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June 20, 2003

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Unapproved Minutes of the June 11, 2003 Joint Sequence VG Operations and Hardware Subgroup and Surveillance Panel Meeting held in Detroit, Michigan

The meeting was called to order at 9:03 AM by Chairman Gordon Farnsworth. A Surveillance Panel membership list was circulated for members and quests to sign in. The signed membership list is included as Attachment 1. A copy of the agenda for the Surveillance Panel meeting is included as attachment 2. No changes to the membership were reported during this meeting. Minutes from the March 19th, 2003 meeting were approved as written, motion to approve, Jerry Brys, second by Dwight.Bowden. There were no membership changes identified during this meeting.

Review of Action Items from Previous Meeting

See Attachment 3.

O&H Status Report

Based on current usage rates, the current AER hardware will be exhausted in roughly August 2003. The cylinder head build out at AER is planned tentatively for week of July 14th. The anticipated cost of the cylinder heads, including core charge is estimated to be approximately $400/head. Jerry Brys noted that on his Romeo tests the valve guides were out of spec after one test. Dan Worcester and Bill Buscher both noted that the heads for the matrix had used guides, while subsequent builds will use new guides. Jerry asked if labs could send cores and not incur the core charge. No AER representative was available to answer his question, though Beto Ariaza noted that AER has made adjustments for this type of thing in the past. Dave Gleanzer questioned what new parts will be used in the new heads. Dan Worcester stated

the rebuilt heads will contain the following; new guides, seats, intake and exhaust valves, springs and seals. The heads will also be machined for installation of Durabond cam bearings. After the head build out, a round table discussion to iron out build practices will be conducted the following day. Work on the information letter to address the procedural issues will also be accomplished during this meeting. Beto will coordinate with AER to schedule. Dwight Bowden raised an issue that has been brought up in other panels, which is the specification of cleaning solvents. It has been recommended to require a Type 2, class C solvent, or High flash point, low aromatics solvent as the specification for cleaning solvents in ASTM methods. The Panel agreed to specify Type 2, Class C solvent meeting ASTM D235 by 12/31/2003. This requirement will be included with the Romeo Hardware information. Ford had expressed concerns that running four runs per block would cause service parts to be consumed by kits, giving warranty problems. Ford has recommended using a second block for parts. Ben Weber explained that there are actually two kits, currently designated as Kits A and B. See attachment 4 for listing of Kit A and B. Mike Riley also noted that pistons and rings will be shipped separate. One advantage to purchasing the second block is that it may be used as a spare if for some reason the original engine block can not be used for subsequent runs. Power Products is looking at shipping separate kits for each piston batch. It is anticipated the 0.125 and 0.375 pistons will be available in 3 to 4 weeks. Bill Buscher suggested that labs may wish to order another batch of 0.25 pistons, due to the ring chamfer being out of spec. Ford will tighten spec for VG pistons. Bill Buscher also commented that Federal Mogul never made any pistons smaller than 0.5 and they have been using the same cutting tool, which may have resulted in smaller chamfer. Bill further commented that with the 0.5 pistons and a chamfer of 0.380, ring gaps were typically 0.41 to 0.43 and the 0.25 piston, with average chamfer of 0.28, required ring gaps 0.58 to 0.60. Pricing was not available, but Power Products is targeting ~$3500 for engine and pistons. Solicitation is anticipated in 2 to 3 weeks but certainly within one month. Kits should be out by end of year. Solicitation for the 0.125 pistons should be out within next 2 to 3 weeks. Mike Riley was not sure who the Power Products contact would be, but the engineer who has been working with the prints is Duane Mattison. Mike will email labs with the contact information for Power Products. Comments were made that not all labs had received kits yet. A question came up about obtaining polished cams, since the cams needed to be removed from the kit and shipped to OHT for polishing. Jason Bowden commented that OHT has inventory, so cams can be shipped right away. Beto Araiazo asked if Ford would sell engines separately. Mike Riley stated he thought the engines would probably be available, but he could not give a price. Mike qualified that he was not sure if the engines will be sold whole or as separate parts. When asked if 0.25 and 0.5 kits can be purchased, Mike noted that the pistons can be ordered separately. Dress kits probably won't be available, and while some parts of the dress kit may be available, the front cover may be a problem. The kit process will be 4 runs per block. Heads will be rebuilt the first time by AER in batches of 200, and subsequently reassembled (valves, etc.) by labs. Valves and seals will be in the kit. Bearings will be obtained from AER. As an aside, the new Romeo heads will need to be sold, Beto has source that will purchase heads at $50/head. Followers and adjusters can be used from Romeo heads. Valves may also be used off of the Romeo heads. Dan Worcester commented that cut valve guides will require a special seal. However, all reworked heads will use Red Viton seals. Seal type may be an action item for build workshop. Kits for second and fourth run have been purchased. Kits for first and third runs should be available for solicitation next week. When questioned about the minimum of pistons in a piston batch, Mike Riley indicated that a minimum 250 pistons would have to be made, which most panel members thought would not be a problem. Bill noted that everyone should order pistons for the kits they have. Solicitation may include all pistons, as 0.25 may need to be replaced. A method for obtaining extra rings may also need to be devised for next solicitation, since additional rings may be needed for reworks.. Solicitation for pistons and rings of all four sizes is targeted for next week, and within one month solicitation for engine, kits, gaskets etc. Mike will email kit pricing as soon as available. Polished cams will be used. Latest version of durabond bearings will be used, but the bearings do not have a tang. AER will not install bearings in the head, so labs must procure the bearing. Bill asked if Beto could have TEI get seals.

Sequence VG Surveillance Panel Meeting
June 11, 2003

Referencing to Introduce Romeo Hardware

Rich Grundza gave a presentation on introduction of the Romeo hardware referencing requirements (see Attachment 5). After some discussion, the following requirements were agreed to.

1) Two tests per lab
2) If a reference oil test is conducted before the industry switch to Romeo Hardware, the reference period for the stand will be extended for existing hardware, providing the Romeo hardware test is operationally valid and statistically acceptable. Romeo reference data will not be used for control charts until candidate testing with the Romeo hardware begins.
3) Once one lab has to switch to Romeo hardware, no starts on AER hardware may occur after one month after the first non-reference oil test on the Romeo hardware.

Motion by Dwight Bowden, second by Dan Worcester, to accept these criteria, approved unanimously.

Bore and Follower Pin Wear

An ACC analysis was provided and was reviewed at the ILSAC oil meeting on June 9, 2003 and also at this meeting. Ford is recommending roller pin and ring wear limits for GF-4. Ford's opinion was that field and dyno tests indicate 4.6L pin and ring wear are sensitive to oil quality. Pin and ring wear was discussed at ILSAC oil meeting, where Charlie Sherwood proposed a cap limit of 30 microns for pin wear (average of both) and 225 microns (average) on ring wear. An alternate proposal was to was to rate and report for GF4, if no significance in one year drop rate and report. Bore wear measurements were conducted on 9 reference oil tests. Bore were measurements may not be conducted on Romeo blocks, since the block may not be available until four tests are conducted, which could be years. Measurements did not show a significant difference between oils but there did appear some variation between measurements. Oils were compared for correlation between VG pin wear and VE cam wear, but only oils 925 and 1006 compare between tests and both were good wear oils. A copy of Mike's presentation is included as Attachment 6. Phil Scinto presented an analysis of pin wear and ring gap increase which was also presented previously to ILSAC oil committee, see attachment 7. Average and max pin wear are positively correlated. A correlation was also found between average and max ring gap increase. There is some statistical evidence that pin wear and ring gap increase response differ by vis grade. No phos level effect was observed for either parameter.

Review of Scope and Objective

Attachment 3 lists the Sequence VG Surveillance Panel Scope and Objectives, which ere reviewed with no changes. Future engine supply task force will be formed and will be chaired by Bill Buscher.

Old Business

A motion was made by Dan Worcester and seconded by Bill Buscher to disband O&H

Under new business, results of fuel analysis were reviewed with the panel. See attachment 5. Several labs were identified as having RVP results below the fuel batch acceptance limits. After some discussion, a motion was made to not allow additional fuel to be dumped on top of this fuel. Several labs stated that this has probably occurred, motion by Dwight Bowden, second Gordon Farnsworth. Motion was approved by 4 for, 2 against and 3 waives. After some additional discussion, it was agreed that the TMC would work with the labs to determine if there has been any reference tests on this discrepant fuel and if additional fuel was added to these tanks. Results of lambda values provided on reference tests were reviewed with the panel. Rich Grundza noted that some labs seemed to have higher stage 3 values than

others. Dave Glaenzer mentioned that these values may indicate that some of these tests may have run lower CO values than others. No definitive action was taken by the panel.

Rate and report items were reviewed and after some discussion, it was agreed to wait till GF-4 is approved to address these.

The meeting was adjourned a 12:50

A copy of the Motions and Acton Items from this (June 2003) meeting is included as attachment 8.

Attachment 1

MEMBERSHIP
ASTM SEQUENCE VG SURVEILLANCE PANEL

Name	Company-Address-Phone-Fax-Email	Signature	Voting Member
Araiazo, Beto ARAIZA ✓	Test Engineering, Inc 12718 Cimarron Path San Antonio, TX 78249 Phone: 210-877-0222 Fax No: 210-690-1959 Email: baraiza@tei-net.com		Yes
Bendele, Larry	Southwest Research Institute P.O Drawer 28510 San Antonio, TX 78228-0510 Phone: 210-522-2824 Fax No: 210-684-7523 Email: lbendele@swri.edu		No
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Brys, Jerome ✓	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 Phone: 440-347-2631 Fax: 440-347-4096 Email: jabs@lubrizol.com		Yes
Buck, Ron	Test Engineering, Inc 12718 Cimarron Path San Antonio, TX 78249 Phone: 210-877-0221 Fax No: 210-690-1959 Email: rbuck@tei-net.com		No
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Clark, Sid ✓	GM Powertrain Mail Code 480-106-160 30500 Mound Road Warren, MI 48090-9055 Phone: 586-986-1929 Fax: 586-9986-2094 Email: Sidney.l.clark@gm.com	Sid	Yes
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Sutherland, Mark	Chevron Oronite Company, LLC 4502 Centerview Drive		No

Frank Fernandez ✓ Chevron Oronite Co, LLC 4502 Centerview Dr #210 San Antonio, TX 78228 F.F. No

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Grundza, Rich WWJS	ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 Phone: 412-365-1031 Fax: 412-365-1045 Email: reg@astmtmc.cmu.edu		Yes
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Attachment 2

AGENDA

Sequence VG Operations & Hardware Subpanel
&
Sequence VG Surveillance Panel meeting
June 11, 2003 (9:00AM – 5:00 PM)

Detroit Marriott, Romulus MI

1. Secretary for this meeting — R. Grundza

2. Motion and Action Recorders

3. Approval of Minutes for Previous Meeting

4. Membership Changes (O&H and SP)

5. Review Action Items from Last Meeting — D. Worcester

6. VG Romeo/AER (Hardware & Rebuild) — D. Worcester
   a. Rebuild of AER Heads
   b. Runs per Block (2, 3 or 4) and Engine Life
   c. Romeo Engines as Build Parts
   d. Polished Cam Journals
   e. Type of Cam Bearings
   f. Status of Kit Orders
   g. Build Procedures at Labs
   h. VG Kit Parts for Multiple Runs
   i. Confirm runs per engine & hardware Sourcing — All

7. VG Wear Measurements — M. Riley
   a. Cylinder Bore
   b. Follower Pins and Ring Wear
   c. Reference Block Measurements
   d. ACC analysis of Candidate data (Ring and Pin wear) — P. Scinto?

8. O&H old Business

9. O&H new Business

10. O&H Adjourn

11. VG Items
    a. Approval of March 2003 minutes
    b. Action items — G. Farnsworth
    c. Referencing plan for Romeo introduction — R. Grundza
    d. TMC semi annual report questions? — All
    e. Scope & Objectives — All
    f. Old Business — All
    g. New business — All

12. SP Adjourn

Attachment 3

ASTM SEQUENCE V SURVEILLANCE PANEL

SCOPE AND OBJECTIVES

SCOPE

The Sequence V Surveillance Panel is responsible for the surveillance and continued improvement of the Sequence VG test documented in ASTM Standard D6593 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 rating technique, test operation, test monitoring and test validation will be accomplished through continual communication with the Test Sponsor, ASTM Test Monitoring Center, ASTM BO.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 deemed appropriate based on input from the preceding. Industry transition to new engine hardware batches will be monitored and redistribution of existing hardware facilitated to accomplish uniform industry implementation. Development and correlation of updated test procedures with previous test procedures will be reviewed by the panel. This process will provide the best possible test procedure for evaluating automotive lubricant performance with respect to the lubricant's ability to prevent engine sludge, engine varnish, cam lobe wear, oil screen plugging, oil ring clogging and ring sticking.

Objectives	Target Date
1. Establish VG fuel reblend confirmation trial timing	**May 2003**
2. Approval testing of next VG fuel reblend	Nov. 2003
3. New Romeo engine equivalency testing complete	Feb. 2003 (Done)
4. Introduce 1009 reference oil	Nov. 2002 (Done)
5. Cylinder Bore Task Group	June 2003
6. Review need for Rate & Report items	May 2003
7. Current engine distribution plan	Jan. 2002
8. Future engine supply plan	Nov. 2003
9. Establish a formal system for final redistribution of 1994 model year hardware, referencing of test stands and introduction of 2000 model year hardware	May 2003

G. R. FARNSWORTH, Chairman
Sequence VE Surveillance Panel
pjr

Updated March 19, 2003
Detroit, Michigan

Engine Kit A

Kit List for Initial First Run with New Romeo Engine

	Part Number	Description	Quantity	Cost Ea.
1	???	PCV Valve (EV-98)	1	
2	E5TE-9601-AB	Air Filter Element	1	
3	1W7E-6C315-AA	Crank Sensor Assembly	1	
4	1W7E-6B288-AA	Cam Position Sensor	1	
5	????	Oversize Piston	8	
6	????	Oversize Piston Ring Set	1	
7	F65E-6251-B8A	Truck Camshaft-LH	1	
8	F65E-6C255-A8A	Truck Camshaft-RH	1	
9	YU1L-6622-AA	Screen and Cover Assembly	1	

Total $0.00

Engine Kit B

Kit List for Subsequent Runs on Used Romeo Engines

Quantities Listed are for only 1 Run

	Part Number	Description	Quantity	Cost Ea.
1	???	PCV Valve (EV-98)	1	
2	AWSF-32P-PF4	Spark Plug Assembly	8	
3	F1AE-6065-BB	Bolt M11X1.5 21035 Hex	20	
4	F1AE-6345-AD	Main Bolt	9	
5	F1AE-6K258-AD	Main Bolt w/Stud Pickup	1	
6	????	Oversize Piston	8	
7	????	Oversize Piston Ring Set	1	
8	F65E-6251-B8A	Truck Camshaft-LH	1	
9	F65E-6C255-A8A	Truck Camshaft-RH	1	
10	F6TE-6529-AB	Roller Follower	16	
11	F65E-6C501-AA	Valve Tappet	16	
12	F5AE-6507-AA	Intake Valve	8	
13	F1AE-6505-CC	Exhaust Valve	8	
14	F65E-6A517-AA	Valve Seal	16	
15	F5AE-6268-AA	Timing Chain	2	
16	F81E-6M269-AA	Timing Chain Tensioner - LH	1	
17	F81E-6L266-AA	Timing Chain Tensioner - RH	1	
18	1L2E-6B274-AA	Timing Chain Guide - LH	1	
19	1L2E-6M256-BA	Timing Chain Guide - RH	1	
20	1L2E-6L253-AA	Tensioner Arm - LH	1	
21	1L2E-6L253-BA	Tensioner Arm - RH	1	
22	XL3E-6306-BA	Crankshaft Sprocket	1	
23	F9ZE-6333-AA	Main Crankshaft Bearing	1	
24	F9ZE-6A338-AA	Main Crankshaft Bearing	5	
25	F9ZE-6A339-AA	Thrust Bearing	4	
26	F9ZE-6A341-AA	Thrust Washer	1	
27	F9ZE-6211-AA	Connecting Rod Bearing Set	16	
28	F8AE-6621-AA	Oil Pump Assembly	1	
29	N806435-S	Oil Gallery Plug	2	

Attachment 5

Sequence VG TMC Items

6/11/03

New Hardware Introduction

- 1) Each laboratory must conduct at least two acceptable reference oil tests on the Romeo hardware configuration as defined by the Surveillance Panel, built with the hardware and in compliance with the procedures and techniques defined in Information Letter 03-3. This will help adjust severity adjustments to reflect the performance on the Romeo hardware.

New Hardware (cont)

- 2) Once one laboratory switches to Romeo Hardware all laboratories are to switch. So that appropriate severity adjustments are generated, the next two starts in the lab are to be reference oil test runs.
- 3) The Romeo engine reference oil tests may be conducted on one stand or multiple stands. Both tests must be chartable.
- 4) The TMC will extend new calibration periods to compensate labs for shortened calibration periods with existing hardware.

Fuel Analysis

- Fuel Analysis has been conducted on a bi-monthly basis in only two labs. These samples have been analyzed on a continuing basis.
- The three remaining labs have only had analysis recently.
- These three labs show low RVP numbers, below that allowed by the fuel specification.
- What Action should be taken?
- Labs should be sampling tanks again this month.

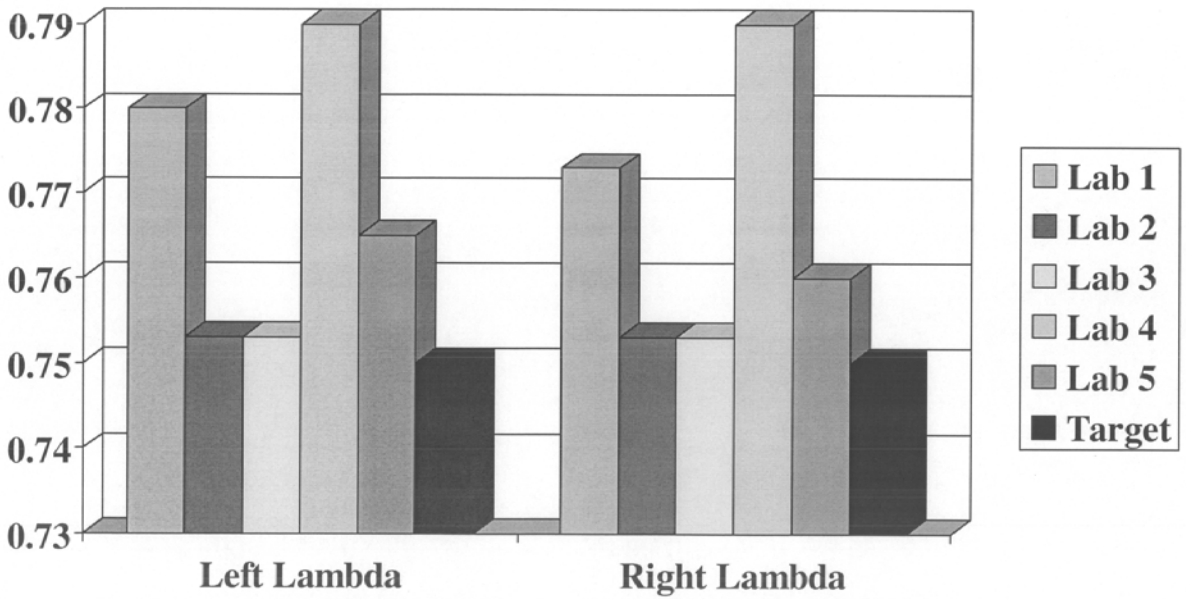
Lambda values

- 5 labs reported 34 results on left and right to date.
- Means by lab show some variability, especially in stage 3
- Stage 3 means and ranges tabulated below.

Stage 3 Means and Ranges

Lab	Right Mean	Right Range	Left Mean	Left Range
1	0.773	0.74 –0.81	0.78	0.74 –0.82
2	0.753	0.75 –0.76	0.753	0.74 –0.77
3	0.753	0.75 –0.76	0.753	0.74 –0.77
4	0.79	0.75 –0.82	0.79	0.76 –0.78
5	0.76	0.74 –0.78	0.765	0.75 –0.78

Mean Stage 3 Lambda Values by Bank and Lab



Sequence VG Report

ASTM Sequence VG O&H & SP Meetings

Detroit, MI

June 11, 2003

Mike Riley

Ford Motor Company

Fuels and Lubricants Engineering

Attachment 6

VG Engine Hardware Update

Objective: Supply additional engines to labs to allow use of 2000 MY engines for an extended period.

Engines/Kits

- Plan is 4 tests/block with 0.125, 0.250, 0.375 and 0.500 micron oversized bores.
- Ford Power Products (FPP) plan to solicit engines/kit A/kit B. Most engines will replace kit parts and block will be available for testing later.
- Kits for previous engines purchased were delivered to SwRI. Others being assembled to deliver to other labs soon.

Pistons/Rings

- SwRI determined the 0.25 piston chamfers did not meet spec. They have been shipped to Federal Mogul to measure and replace. The 0.50 kit pistons meet spec, but may need to be revised with lab funding likely.
- FPP will solicit for 0.125 and 0.375 pistons soon for labs to start testing with new engines by August 1 or sooner. Total purchase from all labs should be more than 250 pistons of each size.

M. Riley
Ford Motor Company
Fuels and Lubricants Eng

VG Engine Wear Measurements

Roller Pin and Ring Wear

- RSI presented candidate oil data at ILSAC/Oil meeting held 6/9/03. Ford proposed roller pin and ring wear limits for GF-4 oil at same meeting.
- G. Farnsworth supplied data on 4 reference oils that indicated negligible wear differences between oils, although there isn't much wear difference expected with these oils.
- Field and dyno tests indicate 4.6L pin and ring wear are sensitive to oil quality.

Bore Wear Study of Reference Oils

- Ford completed measurements on 9 blocks supplied by 3 labs.
- The reference oils tested are: 1009 (5), 1006 (3), 925-3 (1)
- 4 more blocks to be measured were tested with 1009 (3) and 1006 (1).
- Future blocks for measurement should be with reference oils 1006 and 925.

Thanks to Labs for Support

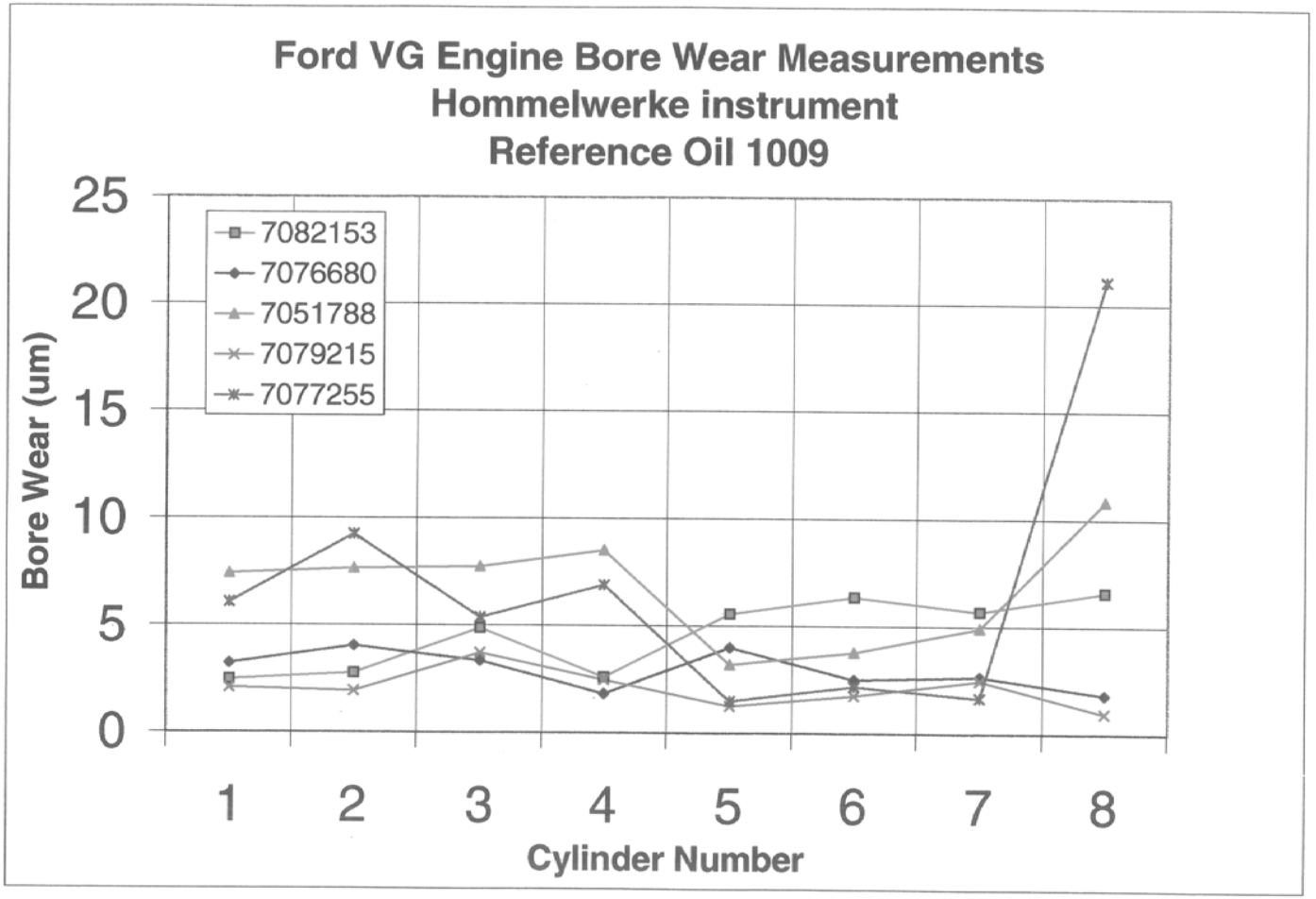
M. Riley
Ford Motor Company
Fuels and Lubricants Eng

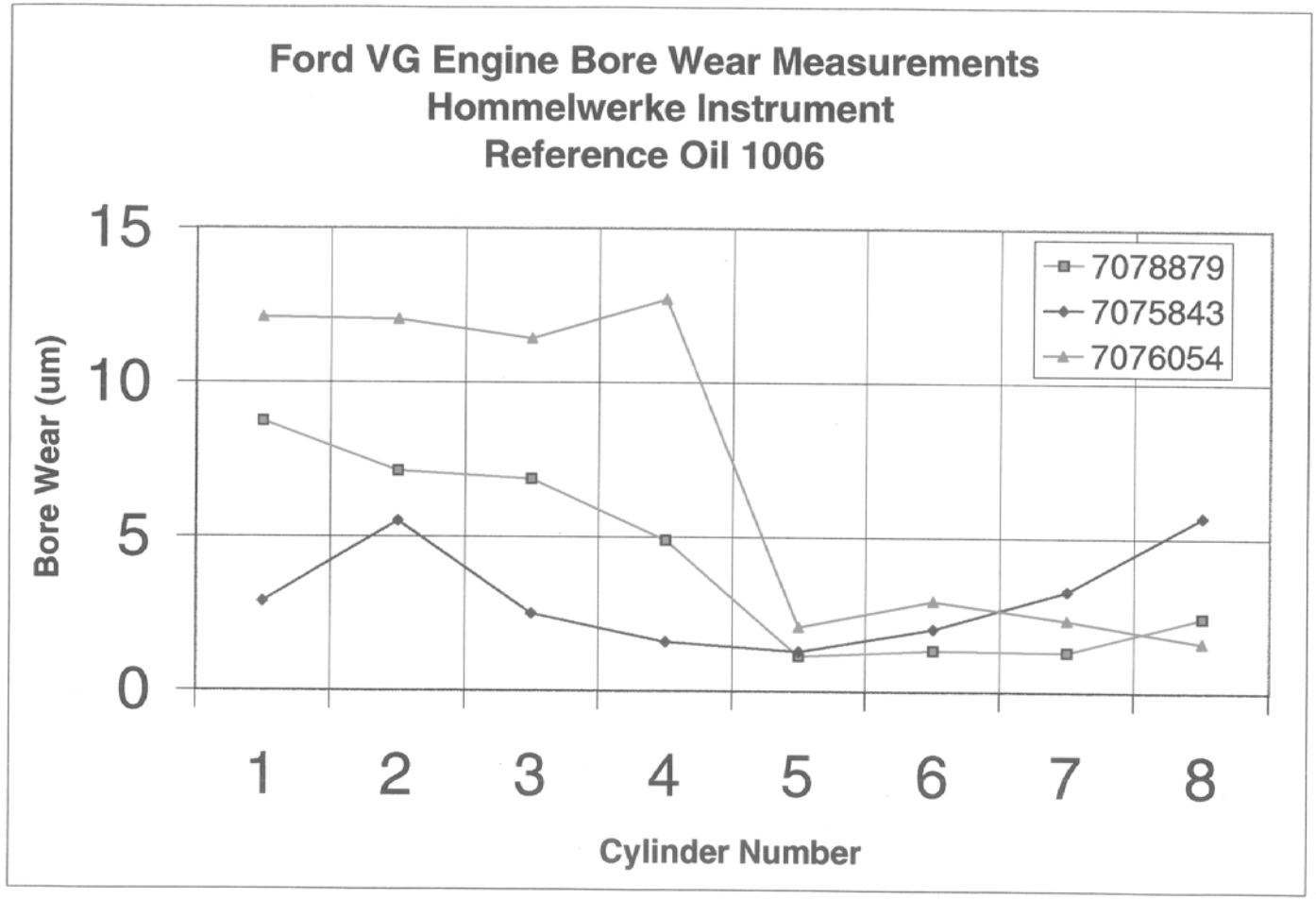
Sequence VG Engine Bore Wear Measured by Ford Hommelwerke Instrument

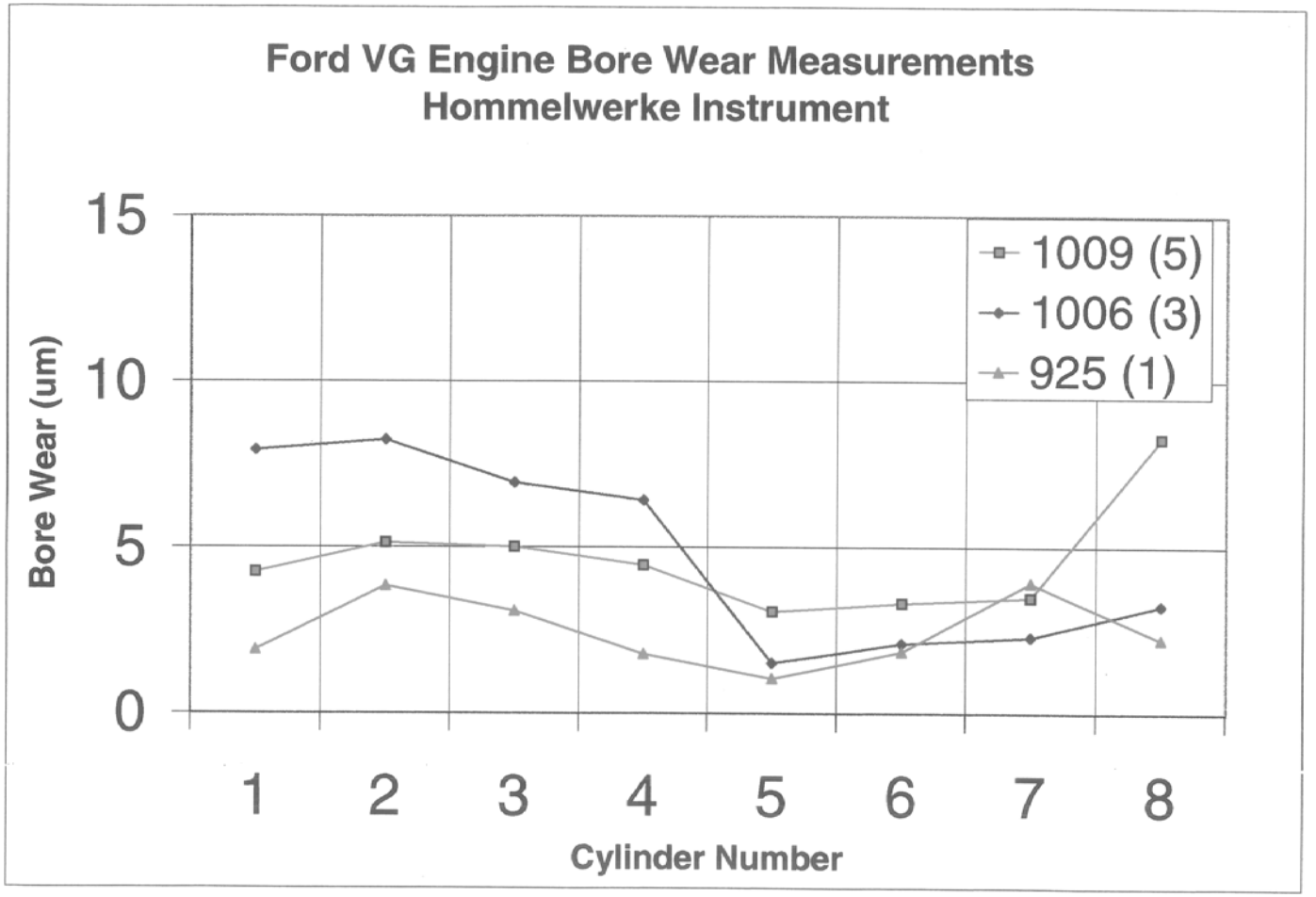
Lab	Received	Engine	AES	AEV	Avg Bore Wear	Oil Type
SwRI	7/5/02	7082153	8.12	8.78	4.7	1009
Perkin/Elmer	7/15/02	7076680	8.13	9.09	2.9	1009
Perkin/Elmer	8/15/02	7075843	8.76	9.17	3.09	1006
SwRI	10/15/02	7076558	6.39	8.74	2.45	925-3
SwRI	10/15/02	7077255	7.29	8.97	6.7	1009
Lubrizol	12/9/02	7051788	7.74	8.91	6.76	1009
Perkin/Elmer	12/15/02	7078879	8.71	9.28	4.23	1006-2
Lubrizol	4/4/03	7076054	8.74	9.18	7.16	1006-2
Lubrizol	4/4/03	7079215	7.66	8.99	2.07	1009

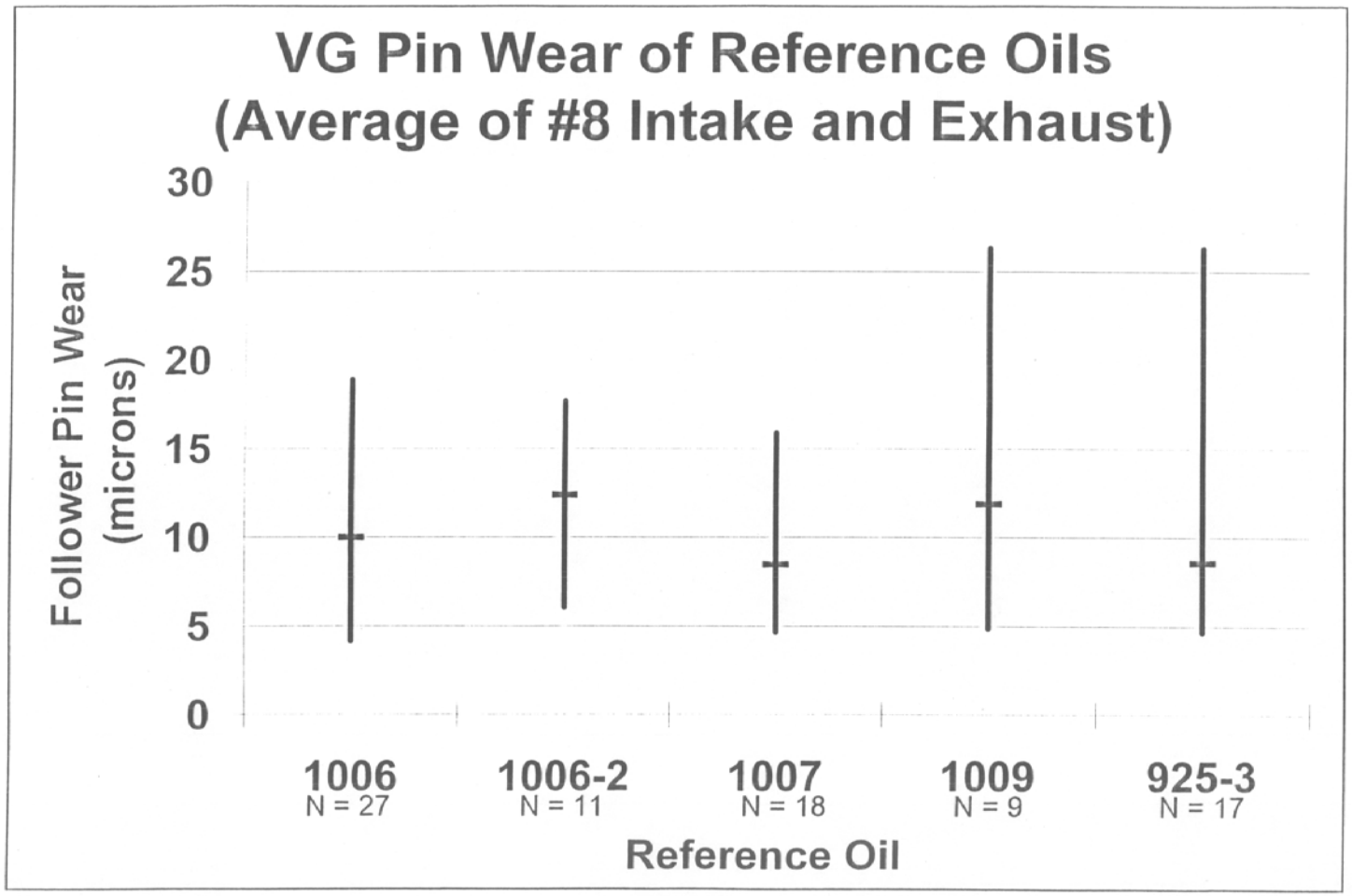
Summary		
Oil	Avg Bore Wear	Avg Range
925 (1)	2.45	-
1006 (3)	4.83	3.09 - 7.16
1009 (5)	4.63	2.07 - 6.76

M. Riley
Ford Motor Co
Fuels and Lubes Eng
June 11, 2003

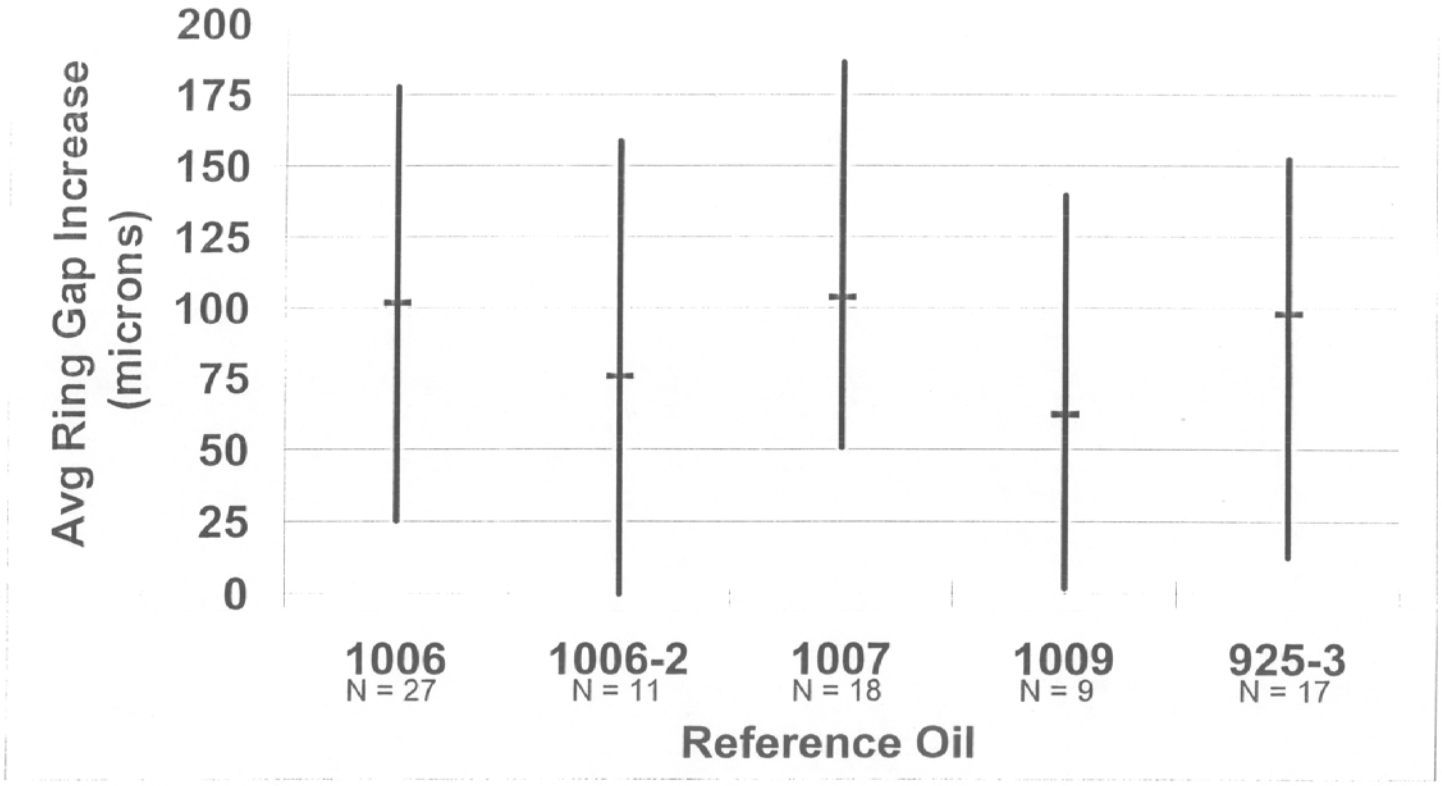

Ford VG Engine Bore Wear Measurements
Hommelwerke instrument
Reference Oil 1009
Bore Wear (um)
25
20
15
10
5
0
7082153
7076680
7051788
7079215
7077255
1
2
3
4
5
6
7
8
Cylinder Number


Ford VG Engine Bore Wear Measurements
Hommelwerke Instrument
Reference Oil 1006
Bore Wear (um)
15
10
5
0
1
2
3
4
5
6
7
8
Cylinder Number
7078879
7075843
7076054

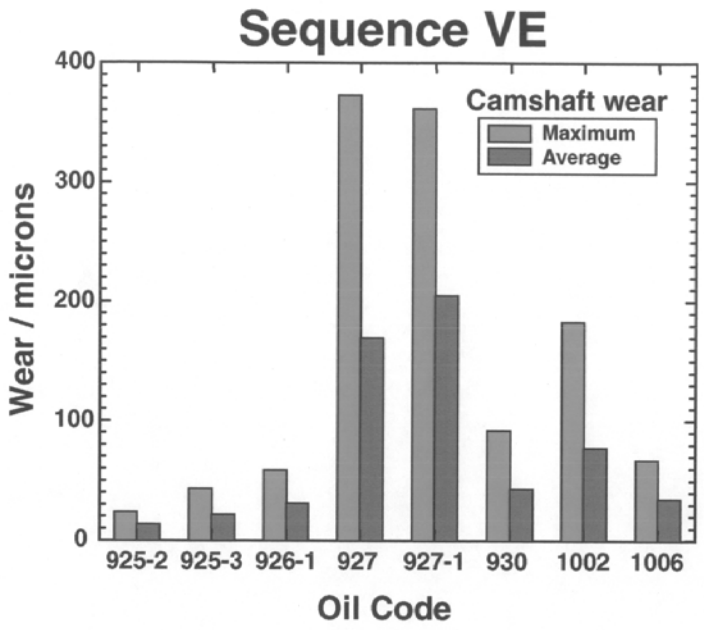

Ford VG Engine Bore Wear Measurements
Hommelwerke Instrument
Bore Wear (um)
15
10
5
0
1
2
3
4
5
6
7
8
Cylinder Number
1009 (5)
1006 (3)
925 (1)

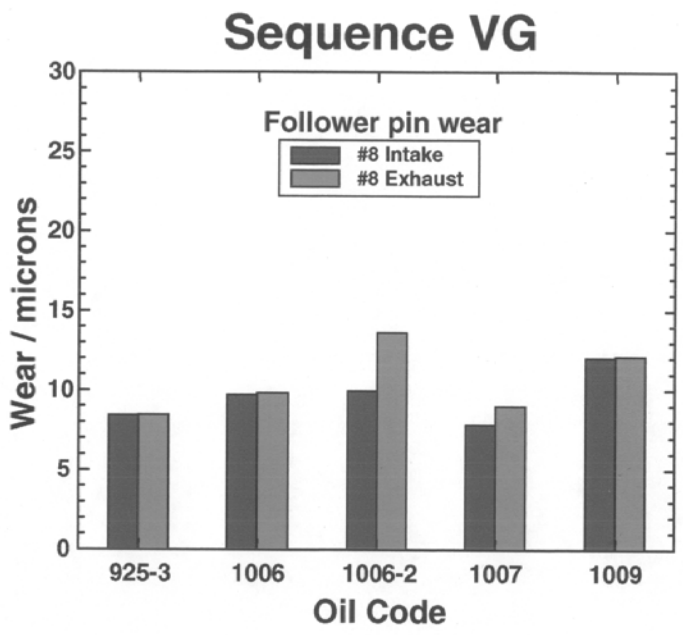

VG Pin Wear of Reference Oils
(Average of #8 Intake and Exhaust)
Follower Pin Wear
(microns)
30
25
20
15
10
5
0
1006
N = 27
1006-2
N = 11
1007
N = 18
1009
N = 9
925-3
N = 17
Reference Oil

VG Ring Wear of Reference Oils
(Average #1 & #8 Ring Gap Increase)



Reference Oil Wear in Sequence V Tests



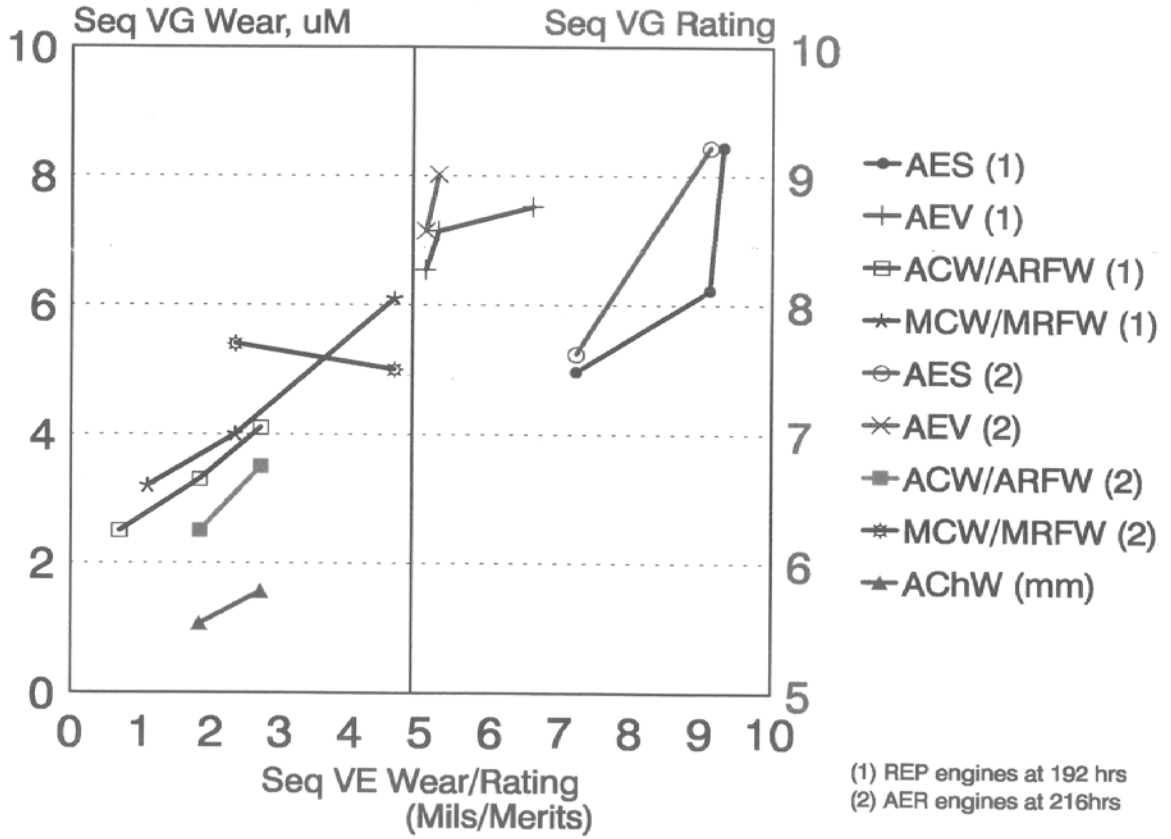


- 925-3 and 1006 are only two oils common to both tests
- Both 925-3 and 1006 are low wear oils in the Sequence VE
- All data shown are averages from the TMC database for each oil

R. Jensen
Ford Research
June 11, 2003

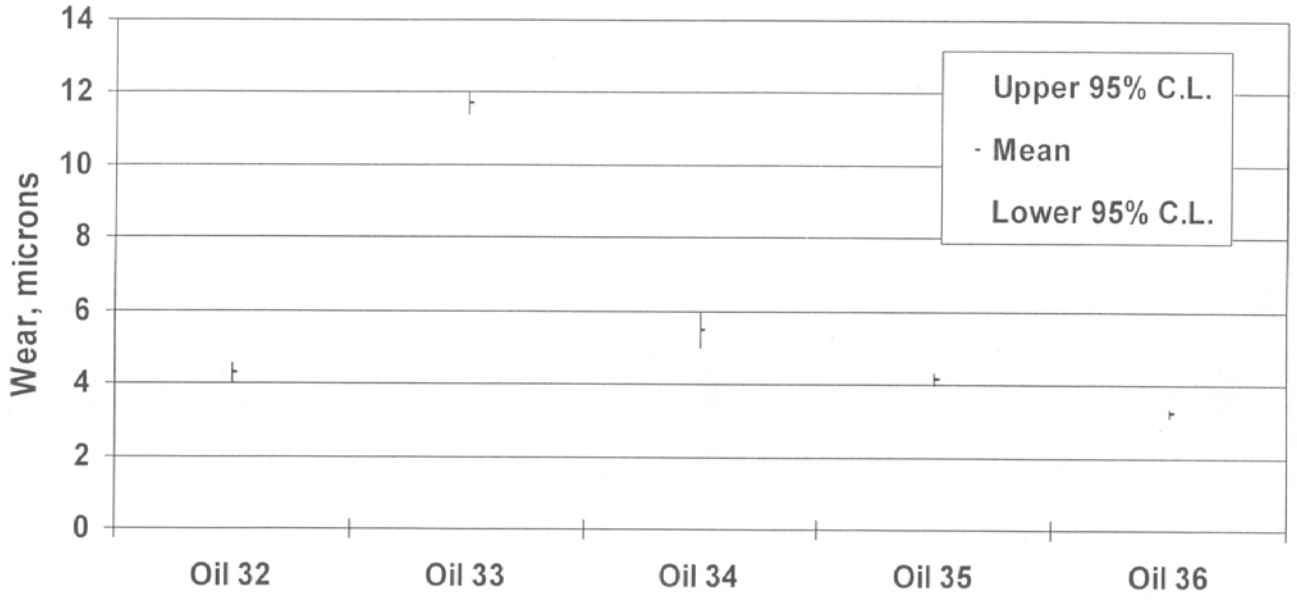
Seq VG/VE Comparison

Wear/Deposit



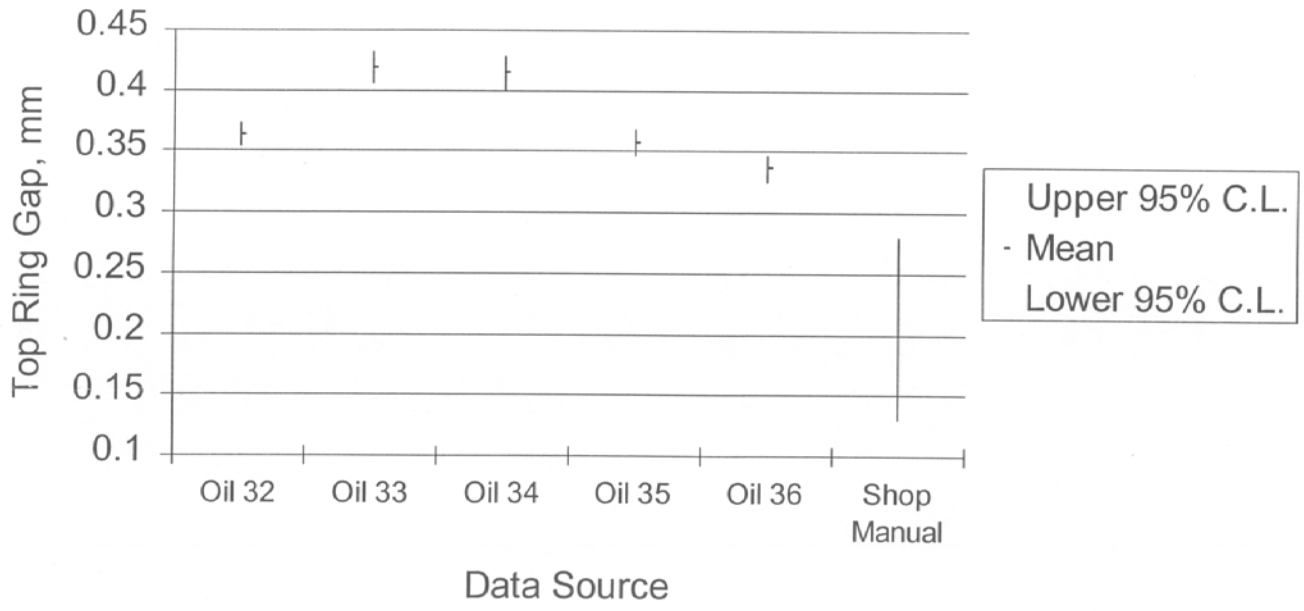
(1) REP engines at 192 hrs
(2) AER engines at 216hrs

100K Mile Roller Follower Pin Wear
Inspection of Two 4.6L V8 Engines Per Oil



Observation:The roller follower pin wear data is statistically different on all oils.

100K Mile Top Ring Gap Data



Observation; **The top ring gap data on the test oils is significantly different. The non-detergent\and non-ZDDP containing oils appear to result in higher top ring wear.**

Attachment 7

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Analysis of the Sequence VG Pin Wear and Ring Gap Increase from ACC Candidate Data

Presented at ILSAC/OIL
June 9, 2003

Data Compilation

- 328 Seq. VG Candidate Test Results Submitted by Four Companies and Compiled by the American Chemistry Council were Analyzed
- Phosphorous for each Candidate is Classified into one of three Categories
  - Less than 0.075%
  - 0.075% to 0.1%
  - Greater than 0.1%
- A Natural Log Transformation Appears to be Appropriate for Pin Wear and Ring Gap Increase

Summary & Conclusions

- Follower Pin Wear Intake is Positively Correlated with Follower Pin Wear Exhaust
- Average Ring Gap Increase is Positively Correlated with Maximum Ring Gap Increase
- There is Some Statistical Evidence that the Pin Wear and Ring Gap Responses Differ by Viscosity Grade
- There is No Statistical Evidence that the Pin Wear and Ring Gap Responses Differ by Phosphorous Level

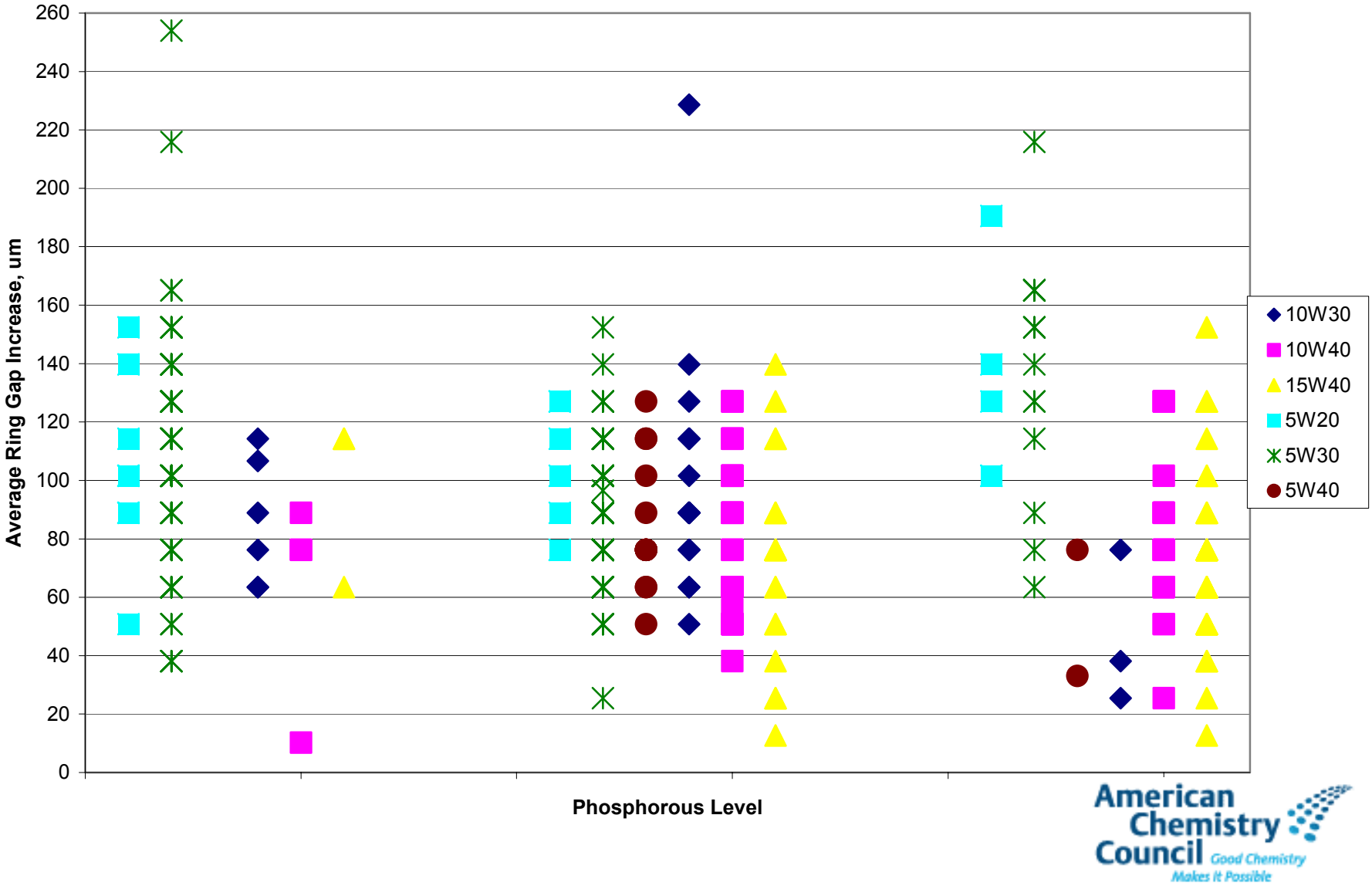
<u>Conclusion</u>

- Pin wear and ring gap do not appear to provide an indication of wear performance in the Sequence VG

Plots

- Scatter Plots of the VG Candidate Data

VG Average Ring Gap Increase as a Function of Viscosity Grade and Phosphorous Level



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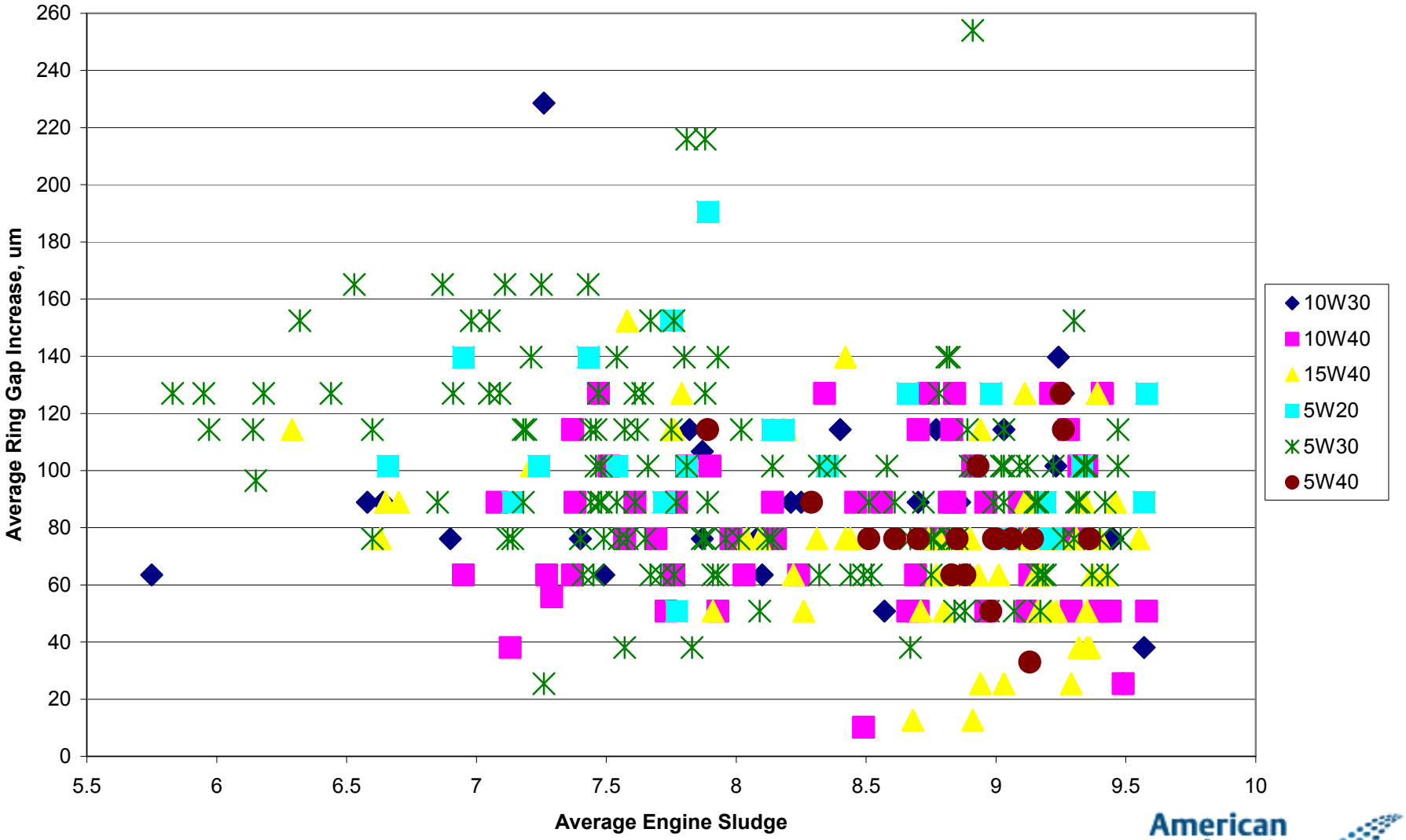
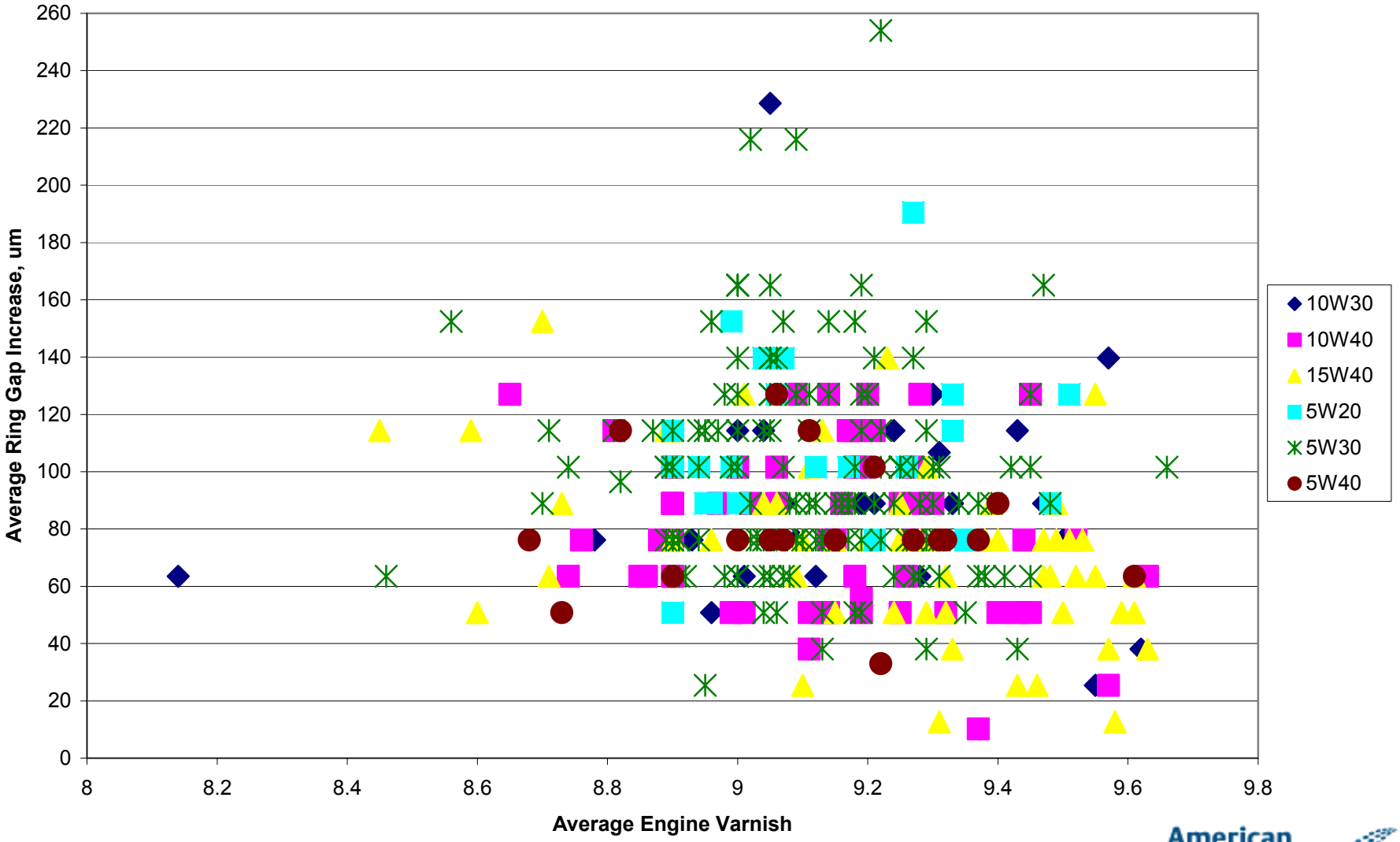
VG Average Ring Gap Increase as a Function of Viscosity Grade and Average Engine Sludge



American Chemistry Council Good Chemistry Makes it Possible

VG Average Ring Gap Increase as a Function of Viscosity Grade and Avg Engine Varnish



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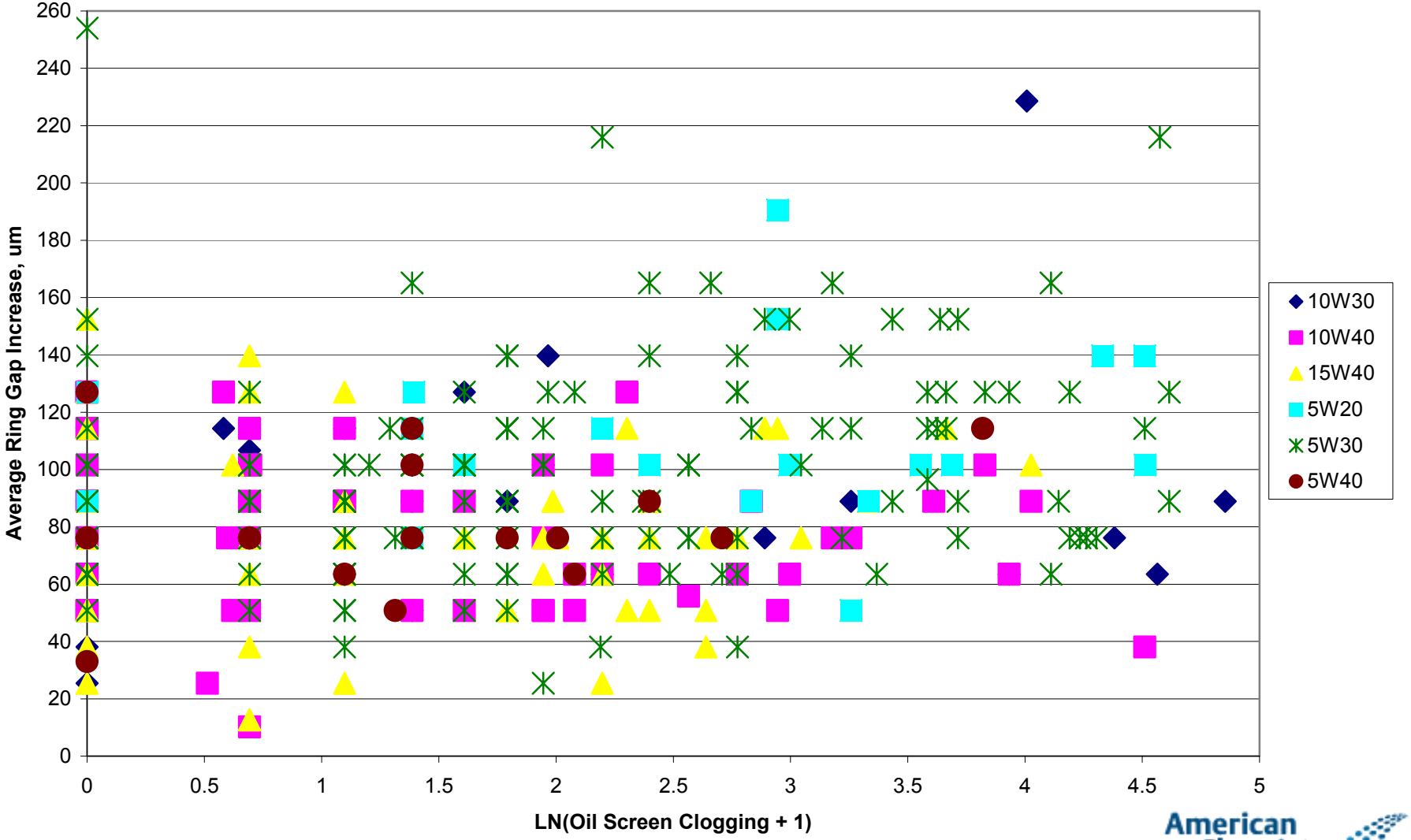
VG Average Ring Gap Increase as a Function of Viscosity Grade and Oil Screen Clogging



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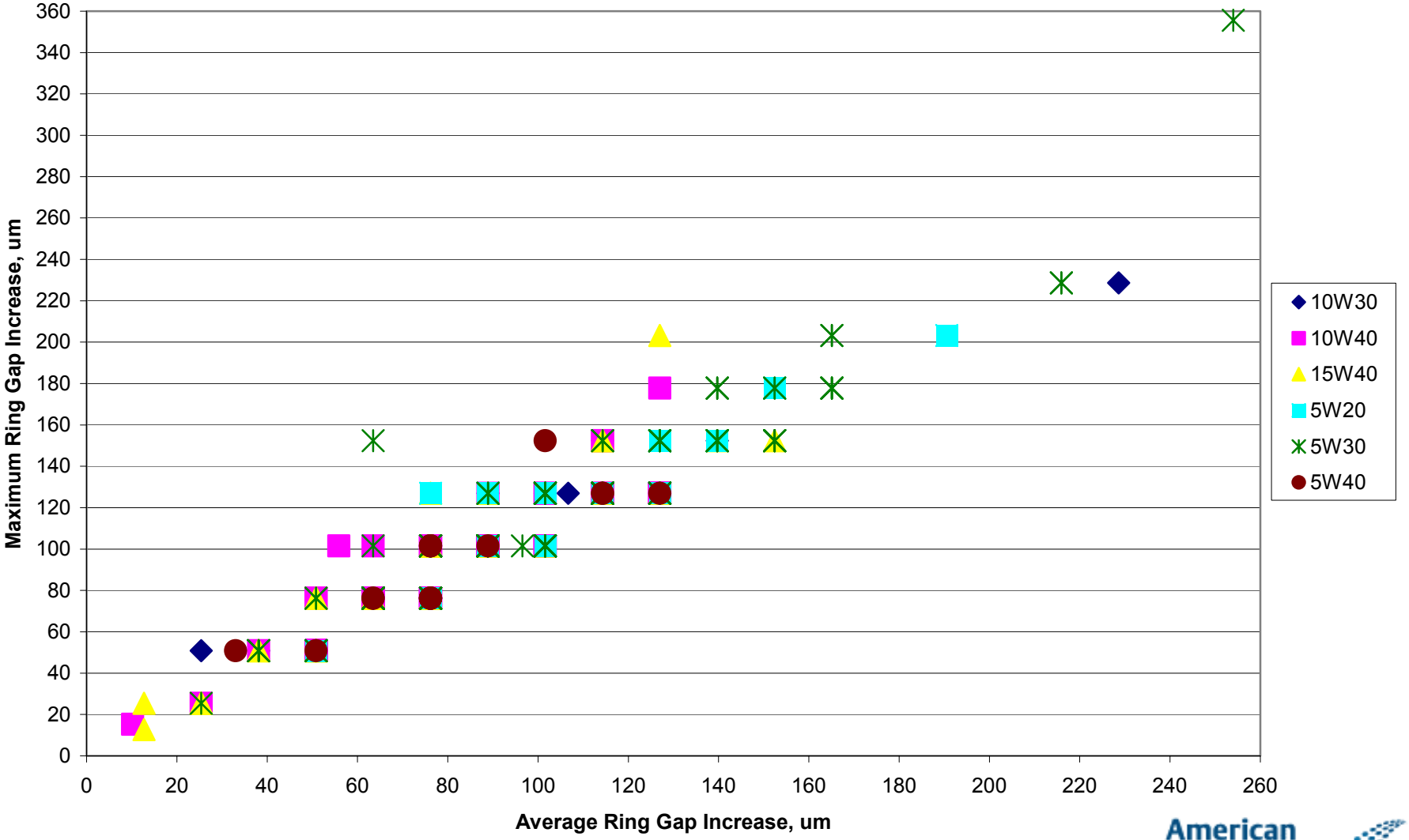
VG Maximum Ring Gap Increase as a Function of Vis Grade and Avg Ring Gap Increase



American Chemistry Council
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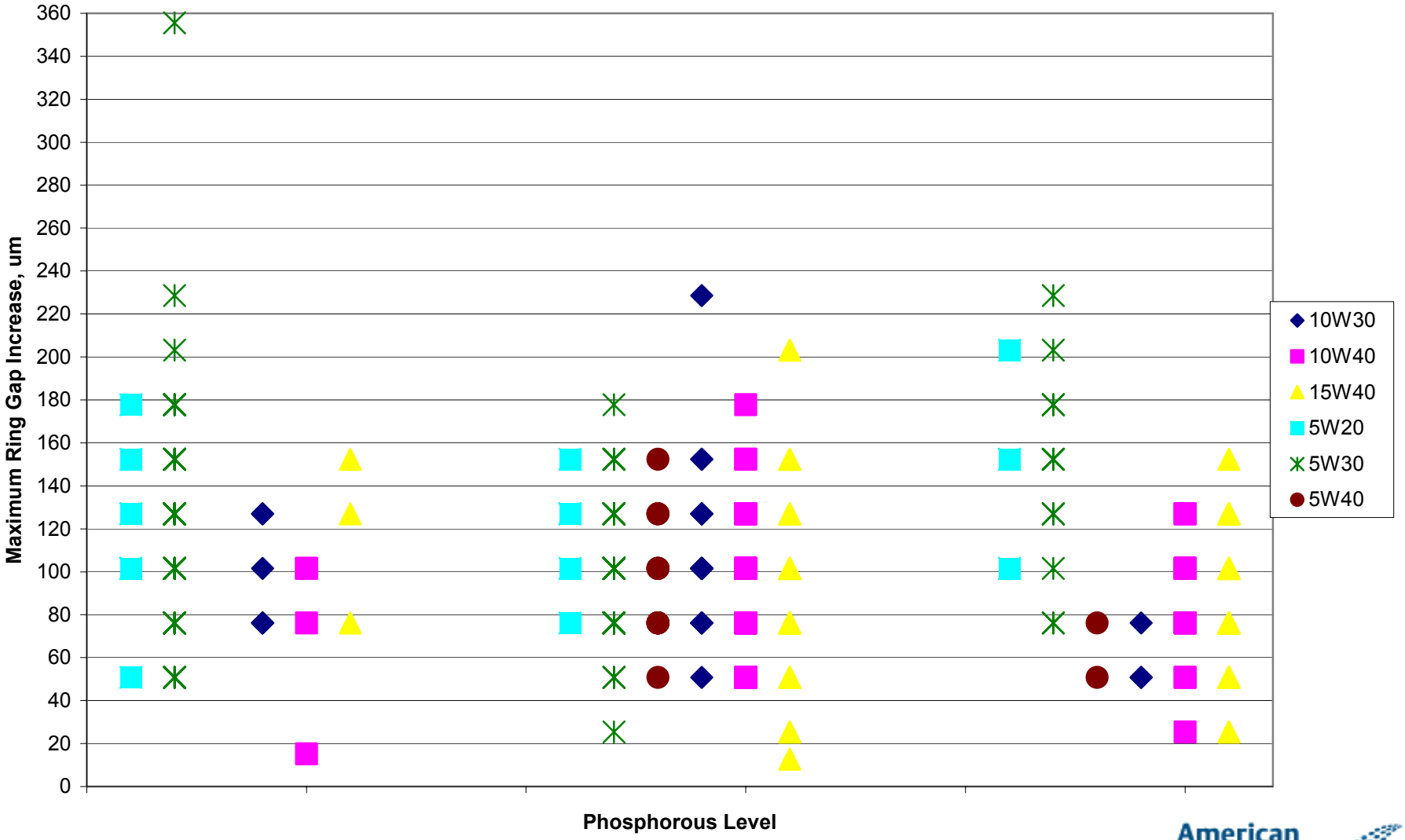
VG Maximum Ring Gap Increase as a Function of Viscosity Grade and Phosphorous Level



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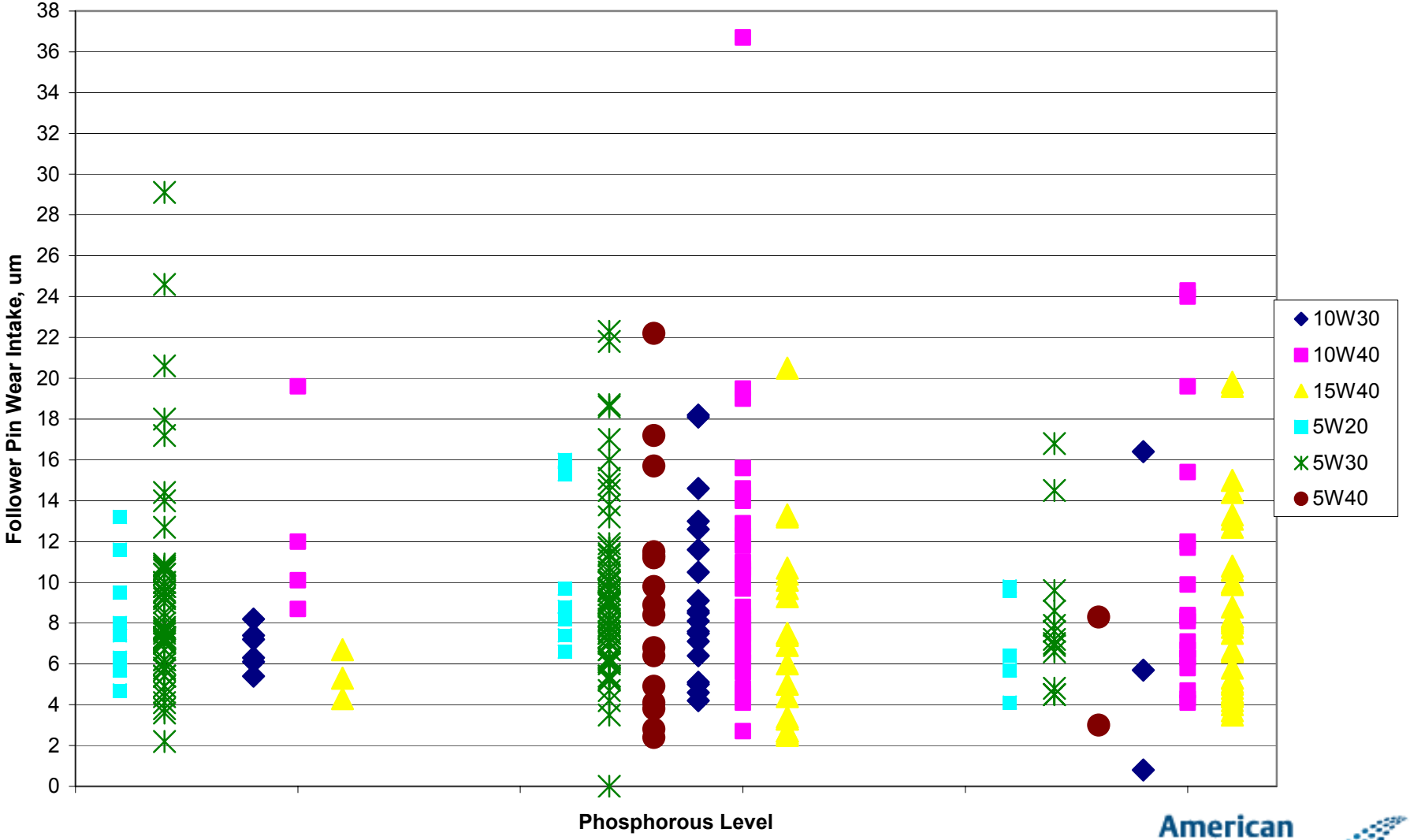
VG Follower Pin Wear Intake as a Function of Viscosity Grade and Phosphorous Level



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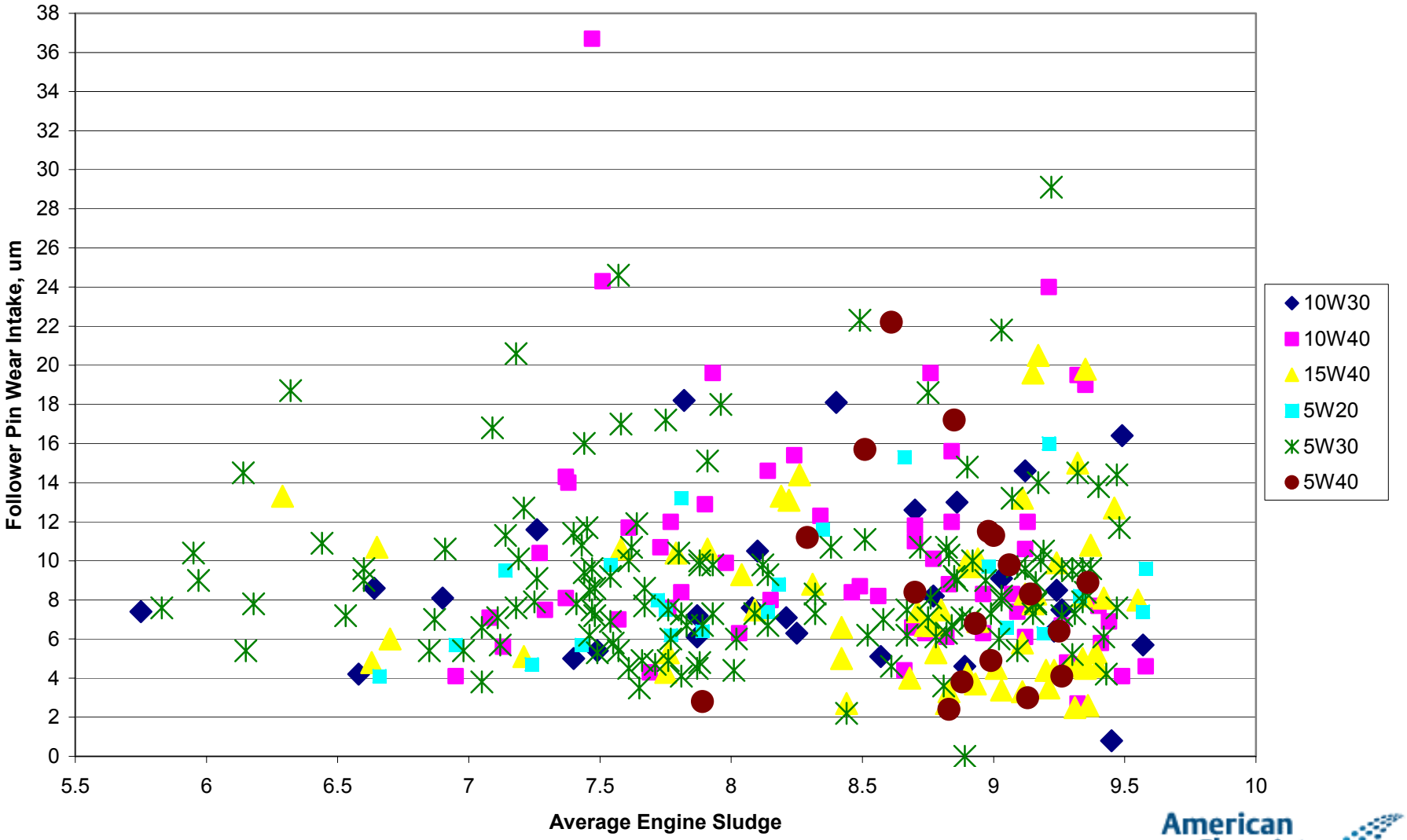
VG Follower Pin Wear Intake as a Function of Viscosity Grade and Average Engine Sludge



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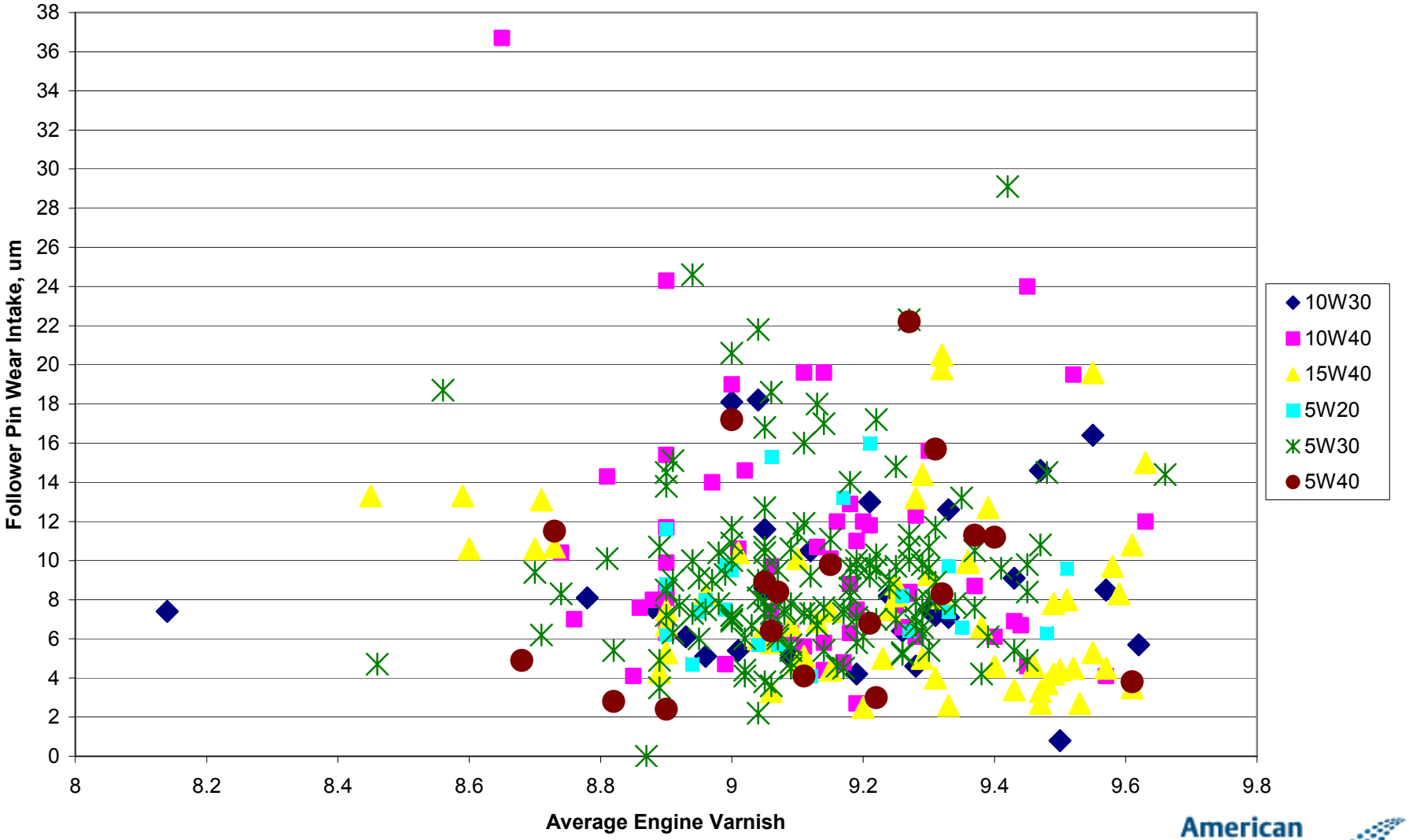
VG Follower Pin Wear Intake as a Function of Viscosity Grade and Average Engine Varnish



American Chemistry Council
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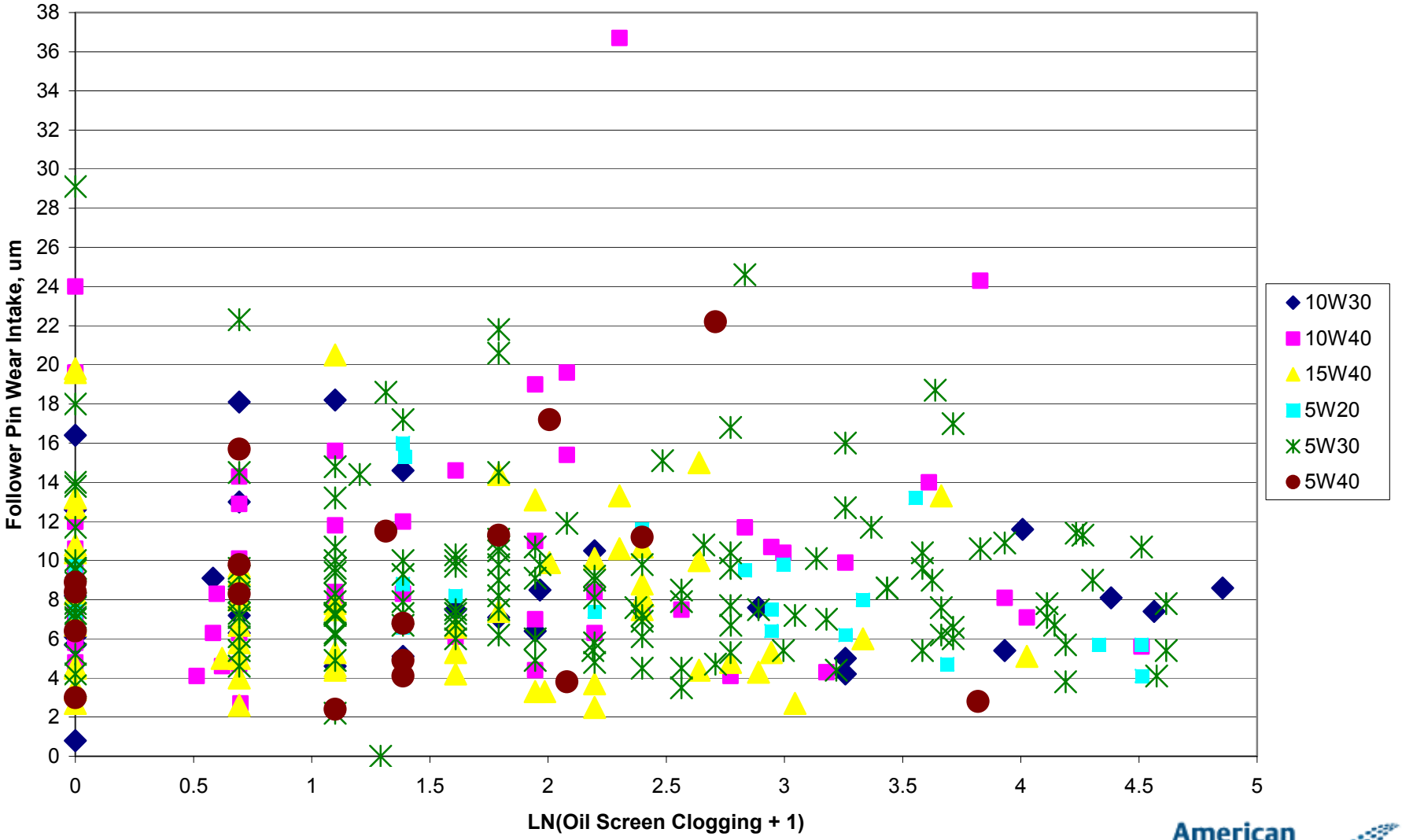
VG Follower Pin Wear Intake as a Function of Viscosity Grade and Oil Screen Clogging



American Chemistry Council
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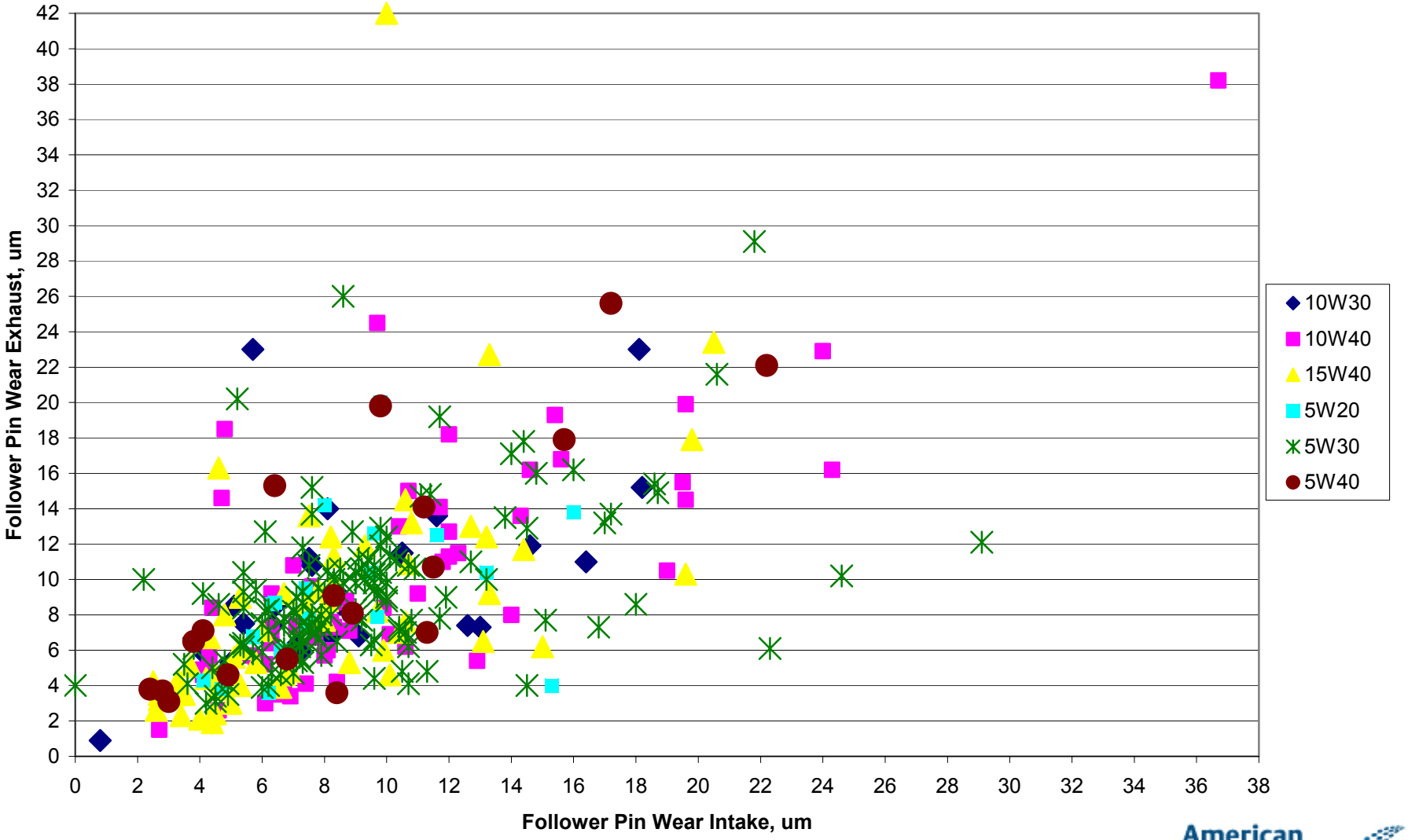
VG Follower Pin Wear Exhaust as a Function of Viscosity Grade and Pin Wear Intake



American Chemistry Council
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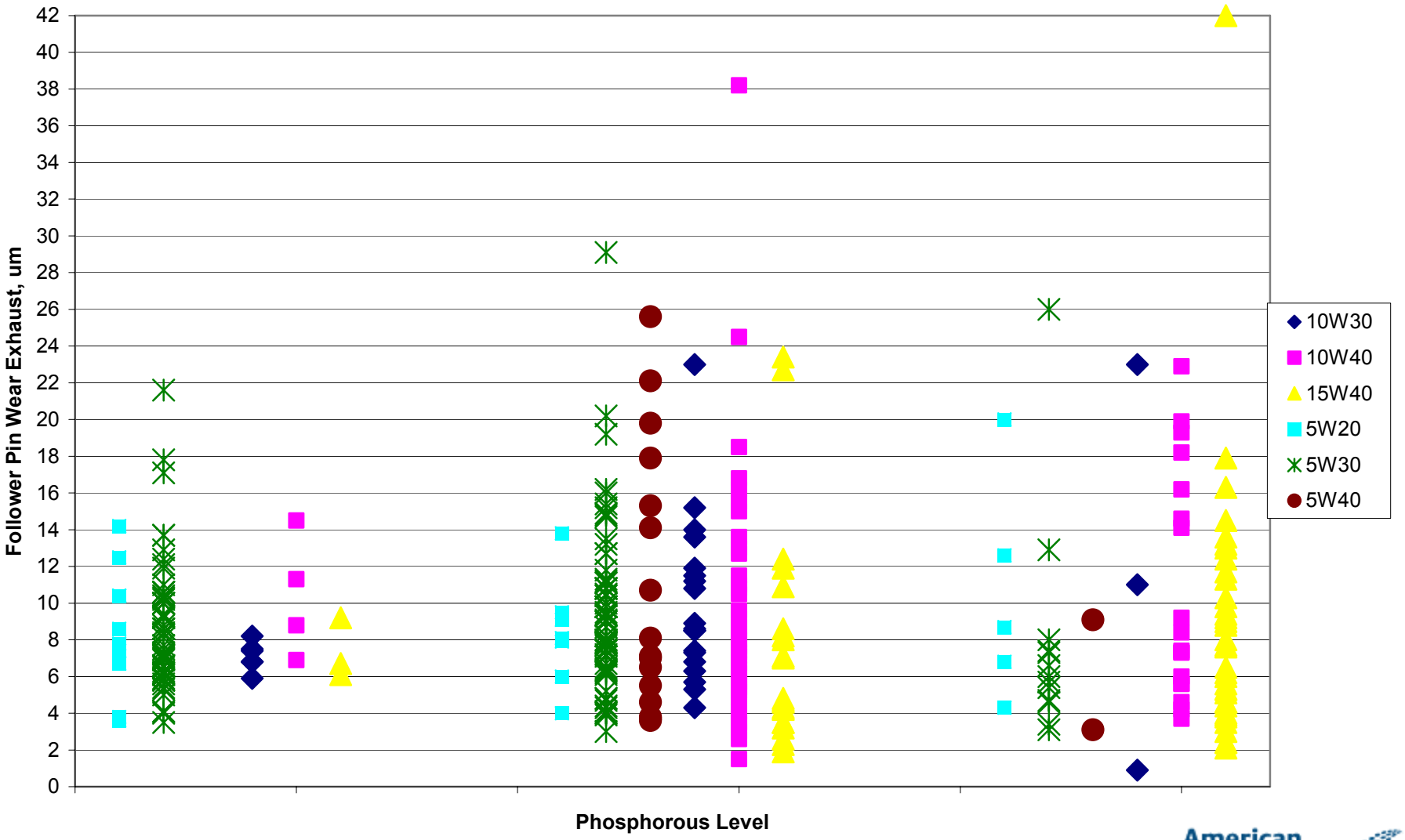
VG Follower Pin Wear Exhaust as a Function of Viscosity Grade and Phosphorous Level



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Data Summary

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Variable	N	Mean	Median	TrMean	StDev	Repeat S
Pin8I	328	9.037	8.000	8.648	4.712	4.79
Pin8E	328	9.229	8.000	8.724	5.355	7.38
Avg Ring Gap Inc	328	89.55	88.90	88.10	34.32	12.05
Max Ring Gap Inc	328	102.92	101.60	101.00	39.55	13.91

Variable	N	Mean	Median	TrMean	StDev	Repeat S
LN(Pin8I)	328	2.0827	2.0794	2.0874	0.4952	0.3698
LN(Pin8E)	328	2.0778	2.0794	2.0815	0.5436	0.6211
LN(ARG)	328	4.4160	4.4875	4.4380	0.4224	0.1862
LN(MRG)	328	4.5563	4.6210	4.5726	0.4172	0.1946

There were 5 degrees of freedom to calculate the standard deviation for repeats
1 5W30, 2 5W40, and 2 10W40 Oils were repeated

Data Summary

Variable		N	Mean	Median	TrMean	StDev
Pin8I	10W30	28	8.711	7.550	8.650	4.268
	10W40	59	10.332	8.400	9.692	6.004
	15W40	61	7.846	6.900	7.471	4.309
	5W20	22	8.532	7.750	8.380	3.170
	5W30	140	9.184	8.150	8.799	4.370
	5W40	18	8.82	8.35	8.38	5.43
Pin8E	10W30	28	9.511	8.350	9.323	4.911
	10W40	59	10.193	8.400	9.598	6.483
	15W40	61	8.298	6.700	7.487	6.451
	5W20	22	8.918	8.350	8.630	3.958
	5W30	140	9.067	8.250	8.679	4.224
	5W40	18	10.42	7.60	9.93	7.03
Avg Ring Gap Inc	10W30	28	90.44	88.90	87.63	37.51
	10W40	59	79.47	76.20	79.89	27.38
	15W40	61	74.53	76.20	74.12	29.92
	5W20	22	109.10	101.60	107.95	30.02
	5W30	140	98.30	88.90	96.22	36.16
	5W40	18	80.15	76.20	80.17	22.81
Max Ring Gap Inc	10W30	28	103.41	101.60	100.62	37.82
	10W40	59	91.53	101.60	91.06	32.04
	15W40	61	87.23	76.20	86.36	37.06
	5W20	22	122.38	127.00	121.92	33.84
	5W30	140	112.85	101.60	110.27	42.14
	5W40	18	91.72	76.20	90.49	27.74

Data Summary

Variable		N	Mean	Median	TrMean	StDev
LN(Pin8I)	10W30	28	2.027	2.022	2.080	0.601
	10W40	59	2.2022	2.1282	2.1913	0.5078
	15W40	61	1.9204	1.9315	1.9145	0.5341
	5W20	22	2.0829	2.0472	2.0820	0.3535
	5W30	140	2.1261	2.0980	2.1231	0.4290
	5W40	18	1.989	2.122	1.989	0.650
LN(Pin8E)	10W30	28	2.115	2.122	2.161	0.594
	10W40	59	2.1424	2.1282	2.1503	0.6143
	15W40	61	1.9007	1.9021	1.8856	0.6457
	5W20	22	2.0944	2.1218	2.0900	0.4508
	5W30	140	2.1113	2.1102	2.1060	0.4297
	5W40	18	2.129	2.026	2.121	0.680
LN(MRG)	10W30	28	4.5783	4.6210	4.5705	0.3542
	10W40	59	4.4407	4.6210	4.4695	0.4296
	15W40	61	4.3609	4.3334	4.3934	0.5101
	5W20	22	4.7680	4.8442	4.7827	0.2959
	5W30	140	4.6628	4.6210	4.6688	0.3597
	5W40	18	4.4759	4.3334	4.4757	0.3027
LN(ARG)	10W30	28	4.4267	4.4875	4.4339	0.4126
	10W40	59	4.3008	4.3334	4.3399	0.4319
	15W40	61	4.2107	4.3334	4.2495	0.4990
	5W20	22	4.6562	4.6210	4.6629	0.2786
	5W30	140	4.5237	4.4875	4.5291	0.3638
	5W40	18	4.3421	4.3334	4.3635	0.3092

Correlations

	AES	RCS	AEV	PSV	LN(OSC)	LN(8I)	LN(8E)	LN(ARG)
RCS	0.591							
AEV	0.540	0.555						
PSV	0.586	0.464	0.743					
LN(OSC)	-0.751	-0.391	-0.385	-0.358				
LN(8I)	-0.064	-0.003	-0.081	-0.142	-0.026			
LN(8E)	-0.065	-0.006	-0.113	-0.160	0.026	0.664		
LN(ARG)	-0.282	-0.107	-0.227	-0.224	0.202	0.128	0.159	
LN(MRG)	-0.267	-0.103	-0.187	-0.223	0.155	0.140	0.153	0.943

Linear Model and T Tests

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LN(Pin8I) = 1.96 + 0.090 10W30 + 0.265 10W40 + 0.172 5W20 + 0.204 5W30
+ 0.035 5W40 - 0.0792 Phos < 0.075 - 0.0601 Phos > 0.10

Predictor	Coef	SE Coef	T	P	VIF
Constant	1.96075	0.07746	25.31	0.000	
10W30	0.0898	0.1174	0.76	0.445	1.5
10W40	0.26512	0.09211	2.88	0.004	1.7
5W20	0.1718	0.1268	1.35	0.176	1.4
5W30	0.20373	0.08537	2.39	0.018	2.4
5W40	0.0352	0.1366	0.26	0.797	1.3
Phos < 0.075	-0.07924	0.07074	-1.12	0.263	1.3
Phos > 0.100	-0.06008	0.07334	-0.82	0.413	1.3

S = 0.4900 R-Sq = 4.2% R-Sq(adj) = 2.1%

Linear Model and T Tests
ILSAC Grades Only and Linear Phos

The regression equation is
LN(Pin8I) = 2.03 + 0.055 5W20 + 0.0983 5W30 - 0.0027 Phos Level

190 cases used 138 cases contain missing values
or had zero weight

Predictor	Coef	SE Coef	T	P	VIF
Constant	2.0323	0.1286	15.80	0.000	
5W20	0.0554	0.1289	0.43	0.668	1.6
5W30	0.09834	0.09416	1.04	0.298	1.6
Phos Lev	-0.00273	0.05080	-0.05	0.957	1.0

S = 0.4518 R-Sq = 0.6% R-Sq(adj) = 0.0%

Linear Model and T Tests

LN(Pin8E) = 1.92 + 0.208 10W30 + 0.235 10W40 + 0.198 5W20 + 0.211 5W30
+ 0.215 5W40 - 0.0339 Phos < 0.075 - 0.0240 Phos > 0.10

Predictor	Coef	SE Coef	T	P	VIF
Constant	1.91691	0.08573	22.36	0.000	
10W30	0.2076	0.1300	1.60	0.111	1.5
10W40	0.2351	0.1019	2.31	0.022	1.7
5W20	0.1984	0.1403	1.41	0.158	1.4
5W30	0.21068	0.09449	2.23	0.026	2.4
5W40	0.2145	0.1512	1.42	0.157	1.3
Phos < 0.075	-0.03394	0.07829	-0.43	0.665	1.3
Phos > 0.100	-0.02404	0.08118	-0.30	0.767	1.3

S = 0.5424 R-Sq = 2.6% R-Sq(adj) = 0.4%

Linear Model and T Tests
ILSAC Grades Only and Linear Phos

The regression equation is
LN(Pin8E) = 2.14 - 0.022 5W20 - 0.0061 5W30 - 0.0131 Phos Level

190 cases used 138 cases contain missing values
or had zero weight

Predictor	Coef	SE Coef	T	P	VIF
Constant	2.1394	0.1311	16.32	0.000	
5W20	-0.0218	0.1313	-0.17	0.869	1.6
5W30	-0.00612	0.09597	-0.06	0.949	1.6
Phos Lev	-0.01310	0.05178	-0.25	0.801	1.0

S = 0.4605 R-Sq = 0.1% R-Sq(adj) = 0.0%

Linear Model and T Tests

LN(ARG) = 4.16 + 0.243 10W30 + 0.112 10W40 + 0.448 5W20 + 0.328 5W30
+ 0.172 5W40 + 0.0654 Phos < 0.075 + 0.0752 Phos > 0.10

Predictor	Coef	SE Coef	T	P	VIF
Constant	4.16183	0.06349	65.55	0.000	
10W30	0.24284	0.09627	2.52	0.012	1.5
10W40	0.11156	0.07550	1.48	0.141	1.7
5W20	0.4476	0.1039	4.31	0.000	1.4
5W30	0.32781	0.06997	4.68	0.000	2.4
5W40	0.1719	0.1120	1.53	0.126	1.3
Phos < 0.075	0.06536	0.05798	1.13	0.260	1.3
Phos > 0.100	0.07523	0.06012	1.25	0.212	1.3

S = 0.4017 R-Sq = 11.5% R-Sq(adj) = 9.6%

Linear Model and T Tests
ILSAC Grades Only and Linear Phos

The regression equation is
LN(ARG) = 4.43 + 0.229 5W20 + 0.0970 5W30 + 0.0001 Phos Level

190 cases used 138 cases contain missing values
or had zero weight

Predictor	Coef	SE Coef	T	P	VIF
Constant	4.4265	0.1036	42.75	0.000	
5W20	0.2295	0.1038	2.21	0.028	1.6
5W30	0.09700	0.07582	1.28	0.202	1.6
Phos Lev	0.00011	0.04091	0.00	0.998	1.0

S = 0.3638 R-Sq = 2.6% R-Sq(adj) = 1.0%

Linear Model and T Tests

LN(MRG) = 4.33 + 0.230 10W30 + 0.0926 10W40 + 0.399 5W20 + 0.302 5W30
+ 0.141 5W40 + 0.0637 Phos < 0.075 + 0.0463 Phos > 0.10

Predictor	Coef	SE Coef	T	P	VIF
Constant	4.32967	0.06301	68.72	0.000	
10W30	0.23001	0.09553	2.41	0.017	1.5
10W40	0.09258	0.07492	1.24	0.218	1.7
5W20	0.3988	0.1031	3.87	0.000	1.4
5W30	0.30248	0.06944	4.36	0.000	2.4
5W40	0.1411	0.1111	1.27	0.205	1.3
Phos < 0.075	0.06370	0.05754	1.11	0.269	1.3
Phos > 0.100	0.04633	0.05966	0.78	0.438	1.3

S = 0.3986 R-Sq = 10.7% R-Sq(adj) = 8.7%

Linear Model and T Tests
ILSAC Grades Only and Linear Phos

The regression equation is
LN(MRG) = 4.59 + 0.189 5W20 + 0.0834 5W30 - 0.0055 Phos Level

190 cases used 138 cases contain missing values
or had zero weight

Predictor	Coef	SE Coef	T	P	VIF
Constant	4.5887	0.1005	45.64	0.000	
5W20	0.1890	0.1007	1.88	0.062	1.6
5W30	0.08337	0.07362	1.13	0.259	1.6
Phos Lev	-0.00548	0.03972	-0.14	0.890	1.0

S = 0.3532 R-Sq = 1.9% R-Sq(adj) = 0.3%

Sequence VG O&H and Surveillance Panel

June 11, 2003
8:00PM – 12:00 Noon
Romulus, Michigan

Motions and Action Items

1. We will hold a rebuild workshop at AER in July with an extra day for documenting all the rebuild details.
2. Ford should have the "final" solicitation letter regarding all the Romeo hardware by next week (June 19, 2003).
3. Motion made by Dan W and seconded by Bill B that the O&H panel be abolished and replaced with task forces as needed.