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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

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May 20, 2002

Reply to: Richard E. Grundza
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Unapproved Minutes of the May 14, 2002 Sequence IVA Surveillance Panel Meeting held in Detroit, MI

The meeting was called to order at 10:00 am by Chairman Bill Buscher. A membership list was circulated for members and guests to sign in. It's shown in Attachment 1.

Membership Changes

Tim Caudill replaces Carl Stephens as the Ashland representative, Jim Carter replaces Bob Rumford as the Dow and Jerry Brys replaces Mark Hull as the Lubrizol representative.

Agenda Review

Ben Weber is the Action Item and Motion recorded.
The Agenda was accepted as attached (Attachment 2)

Meeting Minutes Status

November 14, 2001 minutes were approved, motion by Rich Grundza, second by Gordon Farnsworth.

Sequence IVA Surveillance Panel Meeting
May 14, 2002 Detroit, MI

Action Item Review

Chairman Buscher reviewed the status of action items (Attachment 3) from the previous meeting as follows:

a) Work with Ethyl to address differences in base circle leveling. Addressed by Information Letter 02-2
b) Update test targets for reference oil 1007 @20 and 30 tests. Not completed, 17 tests reported, ongoing.
c) TMC to co-ordinate the introduction of reference oil 1006-2. Donated tests completed, awaiting 10 tests to update.
d) Introduce category reference oil. Oil at TMC, awaiting completion of analytical results before it can be shipped. Should be available in 1-2 months.
e) Evaluate differences in RAC flow between laboratories. Completed, to be addressed later on in the meeting.
f) Surveillance Panel to request 5-10 cams from Nissan for prove out testing prior to introducing a new batch of cams. Unable to get response from Nissan, contacts at Nissan Japan may have moved to other positions.
g) Laboratories to check 2000 heads, some heads were shipped bare. Labs inspected orders; Nissan reimbursed labs for mix up.
h) Surveillance Panel to review draft 5 of IVA procedure. Completed, Information Letter 02-1 was issued to address surveillance panel recommendations.
i) Laboratories to address potential improvements for GF4 introduction. Potential wear measurement improvements to be investigated.

TMC Reference Oil Report

TMC report can be found on the TMC ftp site.
ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceiv/semiannualreports/IVA-04-2002.pdf

Mike Kasimirsky of the TMC presented the Semiannual Report for the period of October 1, 2001 through March 31, 2002 (Attachment 4). Industry data trended mild by approximately 10 microns for the period. There were 10 mild severity alarms this period. Precision was within historical estimates for the period. Introduction of the category reference oil, 1009, was discussed. A motion was made to introduce reference oil 1009 by November, 2002. Each lab will donate a test on 1009 after completing a successful reference oil test on the stand. Calibration period of the test stand will be increased by one test to compensate the lab for the donated test. 1009 will be assigned to 10% of the reference oil tests. Motion by Bill Buscher, second by Mike Kasimirsky. Acceptance of TMC report was moved by Mike Kasimirsky and seconded by Dwight Bowden.

RSI Report

Rick Oliver from RSI presented the candidate severity and precision data for the period October 1, 2001 through March 31, 2002 (Attachment 5). Candidate precision is performing at historical levels and severity exceptions showed candidate data trending somewhat mild this period. Rick moved acceptance of his report which was seconded by Bill Buscher. The RSI report was approved unanimously.

Fuel Suppliers Report

Jim Carter of Dow presented the fuel supplier report (Attachment 6). The fuel in storage has not aged appreciably. There are approximately 16,500 gallons in storage, with approximately 17,500 gallons shipped in the past six months.

Test Engines and Kits

Some limited data has been gathered on the 2001 kits. 4 tests in two labs on both reference oils 1006 and 1006-2 have been run. Bill Buscher presented a summary of the tests run to date (Attachment 7). Bill indicated that the test run on 1006 have been mild of target, but not as mild as some batches. A survey of labs indicated that all labs have the same batch numbers. Solicitation of 2002 kits was begun on 5/15/2002. Orders must be received by Nissan no later than 6/28/2002. Contact Tim Scully at Nissan. Nissan is committed to supporting the test with KA24E hardware till 2008. Bill Buscher noted that with the exception of the distributor, test parts prices had increased by about 9% (See Attachment 8). Dwight Bowden stated that, as a point of order, that issues of cost are not an ASTM Surveillance Panel concern and should not be discussed at a meeting. Ben Weber felt that it was important for labs to know this information. Bill finally commented that Nissan has been requested to identify a lot number on the hardware supplied for testing purposes.

Revision to Sampling Procedure

Bill Buscher presented sections from the IVA procedure which show the sampling location and procedure. Bill then presented data (see Attachment 9) to show a carry over effect, which appears to be caused by the location of the sample valve. Bill then proposed two motions, of which the first motion was put forward for a vote, after being moved by Bill Buscher and seconded by Mike Kasimirsky. The panel unanimously agreed to amend sections 6.3.12.3 and 11.3.4 to require sample to be taken from the bottom of the oil pan, effective June 1, 2002.

Rocker Cover Variability Task Force

Attachment 10 contains the presentation made by Bill Buscher made to the panel regarding the task force's progress in resolving differences in RAC cover coolant flow rates noted between labs/stands. Two conference calls were conducted which were instrumental in determining the reasons for poor reproducibility regarding flow rates. Root causes for poor reproducibility include:
1) Flow calibration errors and transducer conversion errors
2) Plumbing restrictions
3) Defective research valves.
4) Air entrainment in systems.
The task force will continue to investigate the replacement of the Red Research valve with an orifice plate.

Status of IVA Test Relative to GF4 Category

Bill Buscher asked the panel if the IVA test is ready for GF4 category testing. Bill discussed a possible improvement in the 7 point averaging technique, as well as possible engine build workshop and a metrology round robin. Ben Weber requested that GF4 oils be made available as reference oils. Frank Fernandez stated that it is still too early to identify viable candidates for GF4. Gordon Farnsworth stated that some of the oils from the IIIG matrix may become reference oils.

New Business

Dave Glaenzer discussed the calibration of oil gallery, coolant outlet and intake air temperature sensors, which are required to be calibrated every 8 tests while the remainder of the instrumentation channels are required to be calibrated every 16 test or 180 days. After some discussion, a motion was made by Dave Glaenzer to change the calibration frequency for these sensors to every 16 tests or 180 days, effective May 14, 2002. After a second by Bill Buscher, the motion was approved unanimously.

Discussions turned to proposed builders workshop. A workshop is planned for the upcoming months to be held jointly with the Sequence V build workshop. Bill Buscher asked that labs contact him in the next week or so to let him know what weeks are out and to facilitate scheduling of said workshop.

Discussions regarding referencing frequency and strategy was initiated by Bill Buscher. Section 10, which describes the referencing process is very vague and ambiguous. In discussions with Larry Bendele, previous IVA Chair, Bill noted that a 16 test or 6 month frequency was discussed, but was never incorporated in the procedure. Bill presented the procedure for calibration as it reads (Attachment 11) and discussed a proposal that would allow labs to run engines in the stand that had less than 16 runs on another stand, without nullifying the calibration. Frank Farber raised concerns that severity adjustments may not have validity, since there would be a reduction in the number of reference tests run during slower times. Bill stated that it was not the intent to allow calibration beyond a six month period. Bill's concerns were that a number of engines are being removed from the stand after 6 months with only 10 to 12 runs on the engine. Bill has been storing these engines and would like to do something to maximize engine life and thereby eliminate the need to remove an engine from the stand prior to completing 16 runs. A motion was made by Bill Buscher and seconded by Mike Kasimirsky to amend/define the calibration period as 15 non-reference tests or 6 months. Engine changes would not affect stand calibration. This procedure change would be effective May 14, 2002. There was no additional new business.

Review of Scope and Objectives

Chairman Buscher reviewed the Scope and Objectives of the surveillance panel (Attachment 12). No additional items were discussed.

The next meeting will be in November, 2002 or at the call of the chairman.

A listing of the motions and action items taken during this meeting is included as Attachment 13.

The meeting was adjourned at 11:40 am.

Sequence IVA Surveillance Panel

Detroit, Michigan
Crowne Plaza Hotel
May 14, 2002
10:00 a.m. - 12:00 p.m.

Attachment	1
Page	1 of 1
Reference	IVA May 02

AGENDA

1. Membership changes; Chairman change
2. Motion and Action recorder (Weber) / Secretary (Grundza)
3. Approval of minutes for November 14, 2001 meeting
4. Review action items from last meeting (Buscher)
5. TMC Reference Oil Report (Kasimirsky)

   Discuss reference oil targets for 1006-2; 1007; new category oil
6. RSI Candidate Precision Report Status (Oliver)
7. Fuel Supplier Report - KA24E reference fuel (Rumford)
8. Test Engines and Kits (Buscher)

   Precision of 2001 test kits

   2002 Nissan hardware solicitation
9. Proposed revision to oil sampling to reduce sample contamination (Buscher)
10. Review of Task Force work to fix variability of rocker cover coolant flow rate (Buscher)
11. Sequence IVA ready for GF-4?
12. New Business

    Engine Rebuilders Workshop plan

    Proposed referencing motions
13. Review Objectives of Surveillance Panel
14. Next meeting
15. Adjourn

Attachment 2
Page 1 of 7
Reference

MEMBERSHIP
ASTM IVA SURVEILLANCE PANEL

May 8, 2002

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Attachment 2
Page 2 of 7
Reference

MEMBERSHIP
ASTM IVA SURVEILLANCE PANEL

May 8, 2002

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Attachment	2
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Reference	

NON-MEMBER MAILING LIST
ASTM IVA SURVEILLANCE PANEL

May 8, 2002

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Attachment 2
Page 4 of 7
Reference

NON-MEMBER MAILING LIST
ASTM IVA SURVEILLANCE PANEL

May 8, 2002

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Hsu, Jeffery	Pennzoil / Quaker State Company 1520 Lake Front Circle (77380) P.O. Box 7569 The Woodlands, TX 77387 Phone No.: 281-363-8177 (1/10/01) Fax No.: 281-363-8002 (1/10/01) Email: JefferyHsu@PZLQS.com	
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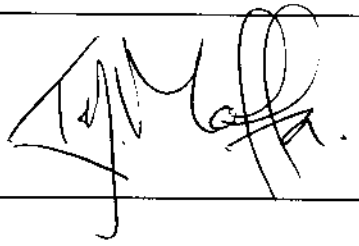
Moffa, John	Castrol International Whitchurch Hill Pangbourne, Reading, UK,RG8 7QR Phone No.: 011-44-1-189-765-263 Fax No.: 011-44-1-189-844-088 Email: john_moffa@burmahcastrol.com	
Nakamura, Kiyotaka	Nissan Motor Co., Ltd. 6-1, Daikoku-cho, Tsurumi-ku Yokohama, Japan (230) Phone No.: 011-81-45-505-8481 Fax No.: 011-81-45-505-8543 Email:	

Attachment 2
Page 5 of 7
Reference

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ASTM IVA SURVEILLANCE PANEL

May 8, 2002

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Attachment 2
Page 6 of 7
Reference

NON-MEMBER MAILING LIST
ASTM IVA SURVEILLANCE PANEL

May 8, 2002

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Attachment 2
Page 2 of 7
Reference

NON-MEMBER MAILING LIST
ASTM IVA SURVEILLANCE PANEL

May 8, 2002

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	Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	
	Phone No.: Fax No.: Email:	

Attachment	3
Page	1 of 1
Reference	

Action Items
IVA Surveillance Panel
November 14, 2001
As Recorded at the Meeting by Ben Weber

1. The Surveillance Panel chair will contact Ethyl regarding differences in base circle leveling. A teleconference might be called to discuss this further, and the recent Information Letter might be amended if necessary.
   Done. Sequence IVA Information Letter No. 02-2 issued on April 5, 2002.

2. The TMC will recalculate the limits of 1007 when 20 & 30 test results are available. Currently there are 11 1007 data points at this time.
   Still waiting for 20 results to become available.

3. The TMC will coordinate a 1006-2 run very soon at each of the labs. The run will be made in a referenced test stand and the reference period will be extended by one run. The 1006-2 limits will be calculated from this data.
   Done. Donated tests have completed and initial 1006-2 limits have been set. 1006-2 currently being used as a Sequence IVA reference oil. Waiting for 10 results to become available to recalculate the limits.

4. The TMC will request 100 gallons of the new GF-3 category reference oil for a 5-year supply. The oil will be used at a 10% level in the reference. Introduction of this oil can be done at a later time, especially following the introduction of 1006-2.
   1009? Update to be presented at this meeting.

5. The IVA surveillance panel will investigate the differences in rocker cover coolant flow and work to make this equal amongst all labs. One area that was discussed was possible differences in plumbing fixtures since this isn't fully specified. Each lab should draw a schematic of their system including pipe sizes, line lengths and fitting sizes. These should be provided to the SP chair for looking to make a common system. A conference call will be called by the chair for further discussion. Pressure isn't currently being measured at it was suggested that this might also help with the investigation.
   Done. Report to be presented at this meeting.

6. The SP will ask Nissan if they will provide 5 to 10 camshafts of a new batch for testing prior to releasing the entire batch for sale to the Industry. This is being done because Nissan will not accept camshafts for return. Some labs have as many as 50 camshafts that produce mild results from particular camshaft batches.
   Status? Nissan contacts in Japan do not return correspondence.

7. The labs should check their 2000 order of heads because SwRI received these as bare heads with no valves or springs. Nissan did accept these for return and exchange.
   Done.

8. The surveillance panel is requested to review the current version of the test method (Draft No. 5 – November 2001) and provide your requested changes to the SP chair by December 10, 2001. An information of this test method will be issued in early January 2002. Passed unanimously.
   Done. Sequence IVA Information Letter No. 02-1 (Draft 6) issued on February 12, 2002.

9. In preparation for GF-4, the labs are encouraged to be thinking about areas where the test could be improved. The following ideas were discussed:
   - SwRI is looking at the area of wear (versus just a depth of wear) using the PDI software.
   - SwRI is also looking at ways to improve the flushing effectiveness. One area for possible improvement could be in the operating conditions such as time and temperature.

   Status?

Attachment	4
Page	1 of 11
Reference	

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

Memorandum: 02-028

Date: April 30, 2002

To: Bill Buscher, Chairman, Sequence IVA Surveillance Panel

From: Michael T. Kasimirsky Michael T. Kasimirsky

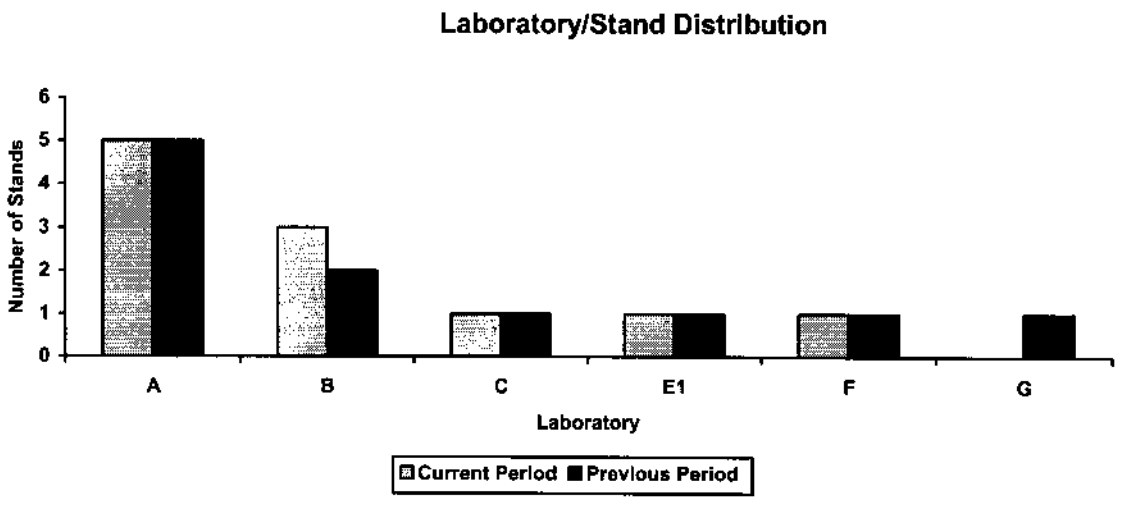
Subject: Sequence IVA Semiannual Report: October 1, 2001 through March 31, 2002

The following is a summary of Sequence IVA reference tests that were reported to the Test Monitoring Center during the period October 1, 2001 through March 31, 2002.

Lab/Stand Distribution

	Reporting Data	Calibrated as of March 31, 2002
Number of Laboratories:	5	3
Number of Test Stands:	11	7

The following chart shows the laboratory/stand distribution:



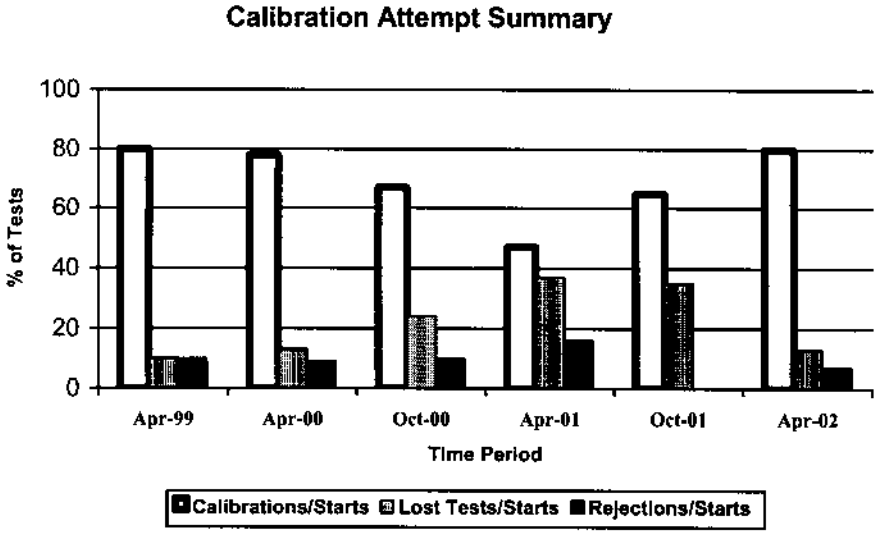
The following summarizes the status of the reference oil tests reported to the TMC:

Attachment	4
Page	2 of 11
Reference	

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	12
Failed Acceptance Criteria	OC	1
Stand Failed Reference Sequence – data pulled	MC	0
Operationally Invalid (Laboratory Judgment)	LC	1
Operationally Invalid (Lab & TMC Judgment)	RC	0
Aborted	XC	1
Total		15

Donated & Industry Support Outcomes	TMC Validity Codes	No. of Tests
Acceptable Decoded Runs	AG	1
Acceptable Donated Tests (Reference oil 1006-2 test target generation)	NI	6
Invalid Decoded Runs	LG	0
Total		7

Calibrations per start, lost tests per start and rejection rates are summarized below:



Attachment	4 Rev
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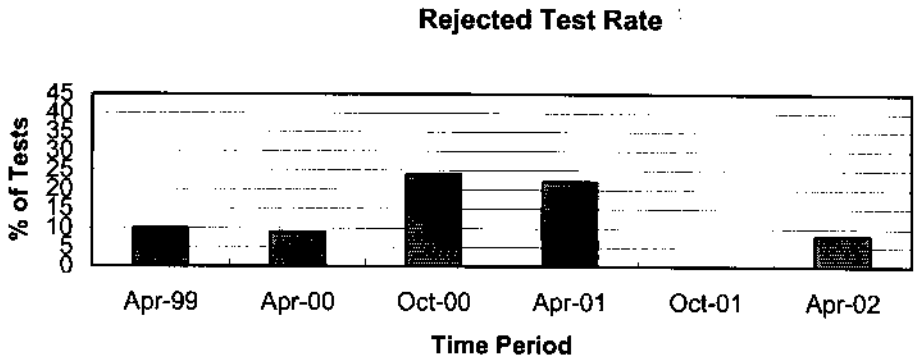
Reference	



One test failed this period for mild ACW.

There were no LTMS Deviations written this period. There has been one deviation from the LTMS since its introduction in 1999.

There was one QI Deviation written this period on Coolant Outlet Temperature due to problems that the laboratory experienced with it's process water systems during a Sequence IVA test.

No lab visits were performed this period.

Lost Test Summary

Two tests were lost this period. The causes are summarized in the following chart:

Lab	Reason for Lost Test	Number of Tests	Breakdown of Tests (LC/RC/XC)
F	Negative QI Results on Intake Air Pressure and Exhaust Back Pressure	1	1/0/0
	Test aborted due to severity concerns with test stand	1	0/0/1

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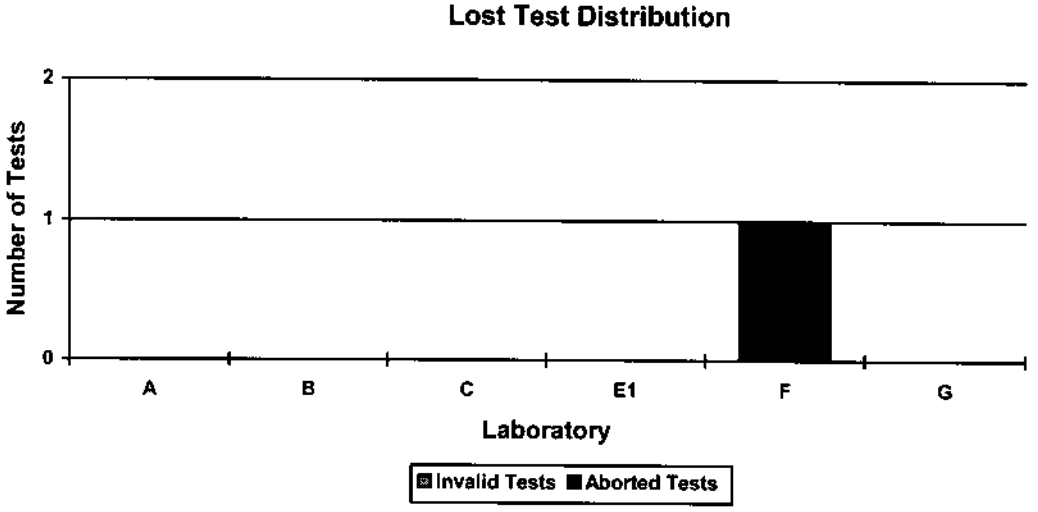

Information Letters

Sequence IVA Information Letter No. 02-1, Sequence No. 7, dated February 12, 2002, was issued during the period and contained a revised engine break-in specification and an updated draft standard of the Sequence IVA test procedure.

Sequence IVA Information Letter No. 02-2, Sequence No. 8, dated April 5, 2002, was issued since the last semiannual report and contained a revision to the camshaft measurement procedure.

Severity and Precision Analysis

Below is a summary of the average Δ/s, pooled standard deviation, and average Δ in reported units for the tests reported during this period. Also below is a summary of the average Δ/s value, by parameter, for all laboratories reporting data during this period.

Industry Severity Summary			
Parameter	Average Δ/s	Pooled standard deviation (degrees of freedom)	Average Δ, in micrometers
ACW	-0.778	11.81 (df=10)	-9.19

ACW Results, by Laboratory	
Laboratory	Average Δ/s
A	-0.593
B	-0.336
C	-0.687
E1	-0.696
F	-2.029
G	-

The industry experienced a severity alarm of ten data points during the period (see Figure 1). This alarm was initiated by a test on reference oil 1006 which generated mild failing results. Seven of the remaining nine tests in the alarm were mild of target but within the Shewhart Severity limits. In addition, all five laboratories reporting data for the period have been mild of target, on average. The mild results do not appear to be driven by test hardware or fuel batch as there are several different batches of hardware and fuel represented in the ten mild test results. The ten data points also include data on both reference oil 1006 and 1007 so it does not appear to be driven by a particular reference oil either. To date, no specific cause for the mild test results has been identified. Subsequent testing has since cleared the alarm. Severity for the period is the mildest obtained to date in the Sequence IVA test while precision is comparable to historical performance (see Figures 2 & 3).

Hardware

No hardware changes were made this period.

During the period, the various test engineers involved in Sequence IVA testing activity discussed via email and also via teleconference the subject of rocker arm cover coolant flow rates. As you know, rocker arm cover coolant flow rate is not controlled in the Sequence IVA test at this time. While there is a control valve in the system, it merely acts as a fixed metering orifice in the Sequence IVA cooling system. Laboratories have reported varying levels of coolant flow through the rocker cover and the reasons for these varying flow rates were the subject of discussion. Several laboratories had noted that they were having trouble reaching the ~3.5 L/min flow rate that other laboratories had been observing. The reasons for these lower flow rates were investigated and the following factors were found to most influence the rocker arm cover flow rate: calibration problems with the system, extra plumbing fittings in the system causing flow restrictions, and in at least one case a bad research valve was found to be the culprit. The TMC was tasked with reviewing the calibration procedures and records for rocker cover flow during lab visits and with monitoring the rocker arm cover flow data on reference oil tests. Beyond that, no further action on this issue, specifically controlling rocker arm cover coolant flow rates using the research valve, is planned.

Reference Oils

Oil	TMC Inventory, in gallons	TMC Inventory, in tests	Laboratory Inventory, in tests	Estimated life
1006	46	11	17	1 month or less[1]
1006-2	5,246	1,311	15	3+ years[1]
1007[2]	509	127	16	3+ years[1]

[1] Multiple test area reference oil; total TMC inventory shown.
[2] Cannot be re-blended.

At the November 15, 2001 meeting of the Sequence IVA Surveillance Panel, the panel approved a plan to run a series of donated tests on reference oil 1006-2 for the purposes of test target generation. This data would be used to set the initial test targets on this reference oil. The targets would subsequently be updated when 10, 20, and 30 total data points became available and frozen after the final update.

Preliminary results showed that this reference oil was generating results significantly milder than the previous blend of this oil, both in Sequence IVA testing as well as in other test areas. Chairman Bendele expressed concern over the potential test targets resulting from this preliminary data set and asked that this issue be reviewed before going forth with the previously approved plan. The TMC generated test targets based upon the six available donated tests, both with and without severity adjustments applied. These

targets were distributed and discussed during a conference call of laboratory engineers that was previously scheduled for discussion of Rocker Arm Cover cooling issues held on January 31, 2002. The general consensus of the Chairman and the laboratory engineers was to introduce this reference oil using the severity adjusted target mean generated from the donated test data but to use the current standard deviation for reference oil 1006 for the initial targets. The targets would then be updated at 10, 20, and 30 data points as previously planned. Since this plan deviated from the plan originally approved by the Surveillance Panel, panel approval was necessary before it could be implemented.

On February 1, 2002, an E-ballot was sent out to the Surveillance Panel asking for approval of this revised plan. The ballot was approved on February 8, 2002, with a final tally of eight votes for the plan, no votes against the plan, and three members who responded but abstained from voting. The approved test targets for reference oil 1006-2 are shown in the following table, along with the latest targets for reference oil 1006 for comparison purposes:

Reference Oil	Mean	Standard Deviation
1006-2	88.74	12.50
1006	121.76	12.50

The TMC currently has a total of eight data points on reference oil 1006-2 and will be processing a test target update when an additional two data points become available.

MTK/mtk

Attachments

c: F. M. Farber, TMC
Sequence IVA Surveillance Panel
ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceiv/semiannualreports/IVA-04-2002.pdf

Distribution: Electronic Mail

List of Figures

- Figure 1 graphically presents the Industry control charts for ACW and also the CUSUM delta/s plot (by count in completion date order) of average camshaft wear for operationally valid tests.
- Figure 2 graphically presents a historic perspective for ACW mean delta/s by report period.
- Figure 3 graphically presents a historic perspective for ACW pooled standard deviations by report period.
- Figure 4 is the Sequence IVA Timeline, created to track changes in test hardware and operations.

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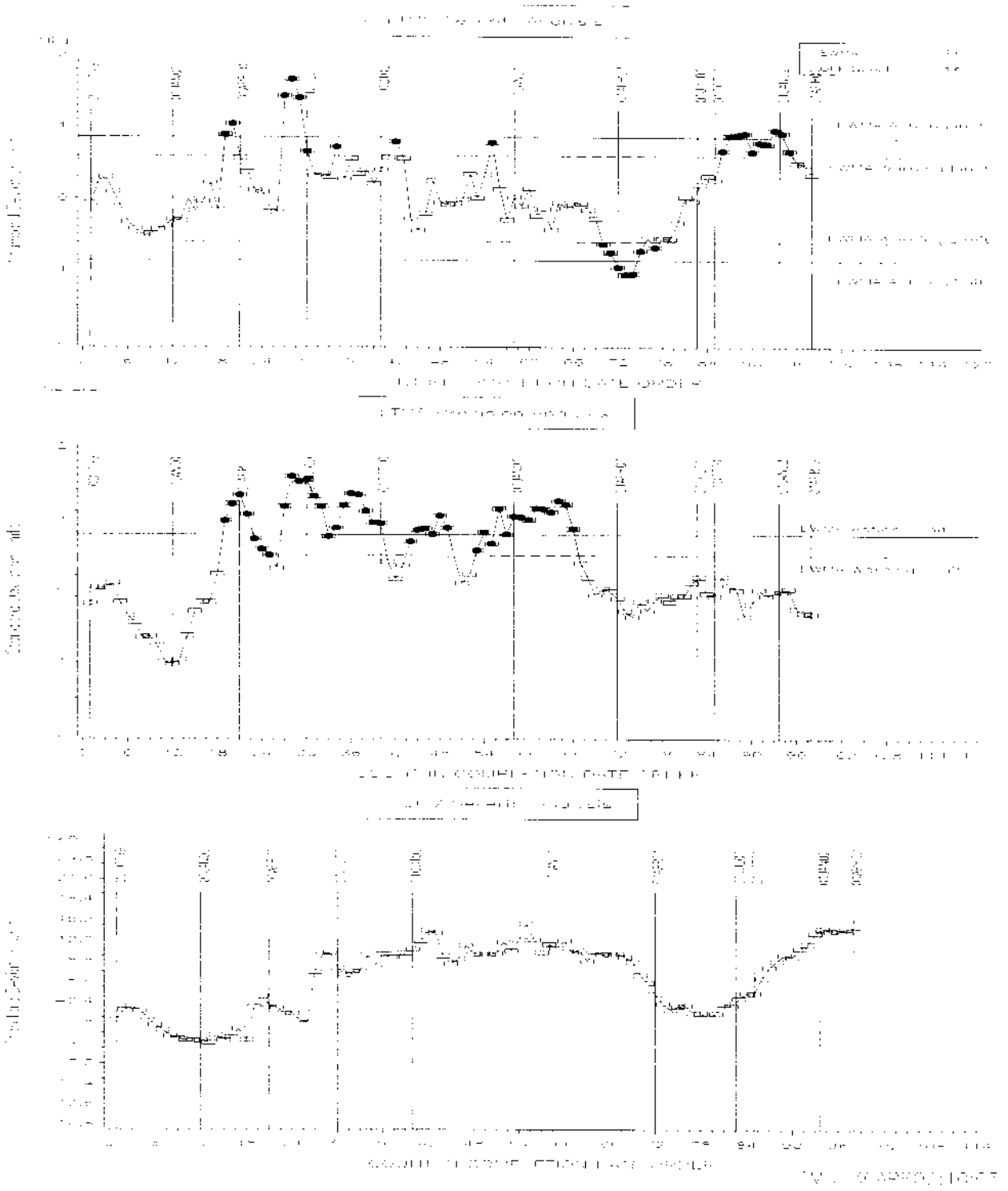
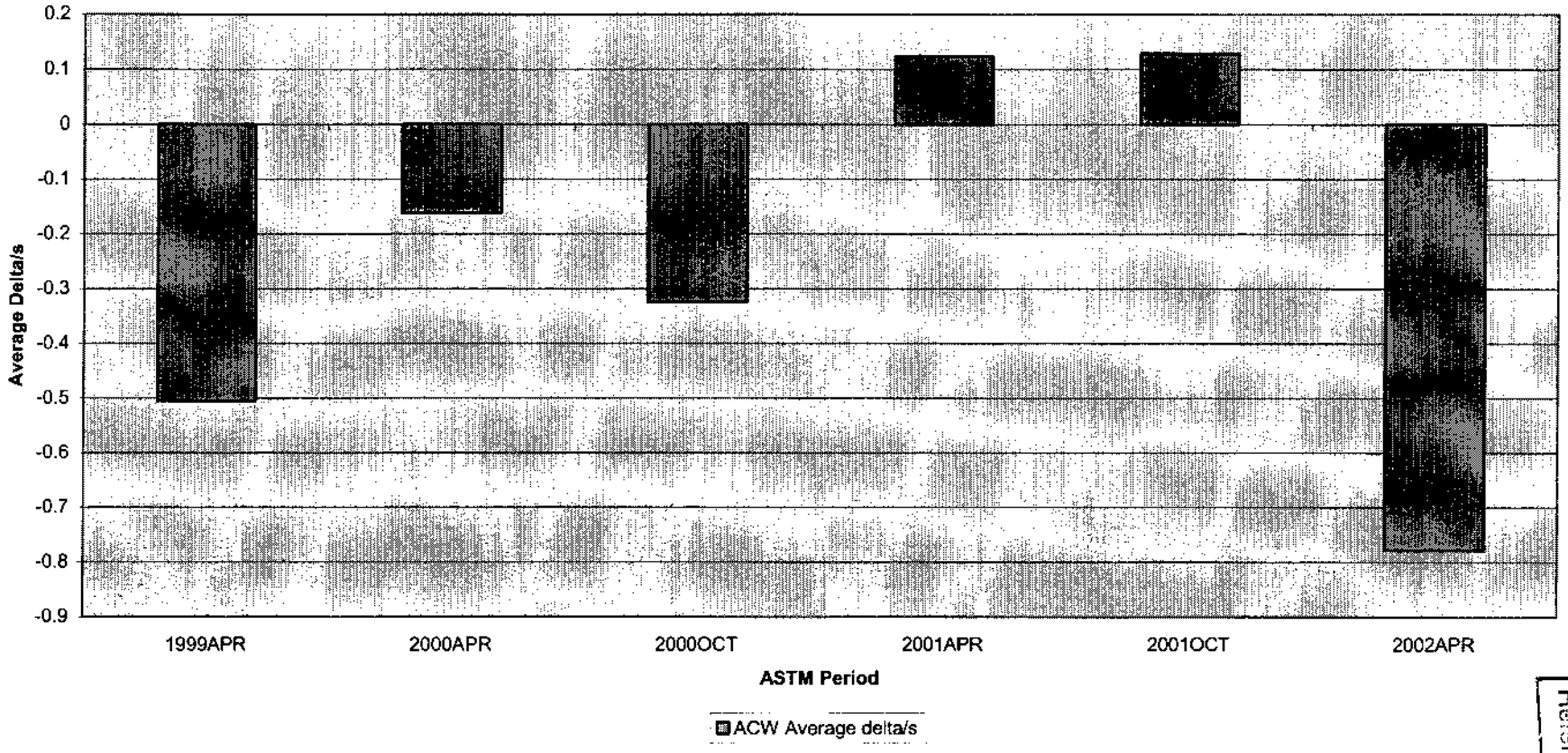


Figure 2 - Sequence IVA Reference Oil Data
Average Camshaft Wear



Attachment 4
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Reference

Attachment	4
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Figure 3 - Sequence IVA Reference Oil Data
Average Camshaft Wear

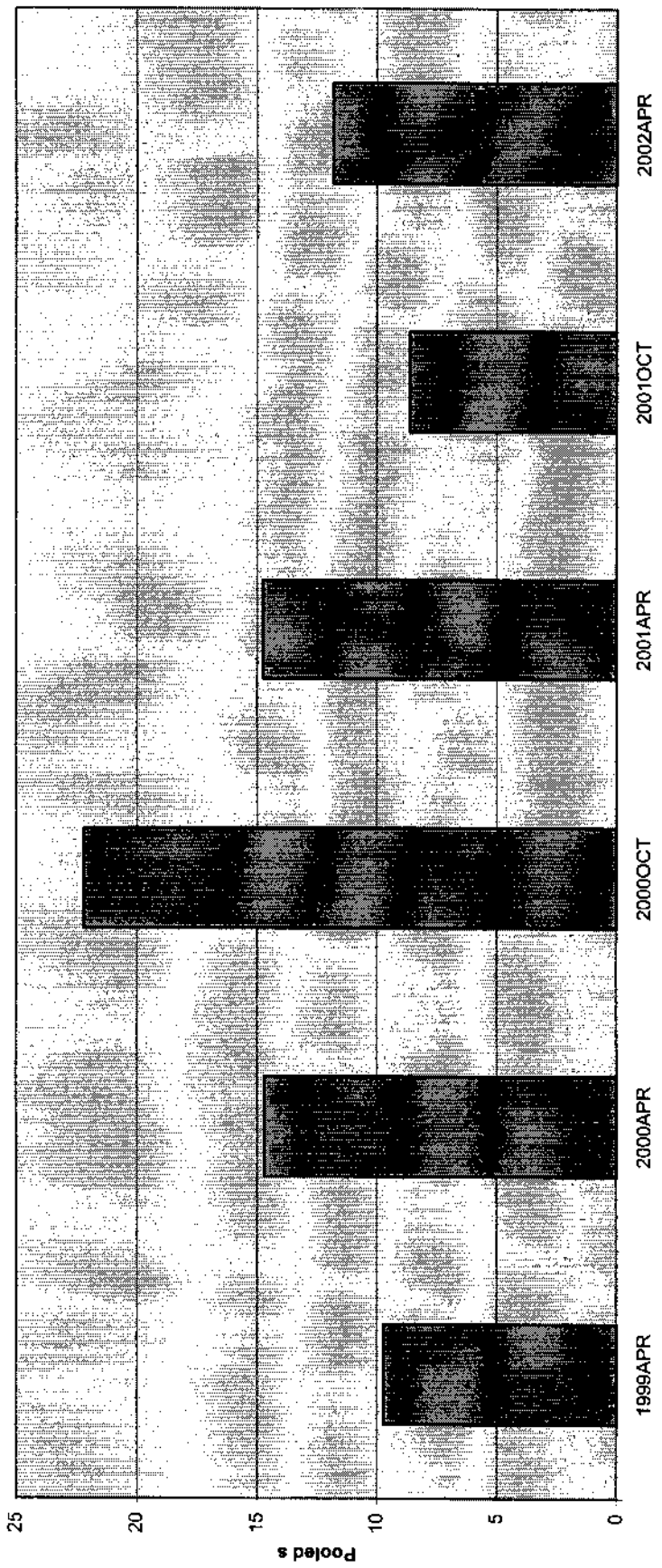


Figure 4 - Sequence IVA Timeline

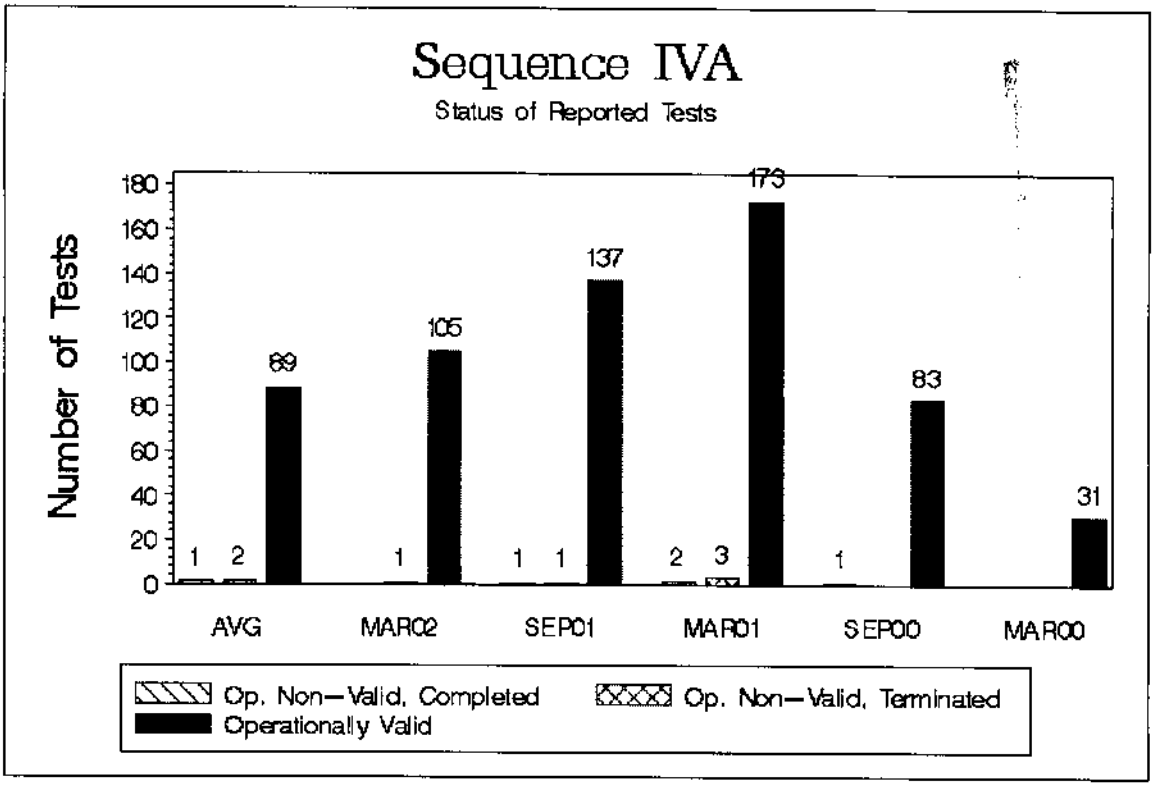
Date	Topic	Information Letter
2/10/1999	SEQUENCE IVA TEST LTMS ESTABLISHED BY SURVEILLANCE PANEL	
11/17/1999	CALIBRATION STATUS RESUMED	
2/16/2000	DRAFT 4 OF TEST PROCEDURE ISSUED. INCORPORATED JACKETED ROCKER COVER, CONTROLLED FLOW OF FRESH AIR TO ROCKER COVER, AND OIL CYLINDER HEAD AS OIL TEMPERATURE CONTROL POINT.	00-1
8/1/2000	REVISED DATA DICTIONARY AND REPORT FORM SET (VERSION 20000126) GOES INTO EFFECT.	00-2
6/12/2000	REVSED DOUBLE-FLUSH COOLANT CONTROL REQUIREMENTS EFFECTIVE	00-3
6/12/2000	REVISED ENGINE STARTING PROCEDURE EFFECTIVE	00-3
6/12/2000	ELIMINATE THE REQUIREMENT FOR LINEAR RAMPING OF TRANSIENT PARAMETERS	00-3
6/12/2000	REVISED OIL SAMPLING PROCEDURE	00-3
6/12/2000	REVISED DOUBLE-FLUSH OIL DRAIN REQUIREMENT	00-3
6/12/2000	REVISED COMPRESSION TEST REQUIREMENTS	00-3
6/12/2000	NEW CAMSHAFT CLEANING REQUIREMENTS	00-3
1/24/2001	CAMSHAFT LOT RESTRICTIONS	00-4
7/22/2001	ROCKER COVER COOLANT FLOW MEASUREMENT & REPORTING	01-1
5/24/2001	REVISED CYLINDER HEAD AND TEST ENGINE REPLACEMENT REQUIREMENTS	01-2
5/25/2001	REVISED TEST NUMBERING REQUIREMENTS	01-2
2/12/2002	REVISED ENGINE BREAK-IN SPECIFICATIONS	02-1
2/12/2002	UPDATED DRAFT STANDARD OF SEQUENCE IVA TEST PROCEDURE RELEASED	02-1
4/5/2002	REVISED CAMSHAFT MEASUREMENT PROCEDURES	02-2

RSI Sequence IVA Semi-Annual Report
Six-Month Period Ending March 31, 2002

Attachment 5
Page 1 of 3
Reference

STATUS OF REPORTED TESTS		
STATUS	**N**	**PERCENT**
Operationally Non-Valid, Terminated	1	0.9%
Operationally Valid	105	99.1%
Total Reported Tests	*106*	*100.0%*
CAUSES FOR LOST TESTS	**N**	
Engine Mechanical Problems	1	

SEQUENCE IVA PRECISION		
COMPONENTS OF REPLICATED DATA BASE	**N**	
Number of Tests	5	
Number of Oils	2	
Number of Labs	2	
Number of Stands	5	
Number of Stand/Engine Combinations	5	
Number of Severity Adjusted Avg Cam Wear Tests	0	
VARIABLE	**Pooled s**	**R**
Avg Cam Wear, Adjusted	7.693	21.540
Avg Cam Wear, Non-Adjusted	7.693	21.540


Sequence IVA
Status of Reported Tests
Number of Tests
180
160
140
120
100
80
60
40
20
0
1
2
89
1
105
1
1
137
2
3
173
1
83
31
AVG
MAR02
SEP01
MAR01
SEP00
MAR00
Op. Non-Valid, Completed
Op. Non-Valid, Terminated
Operationally Valid

Attachment	5
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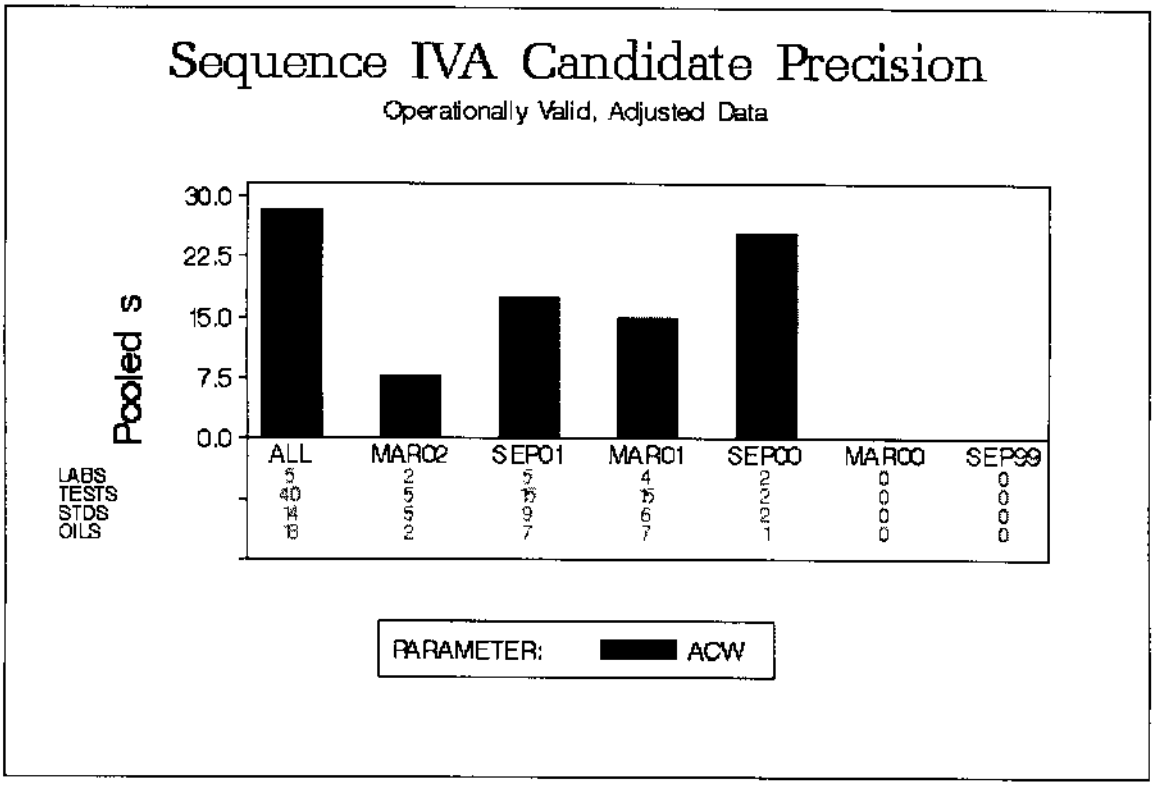
Reference	



Attachment	6
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PRODUCT: KA24E TEST FUEL
PRODUCT CODE: HF008

Batch No.:	0109688	0011769
Tank No.:	682	682
Analysis Date:	9/27/2001	11/20/2000

TEST	METHOD	UNITS	SPECIFICATIONS			RESULTS	RESULTS
			MIN	TARGET	MAX		
Distillation - IBP	ASTM D86	°F	75		95	86	87
5%		°F				114	113
10%		°F	120		135	127	127
20%		°F				149	150
30%		°F				177	180
40%		°F				208	212
50%		°F	200		230	224	227
60%		°F				233	234
70%		°F				242	243
80%		°F				260	261
90%		°F	300		325	320	319
95%		°F				344	343
Distillation - EP		°F	385		415	402	387
Recovery		vol %		Report		98.5	97.9
Residue		vol %		Report		1.0	1.0
Loss		vol %		Report		0.5	1.1
Gravity	ASTM D4052	°API	58.7		61.2	59.2	58.9
Density	ASTM D4052	kg/l	0.734		0.744	0.7420	0.7430
Reid Vapor Pressure	ASTM D323	psi	8.8		9.2	9.1	9.1
Carbon	ASTM E191	wt fraction	0.8580		0.8667	0.8633	0.8610
Carbon	ASTM D3343	wt fraction		Report		#REF!	#REF!
Sulfur	ASTM D4294	wt %	0.01		0.04	0.02	0.02
Lead	ASTM D3237	g/gal			0.05	<0.01	<0.01
Oxygen	ASTM D4815	wt %			0.05	<0.05	<0.05
Composition, aromatics	ASTM D1319	vol %			35.0	29.9	29.9
Composition, olefins	ASTM D1319	vol %	5.0		10.0	6.2	5.5
Composition, saturates	ASTM D1319	vol %		Report		63.9	64.6
Oxidation Stability	ASTM D525	minutes	1440			>1440	>1440
Copper Corrosion	ASTM D130				1	1	1
Gum content, washed	ASTM D381	mg/100ml			5	1	1
Research Octane Number	ASTM D2699		96.0		97.5	97.5	97.0
Motor Octane Number	ASTM D2700			Report		88.2	87.8
R+M/2	D2699/2700			Report		92.9	92.4
Sensitivity	D2699/2700		7.5			9.3	9.2
Net Heat of Combustion	ASTM D240	btu/lb		Report		18364	18388
Color	Visual			Green		Green	Green

Sequence IVA

2001 Hardware: Camshaft Batch # 010926

Proof-of-Performance and Reference Testing

Lab	Stand Number	Oil Code	ACW µm	Comments
F	1	1006	112.63	Pass, 0.73 Standard Deviations Mild
A	1	1006	106.63	Pass, 1.21 Standard Deviations Mild
A	2	1006-2	80.25	Pass, 0.68 Standard Deviations Mild
A	2	1006-2	91.77	Pass, 0.24 Standard Deviations Severe

1006	mean	121.76
TARGETS	std. dev.	12.50
1006-2	mean	88.74
TARGETS	std. dev.	12.50

Attachment 7
Page 1 of 1
Reference

Sequence IVA

Test Parts Price Increase

Description	Part Number	2001 Price Ea.	2002 Price Ea.	Percent Increase
Bare Engine Assembly	A0102-76P01	$7,640.81	$8,341.47	**9.17%**
Test Kit	13000-40F85	$1,128.98	$1,232.51	**9.17%**
Cylinder Head Assembly	A1040-40F80	$1,416.80	$1,546.72	**9.17%**
Oil Cooler Assembly	21305-03E00	$199.40	$217.68	**9.17%**
Engine Valve Regrind Kit	A1042-10C2E	$59.00	$64.41	**9.17%**
Distributor Assembly	22100-40F00RE	$330.00	$330.00	**0.00%**
Test Stand Kits (4 Part Nos.)	A0001-76P25	$2,843.16	$3,103.88	**9.17%**
	A1001-40F25	$3,828.91	$4,180.02	**9.17%**
	B4010-40F26	$695.47	$759.24	**9.17%**
	14004-F4003	$111.05	$121.23	**9.17%**

Attachment 8
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Reference

6.3.12.3 ***Engine Oil Pressure***

Sense the engine oil pressure at the production location on the oil filter block, see Fig. 5. Route the sensing line to a cross fitting, allowing ports to a pressure transducer, an analog pressure gauge, and to an oil sampling valve.

11.3.4 ***Oil Additions and Used Oil Sampling***

During the 100-h test, do not add oil. New oil makeup is not allowed if oil leaks occur. Take a 10-mL oil sample of the new oil, used oil at 25-h, used oil at 50-h, and used oil at 75-h. Remove used oil samples during the transient portion of Stage II (near end of cycle 25, 50, and 75). Remove a 120-mL purge sample from the engine prior to drawing the oil sample. This purge sample is to be returned to the engine via the cover fill cap using a clean filler pipe equipped with an isolation valve to prevent oil *spit back* due to positive crankcase pressure. After the oil consumption has been calculated at the end of 100-h, remove a 100-mL sample of used oil for chemical analyses of the 100-h test oil. Take the 100-mL sample during the final engine oil drain at the end of the test (100-h). No purge sample is required for this final oil sample.

Sequence IVA

Observed Fe Carry-Over in Intermediate Oil Samples

Due to Sample Valve Location @ Oil Filter Block

Stand	78	78	78	78	78	78	78	78	78	78
Run	83	83	83	83	83	84	84	84	84	84
Hours	0	25	50	75	100	0	25	50	75	100
Fe, ppm	**3**	**102**	**91**	**327**	**493**	**1**	**194**	**138**	**63**	**88**

Attachment 9
Page 2 of 6
Reference

Sequence IVA

No Fe Carry-Over in Intermediate Oil Samples

Due to Sample Valve Location @ Oil Pan Sump

Stand	78	78	78	78	78	78	78	78	78	78
Run	134	134	134	134	134	135	135	135	135	135
Hours	0	25	50	75	100	0	25	50	75	100
Fe, ppm	**1**	**31**	**100**	**208**	**335**	**1**	**7**	**9**	**12**	**15**

Attachment 9
Page 3 of 6
Reference

Sequence IVA

Observed Additives Carry-Over in Intermediate Oil Samples

Due to Sample Valve Location @ Oil Filter Block

Stand	80	80	80	80	80	80	80	80	80	80
Run	164	164	164	164	164	165	165	165	165	165
Hours	0	25	50	75	100	0	25	50	75	100
B, ppm	**1**	**3**	**7**	**4**	**1**	**101**	**40**	**49**	**59**	**57**
Ca, ppm	**2641**	**2490**	**2402**	**2413**	**2248**	**408**	**1571**	**1271**	**1032**	**392**
Mg, ppm	**577**	**402**	**322**	**262**	**128**	**468**	**289**	**329**	**358**	**433**
Mo, ppm	**1**	**13**	**6**	**8**	**1**	**159**	**62**	**83**	**99**	**145**
P, ppm	**548**	**667**	**551**	**590**	**463**	**512**	**571**	**560**	**543**	**471**
Zn, ppm	**537**	**689**	**592**	**618**	**476**	**551**	**598**	**589**	**579**	**506**

Attachment 9
Page 4 of 6
Reference

Sequence IVA

No Additives Carry-Over in Intermediate Oil Samples

Due to Sample Valve Location @ Oil Pan Sump

Stand	78	78	78	78	78	78	78	78	78	78
Run	132	132	132	132	132	133	133	133	133	133
Hours	0	25	50	75	100	0	25	50	75	100
B, ppm	**11**	**13**	**10**	**16**	**14**	**1**	**1**	**1**	**1**	**1**
Ca, ppm	**2563**	**2474**	**2481**	**2429**	**2410**	**2199**	**2138**	**2142**	**2168**	**2113**
Mg, ppm	**5**	**4**	**5**	**5**	**5**	**8**	**8**	**8**	**9**	**9**
Mo, ppm	**638**	**614**	**615**	**609**	**604**	**1**	**4**	**4**	**5**	**5**
P, ppm	**506**	**497**	**498**	**482**	**475**	**1067**	**1014**	**1025**	**1023**	**1007**
Zn, ppm	**521**	**521**	**532**	**515**	**508**	**1135**	**1089**	**1077**	**1083**	**1064**

Attachment 9
Page 5 of 6
Reference

MOTION # 1A

CHANGE 6.3.12.3 AND 11.3.4 TO READ

6.3.12.3 Engine Oil Pressure
Sense the engine oil pressure at the production location on the oil filter block, see Fig. 5. Route the sensing line to a **tee** fitting, allowing ports to a pressure transducer **and** an analog pressure gauge.

11.3.4Oil Additions and Used Oil Sampling
During the 100-h test, do not add oil. New oil makeup is not allowed if oil leaks occur. Take a 10-mL oil sample of the new oil, used oil at 25-h, used oil at 50-h, and used oil at 75-h. Remove used oil samples **from the oil sample valve located at the oil pan sump** during the transient portion of Stage II (near end of cycle 25, 50, and 75). Remove a 120-mL purge sample from the engine prior to drawing the oil sample. This purge sample is to be returned to the engine via the cover fill cap using a clean filler pipe equipped with an isolation valve to prevent oil spit back due to positive crankcase pressure. After the oil consumption has been calculated at the end of 100-h, remove a 100-mL sample of used oil for chemical analyses of the 100-h test oil. Take the 100-mL sample during the final engine oil drain at the end of the test (100-h). No purge sample is required for this final oil sample.

MOTION # 1B

CHANGE 6.3.12.3

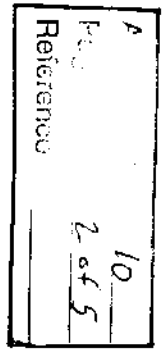
6.3.12.3 Engine Oil Pressure
Sense the engine oil pressure at the production location on the oil filter block, see Fig. 5. Route the sensing line to a cross fitting, allowing ports to a pressure transducer, an analog pressure gauge and to an oil sampling valve. **If a long oil pressure line to the pressure transducer is present, then as an alternative location, the oil sampling valve can be located at the oil pan sump. This will eliminate potential carry-over effects on the intermediate oil samples from stagnant oil in the long oil pressure line. If the alternative location is used for the oil sampling valve, then replace the cross fitting and oil sampling valve with a tee fitting at the oil filter block.**

Resolving Differences Among Laboratories

Sequence IVA Rocker Arm Cover Coolant Flow

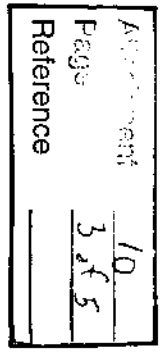
Task Force

- Formed after November 14, 2001 Surveillance Panel meeting
- Objective
  - Find root cause of poor reproducibility for RAC coolant flow
  - Suggest any changes to Surveillance Panel



Meetings

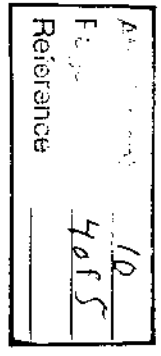
- Two teleconferences among labs and TMC
  - December 18, 2001
  - January 31, 2002



Root Causes

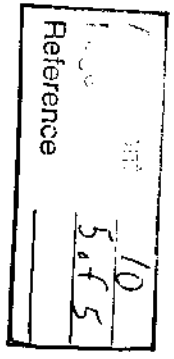
- Flow calibration errors and transducer conversion errors
- Plumbing restrictions
- Defective research valves
- Air entrainment in main and RAC coolant systems

- ***Fixing root causes have solved the reproducibility for RAC coolant flow***



Future Work

- Some labs indicated further interest in replacing wide-open "research valve" with comparable orifice plate assembly.
- Proposals may be forthcoming which would involve Surveillance Panel review and action.



6.4 *Test Engine Hardware*

This section specifies the hardware required to build the test engine.

Use a new engine short block assembly for 16 tests, and a new a kit cylinder head assembly for the first test and the ninth test on that short-block. Conduct the engine break-in procedure prior to the first test and the ninth test on that short-block. The new engine is a long-block, as received. Use the camshaft and rocker arms in the new engine for break-in purposes only. Remove and modify the new cylinder head for the cylinder head oil gallery temperature and pressure measurement port, and for valve spring force calibration. Clean and reassemble the head using the break-in camshaft and rocker arms. Use the break-in procedure shown in 11.1.3. After break-in, replace the break-in camshaft and rocker arms with the new, camshaft and rocker arms parts.

10. Test Stand Calibration and Maintenance

Verify the calibration status of the test laboratory and test engine with reference oils, which are supplied by the TMC. Conduct test stand calibration tests periodically to verify that proper severity level and precision are being achieved. A prerequisite to the conduct of reference oil calibration tests is the proper processing of computer acquired operational data, ensuring accuracy of measurements, and test stand preventative maintenance.

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Reference	

MOTION # 1

MODIFY THE SEQUENCE IVA TEST PROCEDURE AS FOLLOWS:

If a test stand has been calibrated with a used engine/head combination, and the total number of allowable runs has been completed on that engine/head combination prior to that test stand's calibration expiration date, then another used engine/head combination with remaining runs, that has been previously successfully calibrated in any test stand, can be installed on that stand to conduct some or all of the remaining allowable runs for that test stand's calibration period. No additional calibration test would be required.

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MOTION # 2

CHANGE 10. TO READ

Verification:
Verify the calibration of test stands with reference oils supplied by the TMC. Stand calibration tests are normally conducted upon the expiration of the 6-month calibration time period or 15 non-reference oil tests, or both. However, calibration time periods may be adjusted by the TMC. Any non-reference oil test started within 6 months of the completion date of the previous calibration test is considered within the calibration period, providing not more than 14 non-reference oil tests have been completed since the previous calibration test.

Normally a new engine/head combination is used for stand calibration tests. On occasion a used engine/head combination, with remaining runs, might be used for stand calibration tests. If a test stand has been calibrated with a used engine/head combination, and the total number of allowable runs has been completed on that engine/head combination prior to that test stand's calibration expiration date, then another used engine/head combination, with remaining runs, that has been previously successfully calibrated in any test stand, can be installed on that stand to conduct some or all of the remaining allowable runs for that test stand's calibration period. No additional calibration test would be required.

EXAMPLE (FOR MOTION # 1)

(i.e.. Stand 80 is calibrated with engine 2000-004 that has 6 remaining runs, then after 6 runs, previously calibrated engine 2000003 that has 4 remaining runs is installed on stand 80 for 4 runs, then after 10 total runs, previously calibrated engine 2000-002 that has 4 remaining run is installed on stand 80 for 4 runs, then after 14 total runs, previously calibrated engine 1998018 that has 3 remaining runs is installed on stand 80 for 2 runs, assuming all of this is accomplished prior to the calibration expiration date for stand 80.)

ASTM Sequence IVA Surveillance Panel

Scope and Objectives

Scope

The Sequence IVA Surveillance Panel is responsible for the surveillance and continued improvement of the Sequence IVA test documented in the Research Report RR:D02.1218 as updated by the Information Letter system. Data on test precision and laboratory versus field correlation will be solicited and evaluated at least every six months. Improvements in wear measurement technique, test operation, test monitoring and test validation will be accomplished through continual communication with the Test Sponsor and Parts Distributor, ASTM Test Monitoring Center, ASTM Committee D02.B0.01 and the ASTM Passenger Car Engine Oil Classification Panel. Actions to improve the process will be recommended when deemed appropriate based on input from the proceeding. The Panel will review development and correlation of updated test procedures with previous test procedures. This process will provide a suitable test procedure for evaluating an automotive lubricant's effect on controlling cam lobe wear for overhead valvetrain equipped engines with sliding cam followers.

Objectives	Target Date
1. Issue IVA procedure as ASTM standard	June 2002
2. Conduct 2002 engine build workshop	June 2002
3. Conduct 2002 metrology workshop	
4. Institute GF-3 category reference oil into LTMS	Nov 2002
5. Form Test Improvement Task Group	*done-Nov 2001*
6. Continue to improve camshaft quality	
7. Metallurgical examination of cams & followers that yield differing results	

William A. Buscher III, Chairman
Sequence IVA Surveillance Panel

Updated: May 2002

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Reference	

Motions & Action Items
IVA Surveillance Panel
May 14, 2002
As Recorded at the Meeting by Ben Weber

1. Previous meeting minutes were accepted as written.
2. TMC report was accepted as presented.
3. [Bill Buscher, III and Mike K] Follow the previous 1006-2 motion for bringing in the new category reference oil 1009 by October 1, 2002. Each lab will donate 1 1009 test on a current calibrated test stand, and consequently their stand reference period will be extended by one run. Motion passed unanimously.
4. RSI report was accepted as written.
5. Fuel supplier report accepted as presented.
6. [Bill Buscher, III and Mike K] Change the location of the oil sample valve from the oil filter block to the oil pan drain and modify sections 6.3.12.3 and 11.3.4 appropriately. Motion passed unanimously. Effective June 1, 2002.
7. [Dave G. and Bill Buscher] Delete the requirement to calibrate the temperature sensors every 8 tests under section 10.2. Effective May 14, 2002. Motion passed unanimously.
8. The test labs are requested to respond to the IVA SP chairman concerning an upcoming June 2002 IVA and VG workshop.
9. [Bill Buscher and Jerry B] Delete the requirement that a reference oil test be conducted every time the test engine is replaced. The calibration period would be now defined as 15 non-reference oil tests or six months. New engines or cylinder heads may be installed as needed and do not affect stand calibration status. The life of a test engine or cylinder head did not change i.e., a new engine is still required every 16 tests and a new cylinder head is still required every 8 tests. Effective May 14, 2002. Passed unanimously.
10. The IVA SP would like to continue round robins using 2 cams with high and low wear for wear measurement consistency amongst the test labs. Test labs are to notify the chair if they have any cams to offer for this round robin. Target date for completion is November 2002.