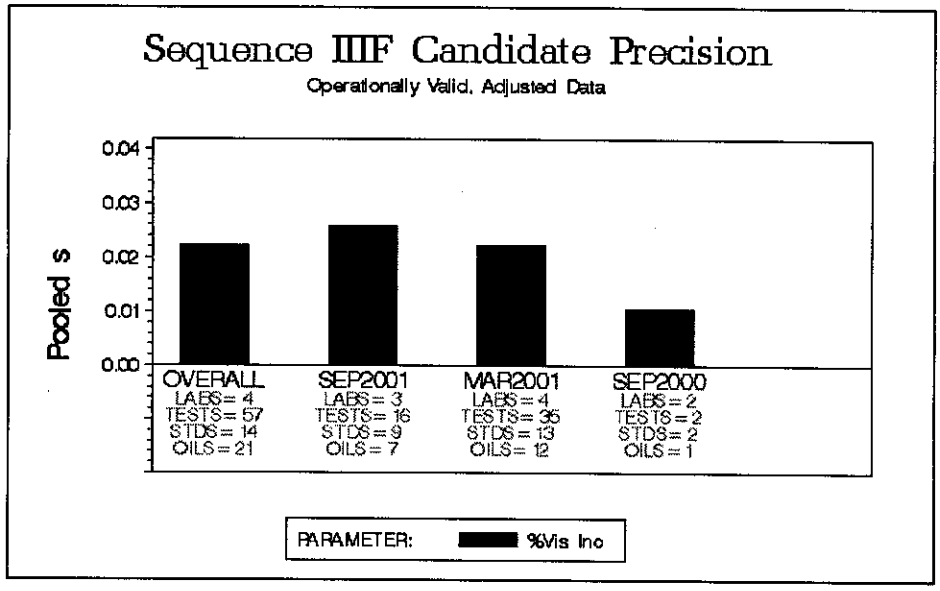
Sequence IIIF

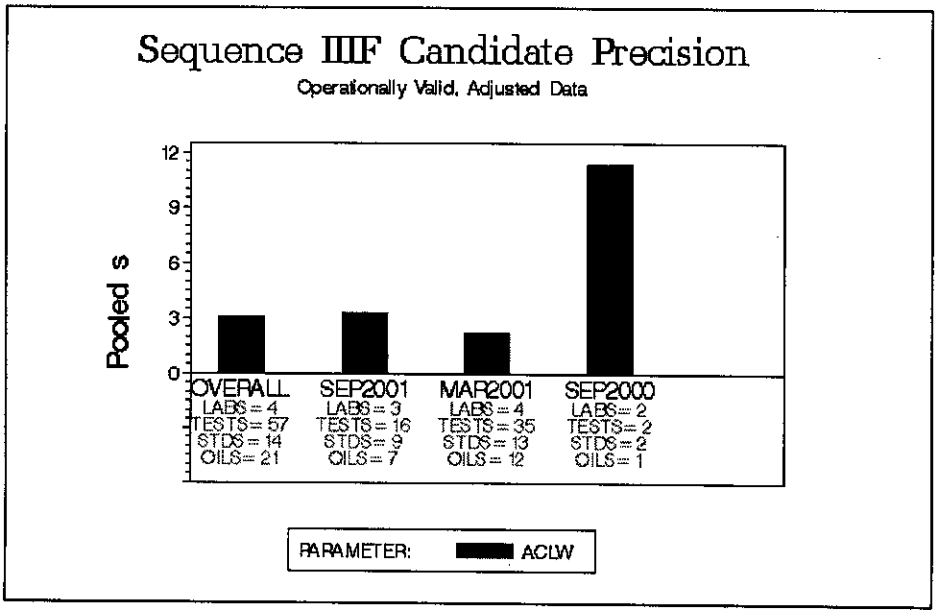
Status of Reported Tests





Attachment 3
Page 3
Reference





Attachment	4
Page	1
Reference	

PRODUCT: EEE Unleaded Gasoline

PRODUCT CODE: HF003 DETROIT BATCHES

Batch No.:	01D-19	01D-16	01D-12
TMO No.:			
Tank No.:	106	105	106
Analysis Date:	9/10/2001	8/10/2001	6/13/2001
Shipment Date:			

TEST	METHOD	UNITS	FED Specs		HALTERMANN Specs			RESULTS	RESULTS	RESULTS
			MIN	MAX	MIN	ARGET	MAX			
Distillation - IBP	ASTM D86	°F	75	95	75		95	89	83	84
5%		°F						118	117	113
10%		°F	120	135	120		135	130	131	125
20%		°F						152	152	145
30%		°F						175	176	170
40%		°F						201	202	198
50%		°F	200	230	200		230	221	220	220
60%		°F						233	232	231
70%		°F						244	244	243
80%		°F						265	264	265
90%		°F	305	325	305		325	319	318	319
95%		°F						335	337	336
Distillation - EP		°F		415			415	387	400	393
Recovery		vol %				Report		98.0	98.0	97.5
Residue		vol %				Report		1.0	1.0	1.0
Loss		vol %				Report		1.0	1.0	1.5
Gravity	ASTM D4052	°API	58.7	61.2	58.7		61.2	59.0	59.0	58.9
Density	ASTM D4052	kg/l			0.734		0.744	0.743	0.743	0.743
Reid Vapor Pressure	ASTM D323	psi	8.7	9.2	8.7		9.2	9.2	9.1	9.0
Reid Vapor Pressure	ASTM D5191	psi				Report		9.20	9.10	8.90
Carbon	ASTM D3343	wt fraction				Report		0.8665	0.8670	0.8671
Carbon	ASTM E191	wt fraction				Report		0.8638	0.8659	0.8659
Hydrogen	ASTM E191	wt fraction				Report		0.1328	0.1298	0.13
Hydrogen/Carbon ratio	ASTM E191	mole/mole				Report		1.832	1.786	1.789
Oxygen	ASTM D4815	wt %					0.05	<0.05	<0.05	<0.05
Sulfur	ASTM D3120	ppm		1000			1000	3	9	4
Sulfur	ASTM D2622	wt%		0.1		Report		<0.001	0.0016	<0.001
Lead	ASTM D3237	g/gal		0.05			0.01	<0.01	<0.01	<0.01
Phosphorous	ASTM D3231	g/gal		0.005			0.005	<0.0008	<0.0008	<0.0008
Composition, aromatics	ASTM D1319	vol %		35.0			35.0	31.1	32.0	31.8
Composition, olefins	ASTM D1319	vol %		10.0			10.0	0.9	0.8	0.6
Composition, saturates	ASTM D1319	vol %				Report		68.0	67.2	67.6
Particulate matter	ASTM D5452	mg/l					1	0.6	0.6	0.8
Oxidation Stability	ASTM D525	minutes			240			>1000	>1000	>1000
Copper Corrosion	ASTM D130						1	1	1	1
Gum content, washed	ASTM D381	mg/100mls					5	1	1	1
Fuel Economy Numerator/C Density	ASTM E191				2401		2441	2432	2440	2441
C Factor	ASTM E191					Report		1.0055	1.0066	1.0103
Research Octane Number	ASTM D2699		93.0		96.0			97.1	96.3	96.5
Motor Octane Number	ASTM D2700					Report		89.0	87.7	87.3
Sensitivity			7.5		7.5			8.1	8.6	9.2
Net Heating Value, btu/lb	ASTM D3338	btu/lb				Report		18445	18432	18430
Net Heating Value, btu/lb	ASTM D240	btu/lb				Report		18324	18363	18257
Color	VISUAL	1.75 ptb				Report				

Attachment 5
Page 1
Reference

PRODUCT: EEE Unleaded Gasoline

PRODUCT CODE: HF003 CHANNELVIEW BATCHES

Batch No.:	01C-23	01C-21	01C-20
TMO No.:	26026	26029	25974
Tank No.:	2012	2012	2012
Analysis Date:	10/24/2001	9/18/2001	9/4/2001
Shipment Date:	11/19/2001	11/9/2001	11/5/2001

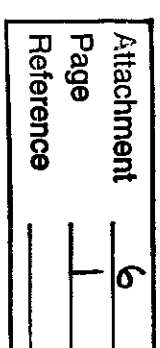
TEST	METHOD	UNITS	FED Specs		HALTERMANN Specs			RESULTS	RESULTS	RESULTS
			MIN	MAX	MIN	TARGET	MAX			
Distillation - IBP	ASTM D86	°F	75	95	75		95	86	88	87
5%		°F						114	115	113
10%		°F	120	135	120		135	128	129	126
20%		°F						149	151	146
30%		°F						173	175	170
40%		°F						200	202	199
50%		°F	200	230	200		230	221	221	220
60%		°F						234	232	232
70%		°F						246	244	244
80%		°F						268	267	265
90%		°F	305	325	305		325	322	320	319
95%		°F						338	356	336
Distillation - EP		°F		415			415	404	393	394
Recovery		vol %				Report		97.7	97.8	98.0
Residue		vol %				Report		1.0	1.0	1.0
Loss		vol %				Report		1.3	1.2	1.0
Gravity	ASTM D4052	°API	58.7	61.2	58.7		61.2	59.1	59.1	59.1
Density	ASTM D4052	kg/l			0.734		0.744	0.742	0.742	0.742
Reid Vapor Pressure	ASTM D323	psi	8.7	9.2	8.7		9.2	9.2	9.0	9.1
Reid Vapor Pressure	ASTM D5191	psi				Report		9.20	8.90	9.10
Carbon	ASTM D3343	wt fraction				Report		0.8669	0.6858	0.8671
Carbon	ASTM E191	wt fraction				Report		0.8627	0.8636	0.8648
Hydrogen	ASTM E191	wt fraction				Report		0.1326	0.1338	0.1306
Hydrogen/Carbon ratio	ASTM E191	mole/mole				Report		1.831	1.846	1.799
Oxygen	ASTM D4815	wt %					0.05	<0.05	<0.01	<0.01
Sulfur	ASTM D3120	ppm		1000			1000	2	1	2
Sulfur	ASTM D2622	wt%		0.1		Report		<0.001	<0.001	<0.001
Lead	ASTM D3237	g/gal		0.05			0.01	<0.01	<0.01	<0.01
Phosphorous	ASTM D3231	g/gal		0.005			0.005	<0.0008	<0.0008	<0.0008
Composition, aromatics	ASTM D1319	vol %		35.0			35.0	31.9	29.9	32.2
Composition, olefins	ASTM D1319	vol %		10.0			10.0	0.7	0.6	0.9
Composition, saturates	ASTM D1319	vol %				Report		67.4	69.5	66.9
Particulate matter	ASTM D5452	mg/l					1	0.6	0.8	0.6
Oxidation Stability	ASTM D525	minutes			240			>1000	>1000	>1000
Copper Corrosion	ASTM D130						1	1	1	1
Gum content, washed	ASTM D381	mg/100mls					5	1	1	1
Fuel Economy Numerator/C Density	ASTM E191				2401		2441	2431	2429	2437
C Factor	ASTM E191					Report		1.0005	1.0002	1.0025
Research Octane Number	ASTM D2699		93.0		96.0			96.9	97.2	96.9
Motor Octane Number	ASTM D2700					Report		88.5	88.8	88.4
Sensitivity			7.5		7.5			8.4	8.4	8.5
Net Heating Value, btu/lb	ASTM D3338	btu/lb				Report		18437	18463	18428
Net Heating Value, btu/lb	ASTM D240	btu/lb				Report		18431	18472	18445
Color	VISUAL	1.75 ptb				Report		Red	Red	Red

Sequence IIIF O&H Report

Presented by: Patrick Lang

November 15, 2001

San Antonio, Texas



Procedural Review Meeting

- A IIIF procedural review meeting was held in San Antonio on October 30 and 31, 2001, hosted by PerkinElmer.
- Special thanks to the representatives from GM, ExxonMobil, SwRI, PerkinElmer, Lubrizol, Ethyl, OHT and TMC for participating in this grueling task.

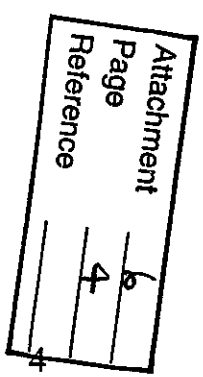
Outcome Of Review

- Draft of the changes posted on TMC website on 11/2/01. Notification of this posting sent out by SP Chairman 11/7/01.
- Changes/enhancements broken down into the following categories:
  - Substantial - need Surveillance Panel Approval
  - Editorial - non sensitive, no approval needed

Substantial Changes

1 Fluid conditioning module to be defined by performance
   - Alternate components allowable if they meet perf. spec., O&H to procure general module schematic and performance specs.

2 After flow checking fuel injectors, remove solvent from injector w/ compressed air.
   - Procedure currently recommends using pressurized fuel.

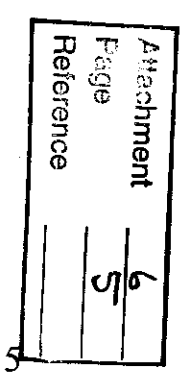


Substantial Changes (cont'd)

3 Remove Section 8, "Hazards"
  - Is it appropriate for the procedure to address laboratory safety?

4 Perform cylinder head calibration by setting deflection at 0.375 inches and determine if load is in specification.

5 Connect intake manifold coolant outlet fitting to the flush cart during engine flush.

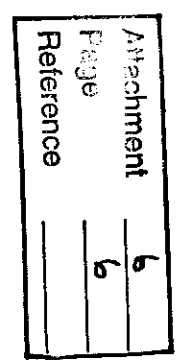


Substantial Changes (cont'd)

6 Procedure to state that the stand must be calibrated before every reference; humidity system calibration every six months.

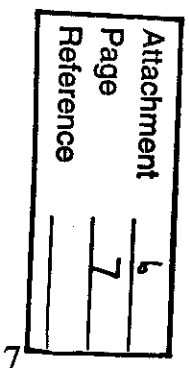
7 AFR to be confirmed by exhaust gas analysis at hours 1, 7, 39 and 79 hours.

8 Run oil cooler temperature control valve wide-open during initial run.



Substantial Changes (cont'd)

9 Remove the two hour "shelf life" limit for mixed glycol.

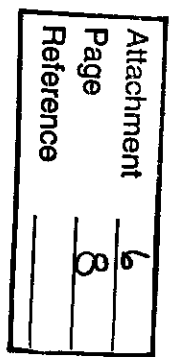


MOTION

- Accept the "Substantial Changes" as recommended by the IIIF Procedural Review Task Force.

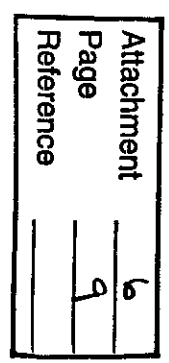
  – Motion made by: Pat Lang

  – Second: ?



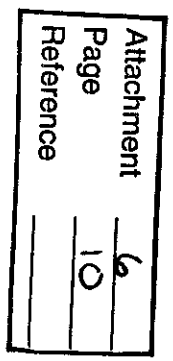
Other Topics

- All labs should be using the GM P/N 24507235 throttle body that utilizes the 2 bolt MAF sensor, GM P/N 24508238. PCV port must be blocked off in throttle body.
- Oil filter bypass/temperature control
  - Oil cooler flow spec to be increased
  - Racor Oil filter in place of PF-47 - Charlie Leverett
  - Weld shut oil cooler bypass



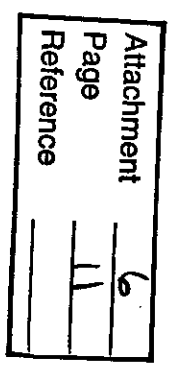
Other Topics (cont'd)

- Cam Bolt Torque - Dwight Bowden
- Water pump housing fastener location print - Dwight Bowden



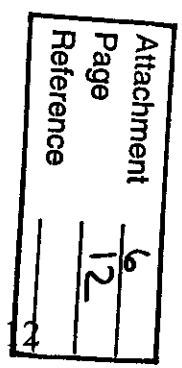
O & H To-Do List

- Recommend changes to the flush cart to help prevent the recirculation of casting sand during the flush. Complete by March 31, 2002.
- Cylinder head round robin in progress, complete by March 31, 2002.
- Define fluid control rack specification and configuration schematic.



To -Do (cont'd)

- Produce AFR control and blowby cart schematics for IIIF procedure.
- Batch Concept/Hardware Control Task Force to generate Info. Letter 60 type document.
- Study oil consumption differences in LTMS.



Report of the

Light Duty Rating Task Force (LDRTF)

to

Sequence III Surveillance Panel

November 15, 2001
Embassy Suites Hotel
San Antonio, Texas

By: Zack Bishop; Task Force Leader

- IIIF Workshop held October 10, 2001 at SwRI

  - Raters reviewed Sequence IIIF Procedure (Rating Section). Copy of the changes suggested for updating the IIIF Procedure is attached.

  - This was the first IIIF workshop held since introduction of the proposed ASTM Rater Calibration Task Force recommendations. TMC played a large role in setting up the workshop and is currently analyzing the rater data generated during this calibration exercise.

Attachment	8
Page	1
Reference	

13. *Determination of Test Results:*

13.1 This section describes techniques used to evaluate the oils performance with respect to oxidation (viscosity increase), wear (camshaft and lifter), piston deposits, ring sticking, sludge deposits, oil pump screen plugging, and oil consumption.

13.2 Engine Disassembly-Disassemble the engine according to the following instructions, in preparation for inspection, rating, and measurement.

13.2.2 Remove the components from the top of the engine in order to gain access to the cylinder bores.

13.2.3 Remove the carbon deposits from the top portion of the cylinder walls, above the top compression ring travel, before removing the pistons from the engine.

13.2.4 Disassemble the remainder of the engine.

13.3 Preparation of Parts for Rating of Sticking, Deposits, and Plugging-Prepare the specified parts for rating according to the following instructions:

13.3.1 Check all piston rings for freedom of action in the grooves as the pistons are removed from the engine. See 13.5.1 through 13.5.1.~~3~~.2.

Piston Ring Sticking-Rate the piston rings for hot-stuck and cold-stuck rings as follows:

See Section 3 for the definition of hot-stuck and cold-stuck rings.

Determine which rings are hot-stuck or cold-stuck and record the piston number and ring identification (for example, piston No. 3, top ring) for such rings on Form 8, Summary of Oil Ring Land Deposit Rating, in standardized report form set (See Annex A6). Record the total number of hot-stuck rings on Form 4, Test Result Summary, in the standardized report form set (See Annex A6).

13.3.2 Determination by rater or mechanic at time disassembly. Remove all piston rings that are free. Leave stuck rings (includes pinched or pivot condition) in place. Definition in CRC Manual No. 18 - Pinched (Cold Stuck). Stuck rings will be rated as having 100% heavy carbon in the groove.

13.3.3 If the piston deposits cannot be rated immediately after the pistons are removed from the engine, store the pistons in a ~~vacuum~~ desiccator, or humidity controlled environment, for no longer than 72 h from end of test before rating. Do not wipe the pistons before storing them. See 13.7.

13.4 Piston deposit ratings - The pistons are rated for skirt varnish, oil ring land deposits, and overall piston deposits using the (Weighted Piston Deposit – ~~WPR~~ WPD).

13.4.1 Establish the proper environment for parts rating (see section xxx). Rate all parts against a white background.

~~13.4.2 Rate piston skirt deposits use CRC manual 14 rating scale and breakdown method under a lamp with two 15-watt cool-white fluorescent tubes which together produce 350 to 500 fc (3800 to 5400 lx) at the rating surface. These ratings will be used for IIIF deposit determinations.~~

~~13.4.3 Blank~~

~~13.4.3.1 Rate the oil pump screen for percent plugging (using CRC manual 12).~~

13.4.3.2 ~~In addition to the ratings generated in section 13.4.2,~~ Rate each piston top groove, 2nd groove, oil ring groove, 2nd land, 3rd land undercrown (Band-Aid area where the horizontal and vertical planes meet), and piston skirts, for deposits using CRC Manual No. 14 and No. 18 rating techniques and breakdown method. Carbon deposit ratings will consist of only two levels: Heavy = 0.00 merit value or Light = 0.75 merit value. These ratings should be performed in a rating booth, using a 20-segment piston rating cap, a piston rating stand, and a 22watt circular rating lamp.

13.4.4 If multiple ratings are deemed necessary of a given part or parts, consensus rating may be used according to the following:

13.4.4.1 The raters shall be from the laboratory in question, no outside raters can be used unless requested and directed through the Sequence IIIF Surveillance Panel.

13.4.4.2 No averaging of ratings is permitted.

13.4.4.3 Only one rating value is to be reported and is to be agreed to by the raters involved.

~~13.6 Intentionally left blank~~

13.7 Piston Skirt Deposits Rating-Rate the piston skirts for deposits using CRC manual 14 rating scale and breakdown method to a tenth of a number. Average the results and report them to the nearest hundredth of a number. Proceed according to the following instructions:

~~13.7.1 Rate the piston skirt deposits immediately upon removal of the pistons from the engine, or within 2 hours after removal of pistons stored in a desiccator. See 13.3.3.~~

13.7.3 Gently wipe off any excess oil from the piston skirts with a soft cloth.

13.7.4 Do not apply any chemicals or build-up oil to the skirts prior to rating them for deposits.

13.7.7 Average each individual piston (thrust side and anti-thrust side) for inclusion in Weighted Deposit Rating (~~WDR~~ WPD).

~~13.7.9 Record ratings on Form 9, Summary of Piston Deposits, in standardized report form set (See Annex A6).~~

~~13.7.10 Calculate the average thrust and anti-thrust values and record on Form 9, Summary of Piston Deposits, and on Form 4, Test Results Summary, in standardized report form set (See Annex A6). Calculate the average of the values of the twelve skirts, and record it as the official piston skirt varnish average on Form 9, Summary of Piston Deposits, and on Form 4, Test Results Summary, in standardized report form set (See Annex A6). Report average results to two places after the decimal point (for example, 8.65).~~

13.7.11 Report any unusual piston skirt deposits observed in the comments section of ~~Form 9~~, Summary of Piston Deposits, in standardized report form set (See Annex A6)

~~13.7.12 Upon completion of the rating and photographing of the pistons, apply build-up oil to the pistons to help preserve their condition during storage.~~

~~13.8 Oil Ring Land Deposits Rating-Rate the piston oil ring land (the face of the land above the oil ring) deposits to the nearest hundredth of a number. Use CRC manual 14 and breakdown method. Refer to Practice E 29 for any needed rounding; use the rounding-off method. Proceed according to the following instructions:~~

~~13.8.1 Rate the piston oil ring land deposits immediately upon removal of the pistons from the engine, or within 2 hours after removal of pistons stored in a desiccator. See 13.3.3.~~

~~13.8.3 Gently wipe off any excess oil from the piston oil ring lands with a soft cloth.~~

~~13.8.4 Do not apply any chemicals or build-up oil to the oil ring lands.~~

13.8.5 Use the rating procedures contained in CRC Manual 14 (non-rubbed scale).

13.8.6 Rate only the deposits present. Though chipped areas might sometimes appear, rate what appears and do not interpolate deposits.

~~13.8.8 Record the rating results on Form 8, Summary of Oil Ring Land Deposit Rating, in standardized report form set (See Annex A6)~~

13.8.9 Calculate the average of the six ratings; record this as the official ring land deposit average on Form 8, Summary of Oil Ring Land Deposit Rating, and on Form 4, Test Results Summary, in standardized report form set (See Annex A6).

13.9 Weighted Piston Deposit Rating (WPD) - This weighted piston rating is comprised of skirt varnish ~~(section 13.7), oil ring land deposit (section 13.8)~~, top groove, 2nd groove, oil ring groove, undercrown, 2nd land, and 3rd land.

13.9.1 Prepare pistons for rating - Gently wipe excess oil from the grooves and lands using a clean and dry soft cloth.

13.9.2 Rate each piston top groove, 2nd groove, oil ring groove, 2nd land, and undercrown (Band-Aid area) using CRC manual 14 rating techniques and breakdown method. Carbon deposit ratings will consist of only two levels: Heavy = 0.00 merit value or Light = 0.75 merit value. These ratings should be performed in a rating booth, using a 20-segment piston rating cap, a piston rating stand, and a 22watt circular rating lamp.

13.9.3 The Weighted Deposit Rating (~~WDR~~ WPD) for each individual piston is calculated using the following factors:

Piston Undercrown	10%
2nd Land	15%
3rd Land (ORLD)	30%
Piston Skirts (avg)	10%
Top Groove	5%
2nd Groove	10%
Oil Ring Groove	20%

13.9.4 The Weighted Deposit Rating (~~WDR~~ WPD) for the test is calculated by a simple average of the six individual piston WDR ratings. ~~Report this value Form 9, Summary of Piston Deposits, in standardized report form set (See Annex A6).~~

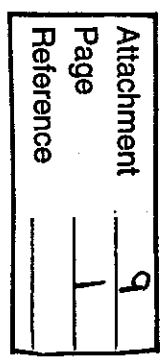
~~13.10 Oil Ring Plugging Observations Rate the specified parts for plugging to the nearest whole percentage number. Refer to Practice E 29 for any needed rounding; use the rounding off method. Proceed according to the following instructions:~~

~~13.10.1 Rate the oil rings for percent plugging of the rail separators. Record the results on Fig. A6.8.~~

~~13.10.2 Calculate the average percent plugging. Record the answer on Form 8, Summary of Oil Ring Land Deposit Rating, in standardized report form set (See Annex A6).~~

Round Robin Rating

- TMC to distribute parts from rating workshop in blind manner
- TMC collects data and reports to Surveillance Panel
- If data suggests possible, develop rater calibration criteria



Attachment	10
Page	1
Reference	

Date: 16 August 2001

To: William Nahumck, Sequence III Surveillance Panel Chair
Pat Lang, Sequence III O&H Sub Panel Chair
Sid Clark, General Motors Corporation

From: Dwight H. Bowden / OH Technologies, Inc.

Re: Motion to Revise Engine Rebuild Manual:
Camshaft Part Number Change
Camshaft Bolt Replacement
Confirmation of Thread Form of Cam and Cam Bolt, Including Cleaning and Lubrication
Torque Specification Change

Gentlemen:

Recently, one laboratory experienced breakage of the camshaft nose resulting in aborted tests. EOT components were forwarded to OH Technologies for evaluation.

As you are aware, cracks in the keyways of LC and MB camshafts have been observed. These cracks were due to an error in the manufacturing machine setup.

Upon receiving the report of the aforementioned failures, OH Technologies contracted for a failure analysis to determine (1.) if the cast iron was free of defects, (2.) if the lab failures were the result of a pre-existing, machine error induced crack and/or (3.) if the root cause of the failure was independent of items (1) and (2).

Failure analysis determined that the cast iron was free of defects, that the lab failures were not the result of a machine induced error and that the failure was due to rotational forces being applied to the keyway due to inadequate clamp load of the assembly.

This report, CRS Report No. S9979, dated June 27, 2001 was sent to you under a separate cover.

Secondly, OH Technologies contracted to have an engineering study performed to determine if the cast iron could tolerate the torque plus angle specification as prescribed in the Service Manual. The recommendations of the report are to use the Service Manual torque specification (torque angle) in order to minimize bolt tension variations in addition to replacing the bolt every test.

This Engineering Report No. STS011, dated July 30, 2001 was forwarded to you under a separate cover.

Therefore, please find attached a motion that I wish to direct to the Surveillance Panel for immediate action.

If there are any questions regarding this issue please do not hesitate to call.

Your interest in this matter is sincerely appreciated.

Regards,
Dwight H. Bowden
OH Technologies, Inc.

Attachment 10
Page 2
Reference

Date: 16 August, 2001

To: William Nahumck, Sequence III Surveillance Panel Chair
Pat Lang, Sequence III O&H Sub Panel Chair
Sid Clark, General Motors Corporation

From: Dwight H. Bowden / OH Technologies, Inc.

Re: Motion to Revise Engine Rebuild Manual:
Camshaft Part Number Change
Camshaft Bolt Replacement
Confirmation of Thread Form of Cam and Cam Bolt, Including Cleaning and Lubrication
Torque Specification Change

Motion to revise Sequence IIIF Engine Rebuild Manual by Dwight Bowden:

Section 3, Sheet 11, REV 1 of the Engine Rebuild Manual be revised (REV 2) as follows:

1.) Specification 1: Change part number to read as follows:

OHT3F-008-6, Camshaft

Section 3, Sheet 14, REV 1 of the Engine Rebuild Manual be revised (REV 2) as follows:

1.) Specification 1: Addition of note, change to read as follows:

24501366, Bolt, Camshaft Sprocket

NOTE: USE NEW BOLT EACH TEST

2.) Add operation:

24501366, Bolt, Camshaft Sprocket

Confirm thread is clean and free of damage

Lubricate bolt with EF-411

3.) Add operation:

OHT3F-008-6, Camshaft

Confirm camshaft drilled and tapped 1/2-20 thread form is clear of all debris using a Class 2B bottoming tap.

Clean and lubricate threads with EF-411.

4.) Section 3, Sheet 14, Operation Z: Change specification to read as follows:

Torque 100Nm + 90 Degrees

Presented by Charlie Leverett

Attachment	II
Page	1
Reference	

Background

During discussion at an IIIG development meeting the sporadic problem of oil temperature control was an item of discussion. A potential problem maybe that the current configuration has three separate systems of possible by-pass (pump plunger, oil cooler and GM oil filter adapter). If the cooler and/or the GM oil filter are in the by-pass mode, the ability to control oil temperature may become impossible.

Other Considerations:

1.) Future supply of the PF-47 is questionable, due to the ability to obtain continued source of constant material.
2.) Anti-Drain back material used in the current filter (PF-47) may have a temperature and/or chemical compatibility problem.

An example of modifications/deviations on OHT tests from the current system are shown below:

Current System	Proposed System
GM Oil Filter Adapter with bypass	GM Oil Filter Adapter *without* bypass
OHT Oil Cooler with bypass	OHT Oil Cooler *without* bypass
Two Piece Oil Filter Adapter Fitting & Connector Ass.	One Piece Stud
PF-47 Filter (25 micron)	OHT/Racor Filter (XX micron)

IIIF/G OIL COOLER/ADAPTER/FILTER SET-UP

Figure 1

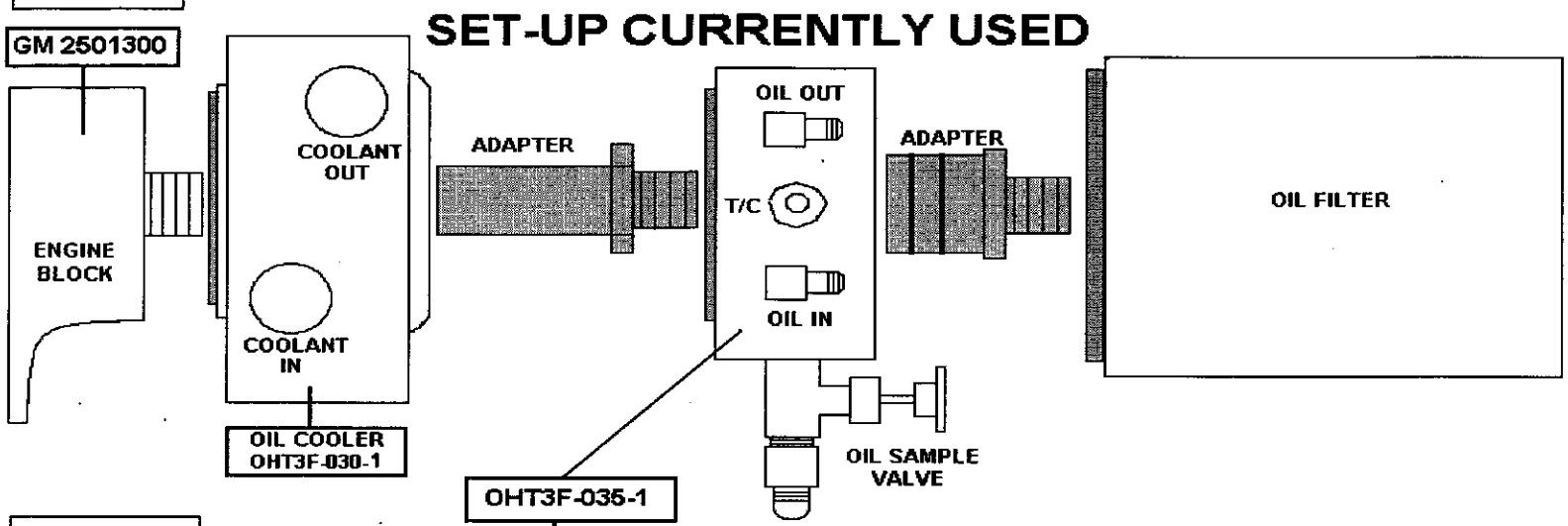
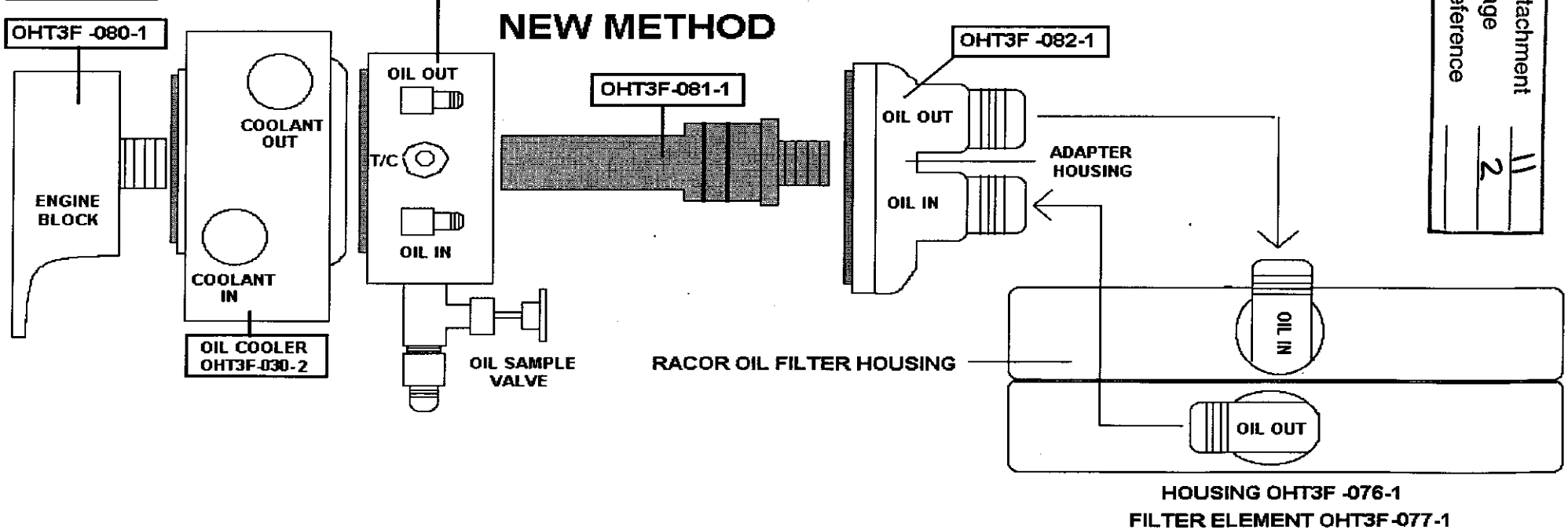


Figure 2



Attachment 11
Page Reference 2

Attachment	12
Page	1
Reference	

CENTRAL PARTS DISTRIBUTOR REPORT
OH Technologies, Inc.

Sequence IIIF Surveillance Panel Meeting

San Antonio, Texas

November 15, 2001

1.) Rejections after 05/04/2001 to 10/19/2001:

Camshaft / 9 Pieces

- Pitted Lobes / 3 Pieces
- Scratched Lobes / 2 Pieces
- No Thread / 2 Pieces
- Rust / 1 Piece
- Diagonal Grind / 1 Piece
- Material replaced

Grade 56 Piston / 2 Piece

- Collapsed Skirt / 1 Piece
- Skirt Finish / 1 Piece
- Material replaced

2.) Technical Memos Issued

Technical Memo 5, Dated 06/13/01
Dipstick Calibration Curve, Revision Dated 05/08/01
Camshaft Bearing Journal, Surface Finish Revision

3.) Batch Code Timeline

Attached

Attachment	13
Page	1
Reference	

Date: 13 June 2001

To: ASTM Sequence IIIF Testing Laboratories

From: Dwight H. Bowden / OH Technologies, Inc.

Re: IIIF CPD Technical Memo 5
Dipstick Calibration Curve, Revision
Camshaft Bearing Journal, Surface Finish Revision

Cc: Mr. Sid Clark / General Motors Powertrain
Mr. Michael Kasimirsky / Test Monitoring Center

Dipstick Calibration Curve, Revision

1.) On 14 May 2001, a revised calibration curve was emailed to the laboratories as attached file 010508 iiifdiprwnote.xls, dated 08 May 2001. This calibration curve supercedes file 981110 iiifdiprwnote.xls, dated 10 November 1998.

Camshaft Bearing Journal, Surface Finish Revision

1.) Letter dated 11 May 2001 from Dwight Bowden to William Nahumck outlines issues and corrective action to be taken to address camshaft bearing distress / camshaft bearing journal surface finish. Mr. Nahumck forwards letter to the IIIF Surveillance panel on 14 May 2001.

2.) On 16 May 2001, laboratories receive camshafts reworked for camshaft bearing journal surface finish of 10 Ra. Reworked material has the standard serial number designation plus the letter "B" stamped on the camshaft.

3.) On 11 June 2001, OHT completes the rework of laboratory material.

If there are any questions or comments regarding the aforementioned item, please do not hesitate to call.

DATE: 10 OCT 01

PROPOSED OHT SPONSORED IIIF TEST RUNS

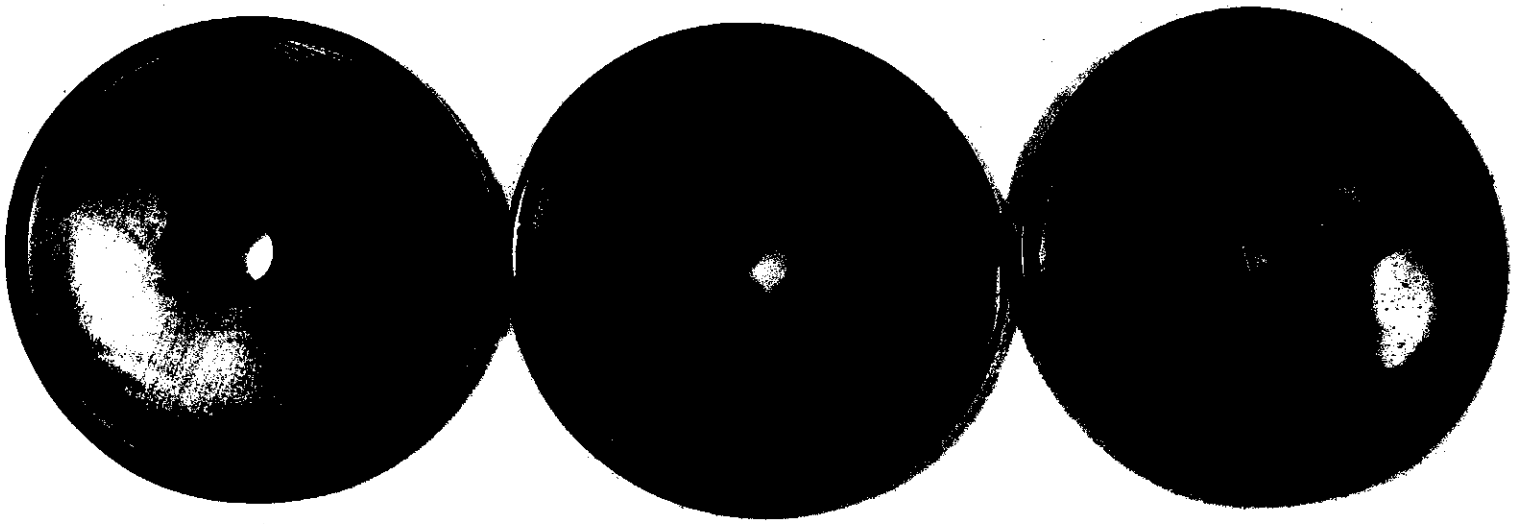
PURPOSE OF TESTS:
1.) RETURN WEAR PERFORMANCE TO REDEVELOPMENT MATRIX LEVEL
2.) VALIDATE OIL COOLING, BYPASS AND FILTER SYSTEM
3.) ENHANCE DEPOSIT AND OXIDATION PERFORMANCE

ENGINE BUILD:
1.) EMPLOY HEAVY DUTY ROLLOVER STAND FOR IMPROVED CLAMP LOAD UNIFORMITY
2.) ELIMINATE REUSE OF TORQUE TO YIELD BOLTS
3.) BOTTOM TAP ALL DRILL AND TAPPED HOLES
4.) EMPLOY LIFTER FILL CHAMBER (TEST FLUID)
5.) EMPLOY 0.1520" THRUST PLATES, CONFIRM AND RECORD END PLAY.
6.) EMPLOY 100nm + 90 DEGREES TORQUE ON CAM BOLT
7.) QUALIFY BALANCE SHAFT, OIL PRESSURE RELIEF VALVE / SPRING, ETC. PER SERVICE MANUAL
8.) COMPARE TORQUE SPECIFICATIONS IN SERVICE MANUAL TO IIIF REBUILD MANUAL
9.) USE NEW CRANKSHAFT
10.) EMPLOY NEW OIL COOLING, BYPASS AND FILTER SYSTEM
11.) MEASURE CAMSHAFT LINEARS BEFORE AND AFTER TEST
12.) EMPLOY NEW BALANCE SHAFT GEAR SET, TIMING CHAIN, AND TIMING GEARS
13.) ESTABLISH STANDARDIZED METHOD OF HOLDING CAMSHAFT WHEN APPLYING TORQUE TO CAM BOLT
14.) AIRGAGE CAM TUNNEL W/ BUSHINGS INSTALLED. RECORD BEARING CLEARANCE BEFORE AND AFTER TEST
15.) GAGE ALL LIFTERS BORES BEFORE TEST.
16.) ESTABLISH PROCEDURE TO POSITIVE OIL CAMSHAFT, THRUST PLATE AND LIFTERS WITH TEST FLUID (ELIMINATE LIFTER DIPPING AND CAMS ROTATION METHOD)
17.) GLYCOL AND FUEL SAMPLES TO BE TAKEN
18.) NO DEVIATIONS FROM PROCEDURE ALLOWED, UNLESS APPROVED BY DHB AND NOTED IN TEST REPORT.
19.) "D" VALUES TO BE OBTAINED AND RECORDED.
20.) MEASURE CLEARANCE ON ALL ROD AND MAIN BEARINGS
21.) CHECK AND RECORD SPARK PLUG GAPS BEFORE AND AFTER TEST
22.) CHECK ENGINE AT STARTUP WITH SCAN TOOL (DUMMY LOAD)
23.) RETAIN EOT SPRINGS FOR LOAD CHECK

OPERATION:
1.) AUDIT BLOWBY METER PERFORMANCE BETWEEN LABORATORIES
2.) RECALCULATE OIL LEVELING WHEN USING MODIFIED OIL COOLING, BYPASS AND FILTER SYSTEM
3.) INSTRUMENTATION REQUIRED TO DETERMINE IF OIL FILTER IS IN BYPASS

GENERAL
1.) DOCUMENT ALL DEVIATIONS FROM CURRENT PROCEDURE

Attachment	15
Page	1
Reference	



OIL FILTER

NEW / 0-60 / 61-80

Tribology

Refresher 101

tri·bol·o·gy.

The science of the mechanisms of friction, lubrication, and wear of interacting surfaces that are in relative motion.

Courtesy American Heritage Dictionary

Tribology

Refresher 101

Boundary lubrication.
A condition that lies between unlubricated sliding and fluid-film lubrication is referred to as boundary lubrication, also defined as that condition of lubrication in which the friction between surfaces is determined by the properties of the surfaces and properties of the lubricant other than viscosity. Boundary lubrication encompasses a significant portion of lubrication phenomena and commonly occurs during the starting and stopping of machines.

Courtesy Encyclopaedia Britannica, Inc.

Attachment 16
Page Reference 2

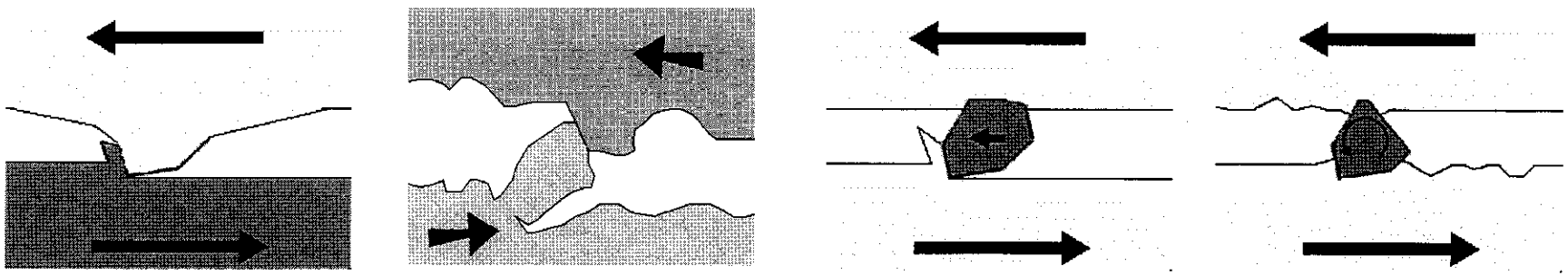
Tribology
Refresher 101

Solid lubrication.
Solids such as graphite and molybdenum disulfide are widely used when normal lubricants do not possess sufficient resistance to load or temperature extremes.

Courtesy Encyclopaedia Britannica, Inc.

Tribology

Refresher 101



Abrasive Wear

The abrasive wear mechanism is basically the same as machining, grinding, polishing or lapping that we use for shaping materials. Two body abrasive wear occurs when one surface (usually harder than the second) cuts material away from the second, although this mechanism very often changes to three body abrasion as the wear debris then acts as an abrasive between the two surfaces. Abrasives can act as in grinding where the abrasive is fixed relative to one surface or as in lapping where the abrasive tumbles producing a series of indentations as opposed to a scratch.

Courtesy Oil Analysis.com

Tribology

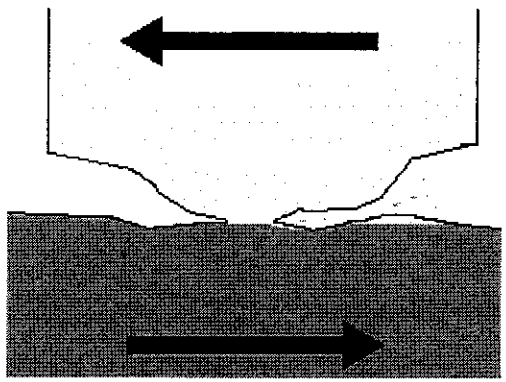
Refresher 101

Fluid-film lubrication.
Interposing a fluid film that completely separates sliding surfaces results in this type of lubrication. The fluid may be introduced intentionally, as the oil in the main bearings of an automobile, or unintentionally, as in the case of water between a smooth rubber tire and a wet pavement. Although the fluid is usually a liquid, it may also be a gas. The gas most commonly employed is air.
To keep the parts separated, it is necessary that the pressure within the lubricating film balance the load on the sliding surfaces. If the lubricating film's pressure is supplied by an external source, the system is said to be lubricated hydrostatically. If the pressure between the surfaces is generated as a result of the shape and motion of the surfaces themselves, however, the system is hydrodynamically lubricated. This second type of lubrication depends upon the viscous properties of the lubricant.

Courtesy Encyclopaedia Britannica, Inc.

Tribology

Refresher 101



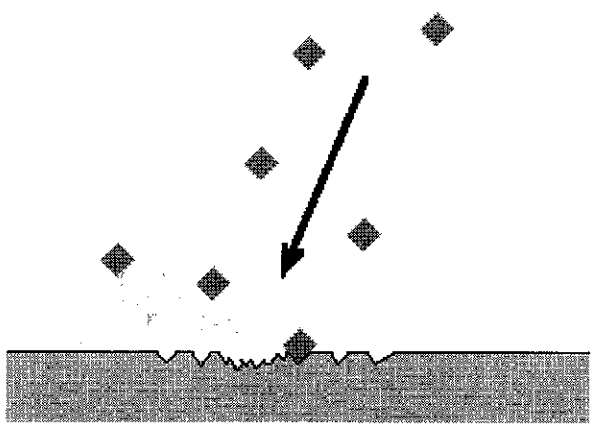
Adhesive Wear

Adhesive wear is produced by the formation and subsequent shearing of welded junctions between two sliding surfaces. For adhesive wear to occur it is necessary for the surfaces to be in intimate contact with each other. Surfaces which are held apart by lubricating films, oxide films etc. reduce the tendency for adhesion to occur.

Courtesy Oil Analysis.com

Tribology

Refresher 101



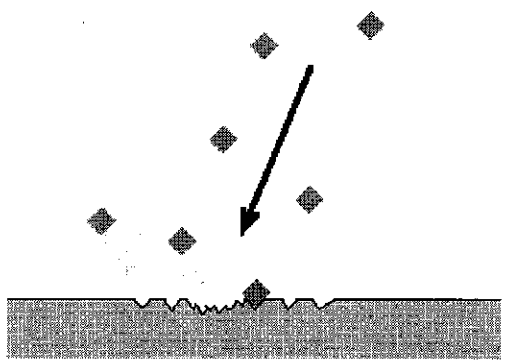
Erosion type wear

Erosion is caused by a gas or a liquid which may or may not carry entrained solid particles, impinging on a surface. When the angle of impingement is small, the wear produced is closely analogous to abrasion. When the angle of impingement is normal to the surface, material is displaced by plastic flow or is dislodged by brittle failure.

Courtesy Oil Analysis.com

Tribology

Refresher 101



Cavitation Erosion

Cavitation is the formation and collapse, within a liquid, of cavities or bubbles that contain vapour or gas. Normally, cavitation originates from changes in pressure in the liquid brought about by turbulent flow or by vibration, but can also occur from changes in temperature (boiling). Cavitation erosion occurs when bubbles or cavities collapse on or very near the eroded surface. The mechanical shock induced by cavitation is similar to that of liquid impingement erosion causing direct localized damage of the surface or by inducing fatigue.

Courtesy Oil Analysis.com

Tribology
Refresher 101

Fretting Wear

Fretting is a small amplitude oscillatory motion, usually tangential, between two solid surfaces in contact. Fretting wear occurs when repeated loading and unloading causes cyclic stresses which induce surface or subsurface break-up and loss of material. Vibration is a common cause of fretting wear.

Courtesy Oil Analysis.com

Attachment
Page 9
Reference

Tribology
Refresher 101

Control functions

The amount and character of the lubricant made available to sliding surfaces have a profound effect upon the friction that is encountered. For example, disregarding such related factors as heat and wear but considering friction alone between two oil-film lubricated surfaces, the friction can be 200 times less than that between the same surfaces with no lubricant. Under boundary lubrication conditions, the effect of viscosity on friction becomes less significant than the chemical nature of the lubricant.

Attachment 16
Page Reference 10

Courtesy Encyclopaedia Britannica, Inc.

Tribology
Refresher 101

Wear Mechanism

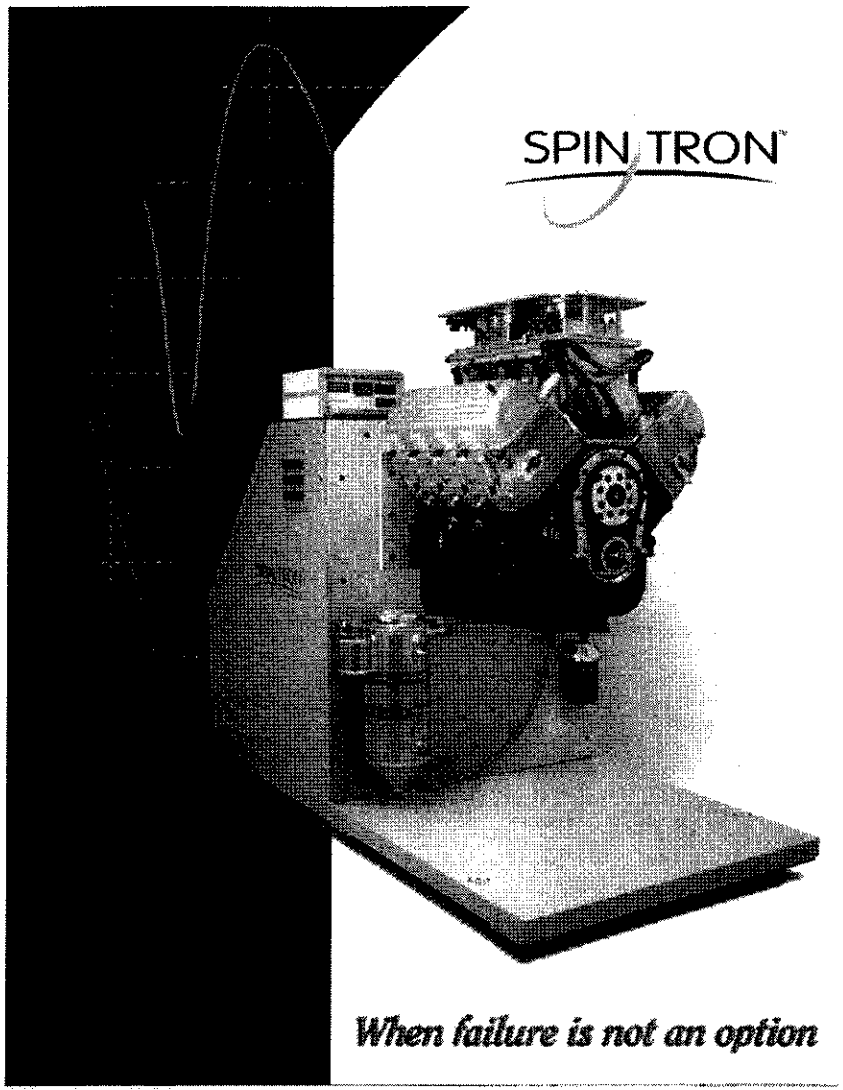
Wear occurs on lubricated surfaces by abrasion, corrosion, and solid-to-solid contact. Proper lubricants will help combat each type. They reduce abrasive and solid-to-solid contact wear by providing a film that increases the distance between the sliding surfaces, thereby lessening the damage by abrasive contaminants and surface asperities.

Courtesy Encyclopaedia Britannica, Inc.

Attachment 16
Page
Reference 11

Sequence IIIF Wear Investigation

- Metallurgy
- Metrology
- Spintron
- Procedural Recommendations
- Future Direction



Attachment 16
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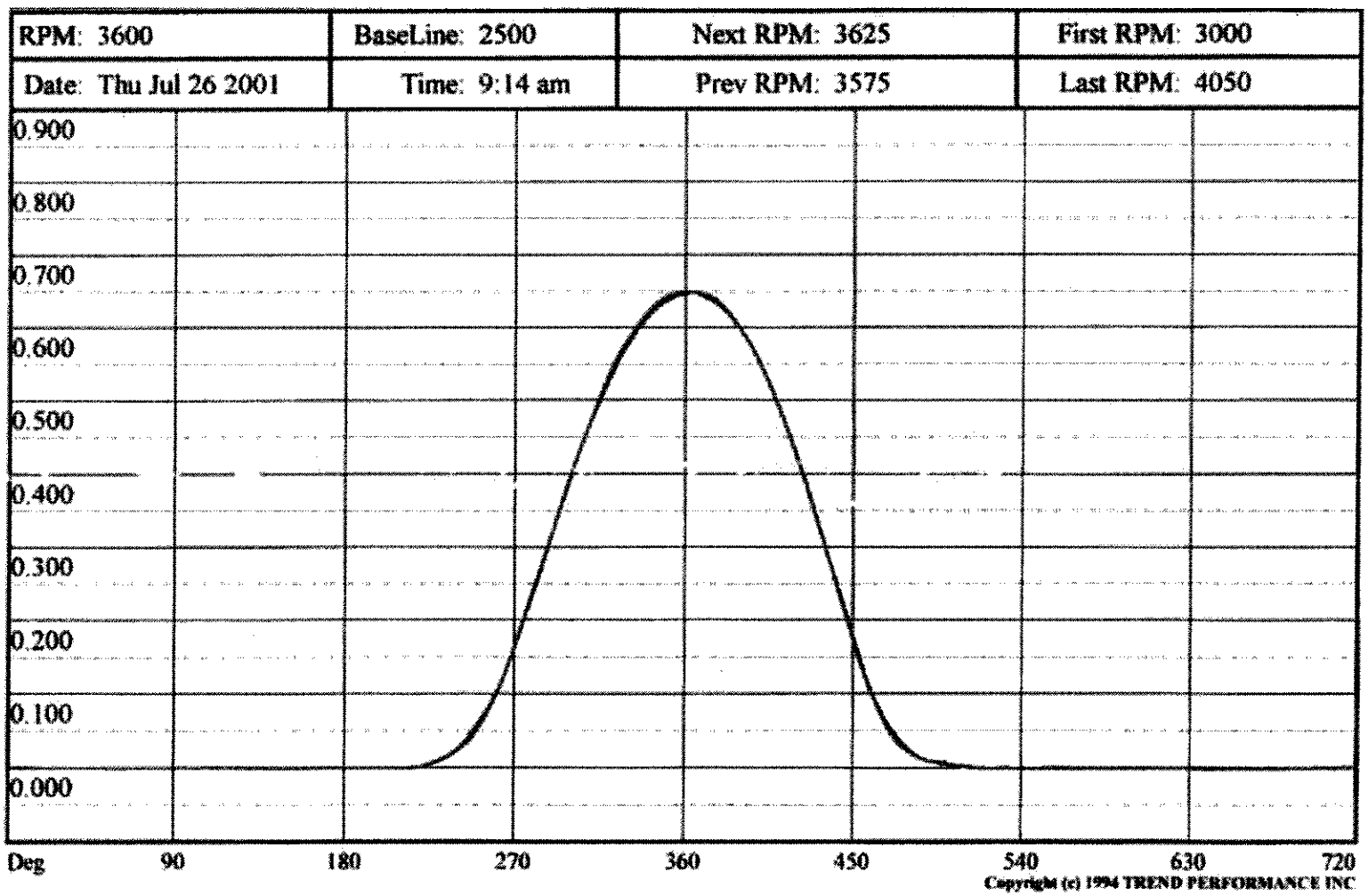
Reference

Spintron



Attachment 16
Page 14
Reference

Metallurgy

CWC and Powertrain metallurgical studies have confirmed that the camshafts and lifters are being manufactured correctly based on carbide levels and Rockwell hardness values.

Metrology

Investigations are continuing with concentrated efforts looking at, camshaft linears, taper, and surface finish along with engine block lifter bore positions and squareness or perpendicularity.

Procedural Recommendations

As a result of investigations into wear during development of the IIIG test, two recommendations were carried forward to the Sequence IIIF Surveillance Panel.

1. **Camshaft pre-lube using test oil**
2. **Screened average wear calculation**

Future Wear Directions

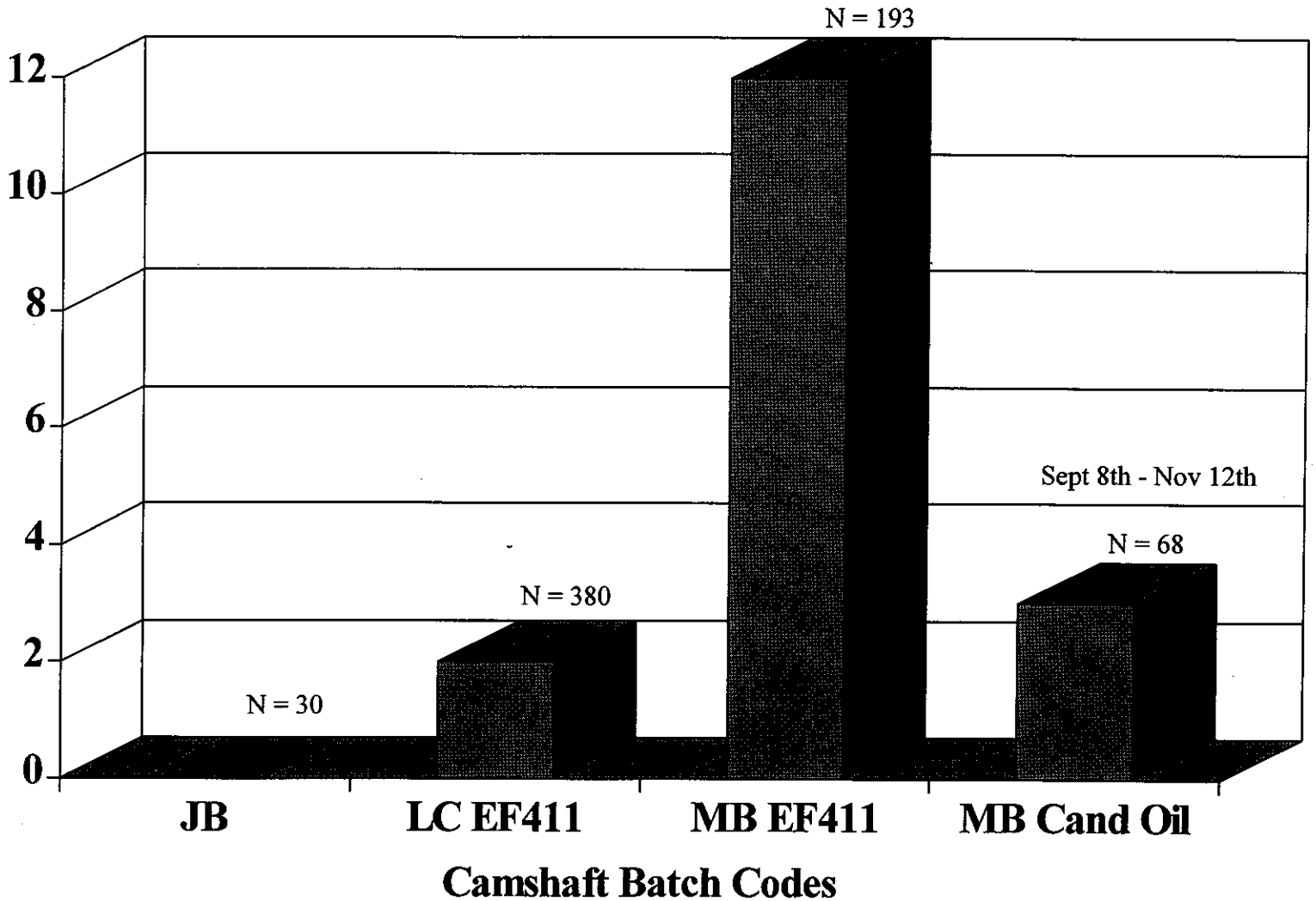
The Sequence IIIG development team continues to investigate wear.

Things we are considering at this time are:

- Consistent engine start-up and operating procedures
- Alternate camshaft materials
- Camshaft and lifter geometries

IIIF Status at the Independents

CANDIDATE % Fails on "non-screened" ACLW @ 20 ONLY



Attachment Page Reference 17

Sequence IIIG

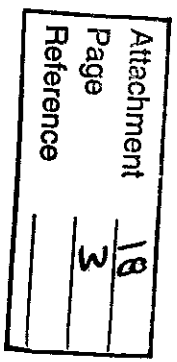
- 3800 Series II (Current production scheduled through 2009)
  - Same test components as Sequence IIIF
  - Virtually the same as Sequence IIIF with a few modifications to enhance severity
    - Test length 100h vs 80h
    - 20h levels vs 10h (5500ml initial with 472 ml additions)
    - Coolant temp 115°C vs 122 °C
    - Oil temp 150 °C vs 155 °C
    - Inlet air temp 35 °C vs 27 °C
    - 250 Nm vs 200Nm @ 3600 RPM
    - Rings .025 Top .042 2nd vs .042 / .038

Sequence IIIG

- Operating Conditions
  - 5500 ml initial oil charge
  - 100 hour test length
  - 20 hour levels with 472 ml new oil additions
  - 15:1 Air-to-Fuel
  - 3600 RPM @ 250 Nm Load
  - 115 °C Coolant
  - 150 °C Oil
  - 35 °C Inlet Air

Sequence IIIG

- 10 runs to date
- Oils
  - 433-1
  - 1006 reformulated
  - 403 reformulated
  - 0.03 Phos
  - 0.05 Phos.
  - 0.1 (0.095) Phos.



Sequence IIIG

Quick Summary

Test #	Lab/Run#	Test Oil	%Vis. Inc.	Avg. Wear	WPD	PSV	Oil Cons.	Comments:
1	SR/01	433-1	6467	132	2.21	7.87		High B/B .042/.038 ring gap EF-411 build 180lb. Springs
2	SR/02	433-1	287	28	2.62	7.96	3.85	.025/.042 ring gap - Test oil build - 180lb. springs
3	PE/01	433-1	130	37	2.82	8.32	4.09	.025/.042 ring gap - Test oil build - 180lb. springs
4	SR/03	403 Reformulated	TVTM	14	1.6	8.2		.025/.042 ring gap - Test oil build - 180lb. springs
5	SR/04	1006 Reformulated	1077	27	2.36	8.62	3.61	.025/.042 ring gap - Test oil build - 180lb. springs
6	SR/05	0.03 Phos.	105	105	3.92	8.4	3.74	.025/.042 ring gap - Test oil build - 180lb. springs
7	SR/06	0.03 Phos.	156	267	2.85	7.79	3.7	.025/.042 ring gap - Test oil build - 180lb. springs
8	PE/02	0.05 Phos.	130	26	3.16	8.69	4.25	.025/.042 ring gap - Test oil build - 180lb. springs
9	PE/03	0.05 Phos.	130	153	3.32	8.52	3.99	.025/.042 ring gap - Test oil build - 205lb. springs
10	PE/04	0.095 Phos.	176	16	3.23	8.84		.025/.042 ring gap - Test oil build - 205lb. springs

SR/01 run with reverse gap strategy and EF-411 build
PE/03 and PE/04 run with deviation from previous standard test configuration

Standard test conditions:
5500 ML Initial oil fill
15:1 Air-to-Fuel Ratio
20 Hour oil levels
35°C Intake air
0.025 / 0.042 Ring gap
150°C Oil temperature
250 Nm Torque
High tension oil rails
Engine build with test oil

Attachment 18
Page 4
Reference

Sequence IIIG

433-1

433-1 (1)		433-1 (2)		433-1 (3)	
Cam	Lifter	Cam	Lifter	Cam	Lifter
278	21	0	25	2	36
121	25	0	17	3	31
0	17	0	36	1	41
5	37	0	40	1	39
0	29	0	38	1	39
186	24	0	21	1	30
160	19	0	30	1	25
5	36	0	31	1	40
0	26	0	34	2	35
159	16	0	18	2	39
249	23	0	21	2	34
136	15	0	28	2	39
180lb. .042/.038 EF-411 Build		180lb. .025/.042 Test Oil Build		180lb. .025/.042 Test Oil Build	

Sequence IIIG
403 & 1006

Reformulated

403		1006	
Cam	Lifter	Cam	Lifter
0	18	0	31
0	11	0	26
0	13	0	37
0	20	0	29
0	13	0	33
0	12	0	28
0	11	0	26
0	19	0	28
0	19	0	23
0	8	0	19
0	11	0	21
0	10	0	21
180lb. .025/.042 Test Oil Build		180lb. .025/.042 Test Oil Build	

Attachment 18
Page 16
Reference

Sequence IIIG

0.03 Phos.

.03 Phos		.03 Phos	
Cam	Lifter	Cam	Lifter
78	37	248	39
95	30	321	44
0	43	285	51
118	39	5	54
0	47	125	47
14	22	300	34
0	33	281	43
254	37	278	36
0	45	245	58
0	36	218	46
159	32	350	46
111	34	2	52
180lb.		180lb.	
.025/.042		.025/.042	
Test Oil Build		Test Oil Build	

Attachment 18
Page 17
Reference

Sequence IIIG

0.05 Phos.

.05 Phos Cam	.05 Phos Lifter	.05 Phos Cam	.05 Phos Lifter
0	38	376	24
0	18	0	18
0	23	0	24
0	35	0	36
0	27	0	35
0	18	0	18
0	22	285	18
0	38	0	31
0	22	0	20
0	18	208	17
0	20	282	24
0	34	395	24
180lb. .025/.042 Test Oil Build		205lb. .025/.042 Test Oil Build	

Attachment 18
Page 1 of 8
Reference

Sequence IIIG

0.095 Phos.

.095 Phos

Cam	Lifter
0	22
0	15
0	13
0	24
0	14
0	13
0	13
0	20
0	16
0	15
0	12
0	14

205lb.

.025/.042

Test Oil Build

Attachment 18
Page 19
Reference

Sequence IIIG
Next Step

Current plans:

1. Continue looking at wear with 205lb. springs
2. Look closer at deposit control
3. Run 0W and 5W-20 grade oils
4. Schedule official release date

If you would like to run your formulation now, contact Bob Olree and SwRI or PerkinElmer

Sequence IIIF GM Race shop

Test Part Supplier Report

1. Monthly Consumption
2. Current Inventory Status
3. Rejected Materials

GM RACING

SLC 11/15/01

Attachment 15
Page 1
Reference

Monthly Consumption

Part #	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
24502286	Engine Block	2	42	15	5	6	20	12	15	12	14			143
24502260	Cylinder Head	246	102	190	145	10	135	168	293	84	254			1627
24502241	Front Cover	3	48	10	2	16	8	5	23	22	17			154
24502168	Crankshaft	20	0	22	24	3	30	180	23	10	13			325
24501696	Connecting Rod	911	430	370	284	484	286	4158	861	329	339			8452

GM RACING

SLC 11/15/01

Attachment 19
Page 2
Reference

Current Inventory Status

Oct-01

Part #	Description	Current Inventory	In Process @ Schwartz	Castings @ Raceshop
24502286	Engine Block	111	74	72
24502260	Cylinder Head	55	150	1200
24502241	Front Cover	173		
24502168	Crankshaft	149		
24501696	Connecting Rod	3637		
24215189	4L60E Transmission	149		
CAH0404	4L60E Test Kit	250		

GM RACING

SLC 11/15/01

Attachment 19
Page 3
Reference

Rejected Materials

9 Cylinder heads for casting porosity

13 Connecting Rods for bearing tang imperfections

7 Crankshafts for journal imperfections

1 Engine Block for casting imperfection

Engine block was returned to inventory

GM RACING

SLC 11/15/01

Attachment 19
Page 4
Reference

THE ASTM SEQUENCE IIIF SURVEILLANCE PANEL

SCOPE & OBJECTIVES

Attachment	20
Page	1
Reference	

SCOPE

The Sequence IIIF Surveillance Panel is responsible for the surveillance and continual improvement of the Sequence IIIF test documented in ASTM Standard DNNNN-XX as update by the Information Letter System. Data on test precision and laboratory versus field correlation will be solicited and evaluated at least every six (6) months. The Surveillance Panel is to provide continual improvement of rating techniques, test operation, test monitoring and test validation through communication with the Test Sponsor, ASTM Test Monitoring Center, Operations and Hardware Subpanel, the Central Parts Distributor, ASTM B0.01 Passenger Car Engine Oil Classification Panel, ASTM Light Duty Rating Task Force, ASTM Committee B0.01, CMA Monitoring Agency and CRC Motor Rating Methods Group. Actions to improve the process will be recommended when appropriate based on input to the Surveillance Panel from one or more of the previously stated groups. Develop updated test procedures when necessary and review the correlation with previous test procedures. This process will provide the best possible Sequence III Type Test Procedure for evaluating automotive lubricant performance with respect to the lubricant's ability to prevent oil thickening, varnish formation, oil consumption and engine wear.

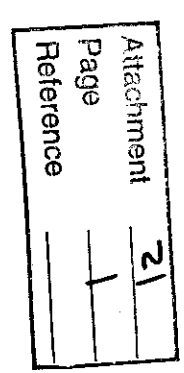
OBJECTIVES	TARGET DATE
1. Identify a 15W-40 HDD, CH-4 oil for the IIIF reference system	On hold
2. Assembly Manual Revision System	November 2001
3. Control System Clarification	November 2001
4. Issue Draft 4 of the Sequence IIIF Test Method	December 2001
5. Resolution of the unexplained, random wear in the IIIF Test Method	January 2002
6. Revise the IIIF Test Method for elevation to ASTM Standard	March 2002
7. Develop the IIIG test for inclusion in the ILSAC GF-4 Specification	March 2002
8. Intro of GF-3 Cat Oil	May 2002

William M. Nahumck, Chairman
Sequence IIIF Surveillance Panel

Updated November 15, 2001
San Antonio, Texas

DCC Request

- Member companies of the Data Communications Committee are requesting the Sequence IIIF Surveillance Panel to develop an extended test length report packet



ASTM Issues

- Extended Sequence IIIF test is not currently documented within ASTM
  - A possible solution is to document extended length testing similar to Sequence IIIFHD
  - Do not document, end of story, Frank sit down!