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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

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December 11, 2001

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Unapproved Minutes of the November 14, 2001 Sequence VG Surveillance Panel Meeting Held in San Antonio, Texas

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Chairman Farnsworth called the meeting to order at 1:00pm. The agenda was handed out and reviewed.
{The Agenda is shown in Attachment 1.}

Motion & Action Item Recorder – Ben Weber is the Motion & Action Item recorder for this meeting.

Approval of 5/23/01 Meeting Minutes – The minutes for the 5/23/01 meeting were approved unanimously and without comment.

Membership Changes – Bill Buscher Jr. will no longer be representing Texaco. He will retain his membership representing Buscher Consulting Services. Jerry Brys will now be the voting member for Lubrizol Corp, in place of Mark Hull. {A Membership list, which was circulated at the meeting, is shown in Attachment 2.}

Sequence VE Status and Update of Surveillance Panel name – The Sequence VE test is no longer monitored and the Surveillance Panel will formally be renamed the Sequence VG Surveillance Panel.

Review of Action Items from Last Meeting – The action items from the last meeting were handed out and reviewed. Of the six action items on the list, all but item 4 have been completed. *{The Action Items from the previous meeting are shown in Attachment 3.}*

TMC Report – Richard Grundza presented the TMC Report, which is available online at the following address: <ftp://tmc.astm.cmri.cmu.edu/docs/gas/sequencev/semiannualreports/vg-10-2001.pdf>. There were 4 labs reporting data on 16 different stands. Thirteen of those stands were calibrated at the end of the period. There were 20 reference oil test starts for the period. Of the reference oil tests that failed, 40% failed due to Varnish and 60% failed due to Sludge. Precision for the period was comparable to previous periods, with the exception of Oil Screen clogging, which had degraded compared to historical estimates. Oil screen clogging precision degradation appears to have been caused by severe results in one stand. Two Quality Index deviations were written this period, both from one laboratory. One LTMS Deviation was written this period and there have been a total of five LTMS Deviations written in the Sequence VG test since its introduction. The panel accepted Mr. Grundza's report unanimously.

Introduction of GF-3 Category Reference Oil – The introduction of the GF-3 Category reference oil was discussed. This oil has returned the following test result in Sequence VG testing:

AES 7.88

RACS 9.33

AEV 9.03

PSV 7.8

OSCR 3%

No hot stuck rings.

There was some discussion as to the desirability of introducing this reference oil into the LTMS at all. The Surveillance Panel agreed to procure this reference oil for future introduction into the LTMS. The Surveillance Panel decided to procure approximately 200 gallons of this oil, assuming a 5-year supply and a 33% assignment rate. A plan to introduce this reference oil will be discussed at a future date.

Introduction of Reference Oil 1006-2 – The introduction of reference oil 1006-2 was discussed. There was discussion of donated tests, coordinating reference oil test starts, and also introducing the oil into the LTMS using the targets for reference oil 1006. Donating tests was not an acceptable option to the Surveillance Panel at this time. The panel decided to introduce this oil using the existing test targets.

Motion (Bill Buscher III/Dwight Bowden) Introduce reference oil 1006-2 using the existing test targets for reference oil 1006. The TMC will generate test targets when five data points are available and review them to determine if they need to be implemented at that time. The targets will be updated at 10, 20, and 30 data points. The motion passed unanimously by voice vote.

RSI Report – Rick Oliver presented the RSI report, which is available, online at the following address: http://www.registration-systems.com/Protected/annual_SEQVG.htm. {RSI Web Page Access, username: acc, password: rsi999} There was no precision estimate for the period because there were no duplicate runs on any candidate oils. Mr. Oliver's report was accepted unanimously.

Fuel Supplier Report – Robert Rumford presented the Fuel Supplier Report. The TMC will add the fuel data to the TMC Web Page. The current fuel supply is approximately 580,000 gallons, which is approximately a 27-month supply at current usage rates. The panel accepted Mr. Rumford's report unanimously.

VG Test Developer Report – Gordon Farnsworth presented some information on the 2000 model test hardware since the Test Developer was not present at the meeting. The Surveillance Panel reviewed a proposed letter to the Test Developer regarding the use of pre-2000 model hardware in Sequence VG testing until the supply is exhausted.

Motion (Bill Buscher III/Carl Stephens) – Send the proposed letter to Ford Motor Company regarding the use of pre-2000 model test hardware. The motion passed 9-0-0.

VG O&H Report – Dan Worcester presented the O&H Subpanel Report. At current usage rates, the AER engines will last until approximately June 2003. He also reviewed the status of the 2000 model matrix tests and the matrix design for validation of this hardware. Dual ratings will be performed on these matrix tests and Zack Bishop, the Light Duty Rating Task Force Chairman, will oversee these rating procedures.

Zack Bishop presented some revisions to the rating procedures listed in the Sequence VG test procedure for review and approval by the Surveillance Panel. A copy of the revised rating procedures is attached. These changes were developed during the last rating workshop by the raters in attendance. The changes are shown in blue in the attachment. *{An original copy of the transparencies presented at the meeting, complete with editorial changes made at the meeting, are shown in Attachment 4A; a revised version of the original document, incorporating these changes, is shown in Attachment 4B.}*

Motion (Zack Bishop/Bill Buscher III) – Issue an Information Letter incorporating the changes that Mr. Bishop proposed for the Sequence VG rating procedures. The motion passed unanimously.

Round Robin Rating – Frank Farber presented some information on a Round Robin Rating procedure. The TMC will distribute parts from a rating workshop in a blind manner. The TMC will then collect data and report it to the Surveillance Panel. If the data suggests it is possible, a rater calibration criteria could be developed. The Surveillance Panel agreed that this is a worthwhile exercise and that the TMC should pursue it. *{Mr. Farber's presentation is shown in Attachment 5.}*

Dan Worcester then presented some proposed changes to the Sequence VG test procedure that were developed in the Sequence VG O&H Subpanel. *{Mr. Worcester's motions are shown in Attachment 6}*

Motion (Dan Worcester/Bill Buscher III) – AFR measurements based on O₂, CO, and CO₂ will be replaced with Horiba LD-700 (or equivalent) to take lambda at each bank for the exhaust. Typical lambda values would be about 1.00 in stages 1 and 2 and 0.75 in stage 3. This would require modifications to Sections 12.3.3.1 and 12.5.5.1 at a minimum. Sensors for the Horiba meter would be located in the same downstream location as the existing AFR probe. This will be introduced with reference oil tests started on or after 3/1/02. The motion passed unanimously by voice vote.

Motion (Dan Worcester/Dwight Bowden) – Eliminate the NO_x readings. This would include Section 14.2 for test validity and Sections 12.3.3.1 and 12.5.5.2 at a minimum. This would be effective on 11/14/01. The motion passed unanimously by voice vote.

Motion (Dan Worcester/Dwight Bowden) – Eliminate the QI requirements for Power in Stage 3. This would be effective on 11/14/01. The motion passed unanimously by voice vote.

Motion (Dan Worcester/Bill Buscher III) – Modify Section 12.4.1 as follows: "A blowby adjustment can be made during break-in or up to the 48 hour oil soak." This would be effective on 11/14/01. The motion passed unanimously by voice vote.

Sequence VG Surveillance Panel Meeting
November 14, 2001
San Antonio, Texas

Dan Worcester also presented some data on using the cam baffle instead of the rocker cover for Average Engine Varnish. This is an ongoing action item and further investigation is planned. The reason for the change is because the rocker covers can become discolored over time, impacting varnish ratings. The camshaft baffles are relatively cheap and can be replaced when they become discolored. The Surveillance Panel took no action on this item.

Light Duty Rating Task Force – Zack Bishop presented the Light Duty Rating Task Force report. A workshop was held on October 9, 2001. Some proposed changes to the Sequence VG rating procedures were developed during this workshop. These changes were addressed during the VG O&H Report. This was the first Sequence VG workshop since the introduction of the proposed ASTM Rater Calibration Task Force recommendations. The TMC played a large role in setting up the workshop and is currently analyzing the rater data generated during this calibration exercise.

Mr. Bishop also noted that he is retiring in early 2002 and as such will be stepping down as chairman of the LDRTF. Mr. Bishop recommended that the TMC take over the leadership role of this Task Force. This Surveillance Panel concurred with this recommendation and it will be passed along to the appropriate parties. *{Mr. Bishop's LDRTF Report is shown in Attachment 7.}*

Scope & Objectives – Chairman Farnsworth reviewed the Scope & Objectives. Introduction of the GF-3 Category reference oil was added as an objective for June 2002. The smooth transition from current hardware to the 2000 model Romeo engines was added as an objective for June 2003.

Old Business – There was no old business.

New Business – Dan Worcester briefly discussed an alternative blowby measurement procedure, but was not prepared to bring it forward at this time.

The next meeting is at the call of the chairman.

The meeting was adjourned at 3:18pm.

{Motions and Action Items recorded at this meeting by Mr. Weber are shown in Attachment 8.}

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Agenda
Sequence VG Surveillance Panel
November 14, 2001
1:00PM – 5:00PM
San Antonio, Texas

1. Chairman comments
2. Motion and Action recorders
3. Approval of minutes for May 23, 2001 meeting
4. Membership changes
5. Review of VE status and update of SP name Farnsworth / Grundza
6. Review action Items from last meeting G. Farnsworth
7. TMC Reference Oil Report (VG) R. Grundza
8. Introduction of “GF-3” category ref oil All
9. RSI Candidate Status & Precision Report
(VE and VG) C. R. Oliver
10. Fuels supply and reblend status (VG)
- Status of mini batch reblend Worcester/Rumford
11. VG Test Developer Report
- Status of 2000 model hardware
12. VG O&H Report D. Worcester
- Ref status of 2000 model matrix tests

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Agenda - continued
 Sequence VG Surveillance Panel
 November 14, 2001
 1:00PM – Noon
San Antonio, Texas

- | | |
|--|--------------------------------|
| 13. Light Duty Rating Task Force | Z. Bishop |
| 14. Scope and Objectives | All |
| 15. Old Business | |
| 16. New Business | |
| <ul style="list-style-type: none"> - Alternative blowby hardware proposal - Lamda meter for AFR proposal | Dan Worcester Dan Worcester |
| 17. Adjourn | |

| <u>Name</u> | <u>Company</u> | <u>Initial</u> |
|--|--|----------------|
| Gordon Farnsworth | Infinium | GF |
| Alfredo Monter | Chevron Oronite | AM |
| Jim CARTER <small>Ph: 517-347-3021 Fx: " - " - 1024 JECARTER@dow.com</small> | HALTERMANN PRODUCTS | JEC |
| Mark Hull | Lubrizol | MRH |
| JERRY BRYS | LUBRIZOL | JABS |
| JOHN PANDOSH | INFINEUM | JPP |
| BETO ARAIZA | T.E. I | Ba |
| Carl Stephens | Ashland | CS |
| DAVID GLAENZER | Ethyl | DL |
| Jim Rutherford | Chevron ORONITE | JR |
| FRANK FARBER | TMC | frank |
| DWIGHT BOWDEN | OH TECHNOLOGIES | DB |
| Jason Bowden | OH TECHNOLOGIES | J.B. |
| Bob Rutherford | Haltermann Products <small>brutherford@dow.com</small> | BR |
| DAN WORCESTER | PEAR | DR |
| Rich Grundza | ASTM Tmc | REG |
| TRICK DRIVER | RSE | TRD |
| William A. Buscher, Jr. | Buscher Consulting Services | WAB |
| William A. Buscher III | SWRI | WAB |

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Name

Company

| | |
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Initial

Phil Scinto

Levizol

PRJ

Michael Kasimirsley

ASTM JMC

MTK

Ben Weber

SWRI

BW

Action Items Review

- 1.) TMC to create new data files with CVS extensions so reference oil information can be easily down loaded to excel. Status: Done
- 2.) TMC create a data file that contains all VG reference oil tests and identifies validity status. Status: Done
- 3.) Issue an info letter dropping requirement for used oil pentane insolubles, TBN, vis @ 100. Status: Done
- 4.) O&H panel to determine what data dictionary fields should be include in TMC web site data. Status: ?????
- 5.) Issue info letter with TGC recommended wording regarding consensus ratings. Status: Done
- 6.) Issue info letter to cease requirement for periodic benzene analysis on fuel stored at laboratories. Status: Done

12.6.3 *Parts Layout for Rating:*

12.6.3.1 Arrange the following parts in the parts rating area in accordance with the layouts detailed in this session. After the parts have been arranged, allow the parts to drain for ~~a minimum of 1 h~~ before rating. Do not attempt to accelerate or force the oil draining. Any fixtures can be used to support the parts as long as they orient the parts in the specified configuration.

12.6.3.2 *Rocker Arm Covers* – Position the RAC’s vertically (upper jacket surface perpendicular to the ground) with the front of the RAC at the bottom.

12.6.3.3 *Camshaft Baffles* – Position the camshaft baffles vertically (top baffle surface perpendicular to the ground) with the rear of the camshaft baffle pointing down.

12.6.3.4 *Cylinder Heads* – Position the cylinder heads with RAC gasket surface pointing down.

12.6.3.5 *Oil Pan* – Position the oil pan upside down, with the pan rail at a 45° angle, with sump end pointing down.

12.6.3.6 *Oil Pan Baffles* - Position the oil pan baffles vertically on the front edges.

12.6.3.7 *Oil Screen and Pickup Tube* – Position the oil screen and pickup tube in the same orientation as they are installed in the engine. The screen should be raised off of the supporting surface to allow drainage. A fixture is necessary to support the oil screen and pickup tube.

13. Interpretation of Results

13.1 *Parts Rating Area – Environment:*

13.1.1 Ensure that the ambient atmosphere of the parts rating area is reasonably free of contaminants, and the temperature maintained at $24 \pm 3^{\circ}\text{C}$ ($75 \pm 5^{\circ}\text{F}$).

13.1.2 Rate all engine parts except the pistons and RAC’s under cool white fluorescent lighting exhibiting approximately 4100 K color temperature, a CRI of 62 and an illumination level of 350 to 500 fc (3800 to 5400 lx). All background and adjacent surfaces shall be flat white.

13.1.3 Rate pistons and RAC’s against a white background using white fluorescent bulbs and a 100% white deflector. Maintain the illumination level between 350 and 600 fc (3800 to 6500 lx), and measure the illumination level 355 mm (14 in.) from the desk top. ~~Provide a 15-W bore light with a cool white fluorescent tube for the cylinder wall varnish rating.~~

Rev Yr.

13.1.4 Rater shall attend at least one ASTM or CRC Rating Workshop having VG specific or comparable hardware.

13.2 Sludge Ratings:

13.2.1 Rate the following parts for sludge deposits: RAC (2), valve deck (2), camshaft baffle (2), timing chain cover, oil pan and oil pan baffle. Use the rating locations identified on the rating worksheets (see A11). Determine the ratings using the techniques detailed in CRC Manual No. 12. Perform the sludge ratings before performing any other required ratings or measurements.

13.2.2 Average Sludge (Unweighted Average of 9 Parts):

13.2.2.1 Use the self-weighting procedure detailed as follows to determine the sludge rating merit for each part.

- (a) Determine the sludge depth at each of the sites shown on rating worksheets. A site is defined as a 20-mm (0.79-in.) diameter circular area.
- (b) Determine an interpolated sludge value for a designated site which exhibits more than one level of sludge depth within this area. This value is generated by multiplying each rated value's volume factor by the percentage of area covered, totaling these volume factor percentages, and comparing the total to the values given in Table 6 to determine the rating for the site: As an example, if a site was determined to be 50% A and 50% E, the calculation would be: 50% of the average sludge depth factor for A (or 1.0), plus 50% of the average sludge depth factor for E (or 16.0); that is: $([0.5 \times 1.0 = 0.5] + [0.5 \times 16.0 = 8]) = 8.5$, and the calculated site sludge depth would be a D. In the event that there are areas where it is apparent that deposits had been formed, but are no longer adhering to the part, the rating site is the closest point to the designated point which will eliminate the voided area from the 20-mm (0.79-in.) rating area.
- (c) Add the total rating checks made for each line on the appropriate worksheets. These shall equal 10 or 20, depending on the part that is rated.
- (d) Multiply the total rating checks made on each line by ten or five, respectively (refer to (c)), to obtain the percent covered by the rated sludge depth. The grand total shall equal 100%.
- (e) Convert the percent covered by the rated sludge depth at each location to a volume factor using the procedure shown in CRC Manual No. 12.
- (f) Add the volume factors on each line to determine the total volume factor. Use CRC Manual No. 12 to convert the total volume factor to the sludge merit rating.

Table 6 Interpolated Average Sludge Site Ratings

| Total | Site Ratings | Total | Site Ratings |
|--------------|--------------|--------------|--------------|
| <0.125 | Clean | ≥3.500<6.000 | C |
| ≥0.125<0.375 | ¼ A 1/4A | ≥6.000<12.00 | D |
| ≥0.375<0.625 | | ≥12.00<24.00 | E |
| ≥0.625<0.875 | | ≥24.00<48.00 | F |
| ≥0.875<1.250 | | ≥48.00<96.00 | G |
| ≥1.250<1.750 | | ≥96.00<192.0 | H |
| ≥1.750<2.500 | | ≥192.0<384.0 | I |
| ≥2.500<3.500 | | ≥384.0 | J |

13.2.2.2 *Flaky, Bubbly Sludge Deposits* – Since the occurrence of flaky, bubbly sludge deposits is thought to have a possible detrimental effect on long-term engine lubrication system performance, document the occurrence of this type of deposit in the Supplemental Operational Data section of the Final Test Report. Record the engine part(s) where this type of deposit was observed and the total percent of the surface area covered. Suggested wording is as follows: Approximately 6% of the (left or right) rocker arm cover was found to exhibit flaky, bubbly sludge deposits.

13.3 *Varnish Ratings:*

13.3.1 *Preparation of Parts* – Rate the following parts for varnish deposits: piston skirts (8, thrust side only) and left and right rocker arm covers (RAC). Perform the varnish ratings after the sludge ratings are completed. The rating locations and dimensions shall conform with the locations and dimensions detailed on the rating worksheets (see A11). Avoid disturbing adjacent sludge deposits when the parts are being prepared for varnish ratings. Heavy sludge can be removed from a varnish rating area with a 25 mm rubber spatula prior to wiping. Wipe all parts firmly with wiping materials specified in CRC Manual No. 14. Firmly rub all wiping areas in the same direction until the surface is dry and free of sludge (until no more deposit is present on the wiping material after wiping).

13.3.2 *Average Varnish (Unweighted Average of three Parts)* – Use the procedure detailed as follows to determine the varnish rating of each part.

13.3.2.1 Rate any areas where varnish deposits have been altered during disassembly or sludge removal according to deposits on the surrounding non-altered areas. Do not rate altered areas as “clean.”

13.3.2.2 Determine varnish ratings of all parts by comparison of the deposit on the rating location using the CRC Rust/Varnish/Lacquer Rating Scale for Non-rubbing Parts from CRC Manual No. 14.

13.4 *Clogging:*

13.4.1 *Oil Screen Clogging* – Determine the percentage of the total screen opening that is obstructed with sludge and debris. Transform the oil screen results by taking the natural log (ln) of the oil screen rating plus 1 (ln(oil screen clogging + 1)). Report both transformed and original result on the appropriate forms(s).

13.4.1.1 Flexible, transparent rating aids can be made for different surface areas so that when compared to the test screen's surface, a more accurate determination of surface slogging is possible.

~~13.4.1.2, Insert Blowing Device Section in Information Letter.~~ If there is any question whether the screen is covered with oil or sludge, blow lightly on the screen (see CRC Manual No. 12). Note an analysis of deposits identified as debris in the Supplemental Operational Data.

13.4.2 *PCV Valve Clogging* – Determine the percent clogging of the PCV valve according to the following procedure:

13.4.2.1 Measure the PCV valve flow rate at differential pressures of 25 and 60 kPa. Calculate the percent clogging in accordance with the following equation:

$$\text{PCV valve clogging, \%} = [(I - F) / I] \times 100$$

Where: I = initial flow rate,
and
F = final flow rate.

13.4.2.2 If there has been replacement of the PCV valves during the test, calculate and report the PCV valve clogging for all the PCV valves. Report the percent clogging of the last valve used on the Ratings and Measurements Page.

13.4.3 *Oil Ring Clogging* – Determine the percentage of slot clogging for each oil ring in accordance with the procedure detailed in CRC Manual No. 12. Calculate and record the average clogging for all eight rings.

13.5 *Sticking:*

13.5.1 *Compressions Rings* – Record the number of stuck compression rings. Definitions to classify the degree and type of sticking are detailed in Section 3. List both hot and cold stuck compression rings on the Test Results Summary page. Denote hot or cold stuck rings on the Supplemental Operational Data page and include the ring location (top or second) and the piston number. Remove "Tight Ring" and "Free Ring" from rating form section and definition Section 3.1.14.

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| Attachment | 4B |
| Page | |
| Reference | |

12.6.3 *Parts Layout for Rating:*

12.6.3.1 Arrange the following parts in the parts rating area in accordance with the layouts detailed in this session. After the parts have been arranged, allow the parts to drain for four to eight hours before rating. Do not attempt to accelerate or force the oil draining. Any fixtures can be used to support the parts as long as they orient the parts in the specified configuration.

12.6.3.2 *Rocker Arm Covers* – Position the RAC’s vertically (upper jacket surface perpendicular to the ground) with the front of the RAC at the bottom.

12.6.3.3 *Camshaft Baffles* – Position the camshaft baffles vertically (top baffle surface perpendicular to the ground) with the rear of the camshaft baffle pointing down.

12.6.3.4 *Cylinder Heads* – Position the cylinder heads with RAC gasket surface pointing down.

12.6.3.5 *Oil Pan* – Position the oil pan upside down, with the pan rail at a 45° angle, with sump end pointing down.

12.6.3.6 *Oil Pan Baffles* - Position the oil pan baffles vertically on the front edges.

12.6.3.7 *Oil Screen and Pickup Tube* – Position the oil screen and pickup tube in the same orientation as they are installed in the engine. The screen should be raised off of the supporting surface to allow drainage. A fixture is necessary to support the oil screen and pickup tube.

13. Interpretation of Results

13.1 *Parts Rating Area – Environment:*

13.1.1 Ensure that the ambient atmosphere of the parts rating area is reasonably free of contaminants, and the temperature maintained at 24 ± 3°C (75 ± 5°F).

13.1.2 Rate all engine parts except the pistons and RAC’s under cool white fluorescent lighting exhibiting approximately 4100 K color temperature, a CRI of 62 and an illumination level of 350 to 500 fc (3800 to 5400 lx). All background and adjacent surfaces shall be flat white.

13.1.3 Rate pistons and RAC’s against a white background using white fluorescent bulbs and a 100% white deflector. Maintain the illumination level between 350 and 600 fc (3800 to 6500 lx), and measure the illumination level 355 mm (14 in.) from the desk top. ~~Provide a 15-W bore light with a cool white fluorescent tube for the cylinder wall varnish rating.~~

13.1.4 Rater shall attend at least one ASTM or CRC Rating Workshop per year having Sequence VG-specific or comparable hardware.

13.2 *Sludge Ratings:*

13.2.1 Rate the following parts for sludge deposits: RAC (2), valve deck (2), camshaft baffle (2), timing chain cover, oil pan and oil pan baffle. Use the rating locations identified on the rating worksheets (see A11). Determine the ratings using the techniques detailed in CRC Manual No. 12. Perform the sludge ratings before performing any other required ratings or measurements.

13.2.2 *Average Sludge (Unweighted Average of 9 Parts):*

13.2.2.1 Use the self-weighting procedure detailed as follows to determine the sludge rating merit for each part.

- (a) Determine the sludge depth at each of the sites shown on rating worksheets. A site is defined as a 20-mm (0.79-in.) diameter circular area.
- (b) Determine an interpolated sludge value for a designated site which exhibits more than one level of sludge depth within this area. This value is generated by multiplying each rated value's volume factor by the percentage of area covered, totaling these volume factor percentages, and comparing the total to the values given in Table 6 to determine the rating for the site: As an example, if a site was determined to be 50% A and 50% E, the calculation would be: 50% of the average sludge depth factor for A (or 1.0), plus 50% of the average sludge depth factor for E (or 16.0); that is: $[(0.5 \times 1.0 = 0.5) + (0.5 \times 16.0 = 8)] = 8.5$, and the calculated site sludge depth would be a D. In the event that there are areas where it is apparent that deposits had been formed, but are no longer adhering to the part, the rating site is the closest point to the designated point which will eliminate the voided area from the 20-mm (0.79-in.) rating area.
- (c) Add the total rating checks made for each line on the appropriate worksheets. These shall equal 10 or 20, depending on the part that is rated.
- (d) Multiply the total rating checks made on each line by ten or five, respectively (refer to (c)), to obtain the percent covered by the rated sludge depth. The grand total shall equal 100%.
- (e) Convert the percent covered by the rated sludge depth at each location to a volume factor using the procedure shown in CRC Manual No. 12.
- (f) Add the volume factors on each line to determine the total volume factor. Use CRC Manual No. 12 to convert the total volume factor to the sludge merit rating.

Table 6 Interpolated Average Sludge Site Ratings

| Total | Site Ratings | Total | Site Ratings |
|--------------|-----------------------|--------------|--------------|
| <0.125 | Clean | ≥3.500<6.000 | C |
| ≥0.125<0.375 | 1/2 A 1/4A | ≥6.000<12.00 | D |
| ≥0.375<0.625 | | ≥12.00<24.00 | E |
| ≥0.625<0.875 | | ≥24.00<48.00 | F |
| ≥0.875<1.250 | | ≥48.00<96.00 | G |
| ≥1.250<1.750 | | ≥96.00<192.0 | H |
| ≥1.750<2.500 | | ≥192.0<384.0 | I |
| ≥2.500<3.500 | | ≥384.0 | J |

13.2.2.2 *Flaky, Bubbly Sludge Deposits* – Since the occurrence of flaky, bubbly sludge deposits is thought to have a possible detrimental effect on long-term engine lubrication system performance, document the occurrence of this type of deposit in the Supplemental Operational Data section of the Final Test Report. Record the engine part(s) where this type of deposit was observed and the total percent of the surface area covered. Suggested wording is as follows: Approximately 6% of the (left or right) rocker arm cover was found to exhibit flaky, bubbly sludge deposits.

13.3 *Varnish Ratings:*

13.3.1 *Preparation of Parts* – Rate the following parts for varnish deposits: piston skirts (8, thrust side only) and left and right rocker arm covers (RAC). Perform the varnish ratings after the sludge ratings are completed. The rating locations and dimensions shall conform with the locations and dimensions detailed on the rating worksheets (see A11). Avoid disturbing adjacent sludge deposits when the parts are being prepared for varnish ratings. Heavy sludge can be removed from a varnish rating area with a 25 mm rubber spatula prior to wiping. Wipe all parts firmly with wiping materials specified in CRC Manual No. 14. Firmly rub all wiping areas in the same direction until the surface is dry and free of sludge (until no more deposit is present on the wiping material after wiping).

13.3.2 *Average Varnish (Unweighted Average of three Parts)* – Use the procedure detailed as follows to determine the varnish rating of each part.

13.3.2.1 Rate any areas where varnish deposits have been altered during disassembly or sludge removal according to deposits on the surrounding non-altered areas. Do not rate altered areas as “clean.”

13.3.2.2 Determine varnish ratings of all parts by comparison of the deposit on the rating location using the CRC Rust/Varnish/Lacquer Rating Scale for Non-rubbing Parts from CRC Manual No. 14.

13.4 *Clogging:*

13.4.1 *Oil Screen Clogging* – Determine the percentage of the total screen opening that is obstructed with sludge and debris. Transform the oil screen results by taking the natural log (ln) of the oil screen rating plus 1 (ln(oil screen clogging + 1)). Report both transformed and original result on the appropriate forms(s).

13.4.1.1 Flexible, transparent rating aids can be made for different surface areas so that when compared to the test screen’s surface, a more accurate determination of surface clogging is possible.

13.4.1.2 If there is any question whether the screen is covered with oil or sludge, blow lightly on the screen (see CRC Manual No. 12). Note an analysis of deposits identified as debris in the Supplemental Operational Data.

13.4.2 *PCV Valve Clogging* – Determine the percent clogging of the PCV valve according to the following procedure:

13.4.2.1 Measure the PCV valve flow rate at differential pressures of 25 and 60 kPa. Calculate the percent clogging in accordance with the following equation:

$$\text{PCV valve clogging, \%} = [(I - F) / I] \times 100$$

Where: I = initial flow rate,
and
F = final flow rate.

13.4.2.2 If there has been replacement of the PCV valves during the test, calculate and report the PCV valve clogging for all the PCV valves. Report the percent clogging of the last valve used on the Ratings and Measurements Page.

13.4.3 *Oil Ring Clogging* – Determine the percentage of slot clogging for each oil ring in accordance with the procedure detailed in CRC Manual No. 12. Calculate and record the average clogging for all eight rings.

13.5 *Sticking:*

13.5.1 *Compressions Rings* – Record the number of stuck compression rings. Definitions to classify the degree and type of sticking are detailed in Section 3. List both hot and cold stuck compression rings on the Test Results Summary page. Denote hot or cold stuck rings on the Supplemental Operational Data page and include the ring location (top or second) and the piston number. [Remove “Tight Ring” and “Free Ring” from rating form section and definition Section 3.1.14.](#)

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

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MOTION # 1

AFR MEASUREMENTS BASED ON O₂, CO AND CO₂ WILL BE REPLACED WITH HORIBA LD-700 [OR EQUIVALENT] TO TAKE LAMBDA AT EACH BANK FOR THE EXHAUST. TYPICAL LAMBDA VALUES WOULD BE ABOUT 1.00 IN STAGES 1 AND 2, AND 0.75 IN STAGE 3. THIS WOULD REQUIRE MODIFICATIONS TO SECTIONS 12.3.3.1 AND 12.5.5.1 AT A MINIMUM. SENSORS FOR THE HORIBA METER WOULD BE LOCATED AT THE SAME DOWNSTREAM LOCATION AS THE EXISTING AFR PROBE. THIS WILL BE INTRODUCED WITH REFERENCE TESTS STARTED ON OR AFTER 03/01/02.

B.11

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MOTION # 2


**RECOMMEND TO THE SURVEILLANCE
PANEL THAT NO_x READINGS BE
ELIMINATED. THIS WOULD INCLUDE
SECTION 14.2 FOR TEST VALIDITY, AND
SECTIONS 12.3.3.2 AND 12.5.5.2 AT A
MINIMUM. THIS WOULD BE EFFECTIVE ON
11.14.2001.**

Dwight

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MOTION # 3

**RECOMMEND TO THE SURVEILLANCE
PANEL THAT Qi REQUIREMENTS FOR
POWER IN STAGE 3 BE ELIMINATED. THIS
WOULD BE EFFECTIVE 11.14.2001.**

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MOTION # 4

**RECOMMEND TO THE SURVEILLANCE
PANEL THAT D 6593, SECTION 12.4.1 BE
MODIFIED AS FOLLOWS:”A BLOWBY
ADJUSTMENT CAN BE MADE DURING
BREAK-IN OR UP TO THE 48 HOUR OIL
SOAK.” THIS WOULD BE EFFECTIVE
11.14.2001.**

Report of the

Light Duty Rating Task Force (LDRTF)

to

Sequence V Surveillance Panel

November 14, 2001

Embassy Suites Hotel

San Antonio, Texas

By: Zack Bishop; Task Force Leader

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- ◆ VG Workshop held October 9, 2001 at SwRI
 - Raters reviewed Sequence VG Procedure (Rating Section). Copy of the changes suggested for updating the VG Procedure is attached.
 - This was the first VG 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.

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Motions & Action Items
Sequence VG Surveillance Panel
November 14, 2001
As Recorded at the Meeting by Ben Weber

1. Meetings minutes were accepted as written
2. The O&H panel still needs to determine what data dictionary fields need to be included in the TMC website data.
3. TMC, RSI, O&H, and fuel supplier reports were accepted as presented.
4. TMC will request a 5-year supply of the new GF-3 category calibration oil.
5. Motion made by Bill Buscher III and seconded by Dwight Bowden is to introduce 1006-2 using the existing 1006 targets. 1006-2 targets will be evaluated at 5 tests and updated at 10, 20 & 30 tests. Passed unanimously.
6. The new GF-3 category calibration oil will be introduced starting mid-year of 2002.
7. Motion by Bill Buscher III and seconded by Carl Stephens that the letter as presented at the SP will be forwarded to Ford Motor Co. Passed unanimously.
8. The TMC will initiate a rating round robin using old parts and collecting the data. If the data suggests it is possible, then develop a rater calibration criteria at a later time.
9. Motion by Dan Worcester and seconded by Bill Buscher III AFR measurements based on O2, CO and CO2 will be replaced with Horiba LD-700 (or equivalent) to take lambda at each bank for the exhaust. Typical lambda values would be about 1.00 in stages 1 and 2, and 0.75 in stage 3. This would require modifications to sections 12.3.3.1 and 12.5.5.1 at a minimum. Sensors for the Horiba meter would be located at the same downstream location as the existing AFR probe. This will be introduced with reference tests started on or after 3/1/02. Passed unanimously.
10. Motion by Dan Worcester and seconded by Dwight Bowden to recommend to the surveillance panel that NOx readings be eliminated. This would include section 14.2 for test validity, and sections 12.3.3.2 and 12.5.5.2 at a minimum. This would be effective on 11/14/2001. Passed unanimously.
11. Motion by Dan Worcester and seconded by Dwight Bowden to recommend to the surveillance panel that QI requirement for power in stage 3 be eliminated. This would be effective 11/14/2001. Passed unanimously.
12. Motion by Dan Worcester and seconded by Bill Buscher III to recommend to the surveillance panel that D6593, section 12.4.1 be modified as follows: "a blow-by adjustment can be made during break-in or up to the 48 hour oil soak." This would be effective 11/14/2001. Passed unanimously.
13. Zack Bishop recommended that the TMC take over the light-duty rater workshops. Everyone agreed to this.
14. Motion by Zack Bishop and seconded by Bill Buscher III to add to section 13.1.4 that the Rater shall attend at least one ASTM or CRC Rating Workshop having VG specific or comparable hardware. Passed unanimously.
15. Motion by Zack Bishop and seconded by Bill Buscher III to change Table 6 to reflect interpolated average sludge sites and to correct the typo in Table 6. Passed unanimously.
16. Motion by Zack Bishop and seconded by Bill Buscher III to remove tight and free ring ratings from report forms and from definitions, section 3.1.14. Passed unanimously.