Address 100 Barr Harbor Drive
PO Box C700
W. Conshohocken, PA
19428-2959 | USA

Phone 610.832.9500
Fax 610.832.9555
e-mail service@astm.org
Web www.astm.org

Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

Chairman: W. JAMES BOVER, ExxonMobil Biomedical Sciences, 1545 Route 22 East, PO Box 971, Annandale, NJ 08801-0971, (908) 730-1048, Fax: (908) 730-1151, e-mail: w.j.bover@exxonmobil.com
First Vice Chairman: KENNETH O. HENDERSON, Cannon Instrument Co., 30 Doe Dr., Port Matilda, PA 16870, (814) 353-8000 ext:265, Fax: (814) 353-8007, e-mail: kenohenderson@worldnet.att.net
Second Vice Chairman: SALVATORE J. RAND, 221 Flamingo Dr., Fort Myers, FL 33908, (239) 481-4729, Fax: (239) 481-4729, e-mail: sjrand@earthlink.net
Secretary: MICHAEL A. COLLIER, Petroleum Analyzer Co. LP, PO Box 206, Wilmington, IL 60481, (815) 458-0216, Fax: (815) 458-0217, e-mail: macvarlen@aol.com
Assistant Secretary: JANET L. LANE, ExxonMobil Research & Engineering, 600 Billingsport Rd., PO Box 480, Paulsboro, NJ 08066-0480, (856) 224-3302, Fax: (856) 224-3616, e-mail: janet.l.lane@exxonmobil.com
Staff Manager: DAVID R. BRADLEY, (610) 832-9681, Fax: (610) 832-9668, e-mail: dbradley@astm.org

February 23, 2004

Reply to: Sid Clark
GM Powertrain
823 Joslyn Rd.
Pontiac, MI. 48340-2920
MC 483-730-322
Phone: 248-857-9959
Fax: 248-857-4425
Sidney.l.clark@gm.com

Unapproved minutes of the October 28, 2003 Sequence III Operations and Hardware Subpanel Meeting San Antonio, Texas

The meetings were held at Southwest Research Institute building 209. Mr. Pat Lang, chairman of the Sequence III O&H subpanel called the meetings to order at 09:00

Secretary and Motion & Action Item Recorder – Sid Clark volunteered to act as secretary and Jason Bowden volunteered to be the motion and action item recorder for this meeting.

Approval of the May 3, 2001 minutes – After minimal discussion with no changes requested, the panel voted to approve the May 3, 2001 minutes.

Membership – Since it has been some time since the last meeting, Mr. Pat Lang circulated a blank sign-in sheet for those present to sign. An electronic copy of the sign-in sheet will be distributed for future use, identifying voting membership and attendee participants. (**Attachment #1**)

Agenda Items – (Attachment #2)

Minutes of the O&H Meeting:

Fuel Pressure:
Mr. Pat Lang indicated that the Sequence IIIF and IIIG test procedures specify a control pressure at the fuel rail of 365 kPa +/- 6.9 kPa (52.94 +/- 1psi). Mr. Mike Kasimirsky indicated that he has seen fuel rail pressures as high as 400 kPa during laboratory visits. As he recalled, the pressure specification was specified as a minimum pressure. Mr. Sid Clark provided a diagram of the fuel system (**Attachment #3**) indicating the pressure to be set at 53 psi. and commented that the original intent during development of the IIIF test was to have the Weldon pressure regulator control the pressure and not the regulator on the fuel rail during test operation. Conversation continued about the control capability of the PCM, which controls AFR by adjusting the injector pulse width using input from the O_2 sensor readings. The concerns of the panel are that fuel rail pressure does not have a range specified and laboratories are running different pressures.

Motion #1: Sid Clark / Mike Kasimirsky – Change the fuel rail pressure specification from 365 kPa to a range specification of 365 to 390 kPa for both the Sequence IIIF and IIIG tests. The motion passed. Unanimous.

Mr. Mike Kasimirsky said he would incorporate the changes into both procedures.

Review of the July 2003 IIIG rating workshop data: (Attachment #4)
TMC Memorandum 03-074 (Summary of workshop data).
Mr. Pat Lang briefly discussed the summary data and expressed concern about the variation in the under crown ratings. Comment from the raters indicated that the area is not clearly specified in the procedure. Mr. Mike Kasimirsky referred everyone to section 13.4.2.1 in the IIIG procedure which states; "The undercrown area to be rated is defined as the area on the undercrown area of the piston that resembles a common adhesive bandage." Mr. Lang indicated that the raters seem to be having a problem because the area rolls up the inside of the piston skirt and the raters would like a better definition of how much of the area to consider during their rating.

Action Item:
As an action item it was decided that Mr. Kasimirsky will ask Scott Parke if the current description of the under crown rating area of the piston, as described in the procedure, is acceptable. If not, what changes will be needed for clarification to assist the rater?

Mr. Lang also commented that the piston ring groove ratings are an area of variability in the WPD rating. The procedure does not specify a method for cleaning the oil residue

from the groove prior to rating. Mr. Kasimirsky also commented that CRC Manual 20 does not clearly specify the cleaning of grooves prior to rating.

Secretary comment:
Looking at CRC Manual 20, Page 79 section III. Preparation for Rating, second paragraph does indicate that pistons may be cleaned with solvent and air dried, unless otherwise specified.

Mr. Charlie Leverett expressed concern about cleaning of ring grooves prior to rating and suggested that we pole the raters at each laboratory to find out what each rater is doing before taking any action on this subject. The topic was tabled until further information is received.

Conversation switched to rater calibration and Mr. Kasimirsky reminded the panel that there is no formal requirement for calibration of raters. Mr. Dwight Bowden recalled that at one time the Technical Guidance Committee recommended rater calibration. Mr. Tom Franklin indicated that as an alternative to that request, raters were to meet annually and participate in a CRC Rating Workshop to be considered qualified to rate Sequence Tests. The panel was reminded that in June 2003, as directed by the Sequence III Surveillance Panel, a IIIG Test Specific Rating Workshop was conducted on July 15-16, 2003 in San Antonio Texas.

Mr. Charlie Leverett made a motion that all Sequence III raters attend a rating workshop annually in order to be qualified. Subsequent discussions disclosed major concerns by some of the laboratories about rater availability and the repercussions if a rater was unavailable to attend the scheduled workshop. After lengthy discussion, Charlie withdrew his motion for lack of a second. Mr. Dwight Bowden attempted to make a motion that all raters be required to attend a CRC Rating workshop annually and again the discussion centered around the repercussions at the laboratory level if raters were unable to attend the scheduled workshop. After lengthy discussions and reading of the requirements in the 1R test, the following motion was made:

Motion #2: Dwight Bowden / Mike Kasimirsky- Recommend to the Sequence III Surveillance Panel that all raters who rate Sequence III parts must attend a rater workshop within a 12 month period. If a rater misses the scheduled workshop, he or she must attend an alternate workshop within 90 days, as defined by the Test Monitoring Center. Motion passed unanimous

Honing:
Mr. Sid Clark reviewed the Sequence IIIG Honing Update presentation given to the ILSAC / Oil group on October 21, 2003 (**Attachment #5**). He followed that presentation with one prepared for the O&H Subpanel outlining the refinements incorporated at PerkinElmer with additional information as agreed upon by the Honing Task Force and O&H Subpanel chairmen (**Attachment #6**).

After review of the aforementioned presentations, the panel members discussed the refinements as outlined and Mr. Bill Nahumck told the panel that he sees the refinements as something that enhances the procedure. Mr. Charlie Leverett wanted the panel to know that he worked on these refinements prior to the formation of the Honing Task Force and that he put this procedure together prior to the surface finish data collection on the Honing Task Force round robin engine blocks. Conversation continued with people expressing their concerns about the potential benefits to early oil consumption rates with different volatility oils. The panel agreed that we should continue plans to have Sunnen calibrate all honers and adopt the honing recommendations including a detailed process for breaking in new honing stones.

Mr. Sid Clark made a motion, seconded by Charlie Leverett, to recommend to the Sequence III Surveillance Panel to adopt the honing refinements as outlined with calibration of all honers by Sunnen and additional recommendations for new stone break-in procedures. After lengthy discussion, Mr. Clark withdrew his motion and it was agreed by the panel that the Honing Task Force should continue their investigation including the following action items.

Action Item:
The Honing Task Force will continue their investigation looking into:

1. Sunnen calibration of all industry honers including proper counter weight configuration.

2. Establishing break-in procedures for EHU 512 stones and 731 Plateau brushes

3. Determine if there is any merit in recording batch code information for the EHU 512 stones, 731 Plateau brushes, and LP8X-55 honing fluid.

4. Conduct a Phase III Round Robin exercise having each laboratory hone all six cylinders using a sixth run block incorporating the proposed honing refinements.

Mr. Bob Olree commented that as Test Sponsor, he felt that if any laboratory chose to incorporate the proposed honing refinements, they should be allowed to do so. After discussion the following motion was made.

Need info, motioner and seconder was not recorded by Motion Recorder or Secretary.
Motion#3: _____ / _____
Accept the changes to the honing process and update the procedure and assembly manual as necessary. After Sunnen has calibrated all honing machines, laboratories will be allowed to incorporate this process bringing it into their lab with a reference.
Passed unanimous.

Parts Washing:
Mr. Pat Lang reviewed new and used ICP data generated by Southwest Research and PerkinElmer during development studies on the NAT 50 soap solutions used in the

automated parts washers. After lengthy discussions, Mr. Charlie Leverett expressed concern that we should recommend at least a minimum change interval or required soap addition interval. After further discussion the following motion was made.
Motion #4: Charlie Leverett / Dwight Bowden – Change the automated parts washer soap and water solution a minimum of every six months.
Passed unanimous.

Oil Leveling
The group discussed variations in end of test milliliters low oil level reporting. Some laboratories have been reporting the end of test milliliters low level on form 5, accounting only for the 236ml analysis sample that was not added back and some labs were accounting for the 472ml new oil that is not actually added back plus the 236 ml analysis sample that was not added back. Despite this difference, Pat Lang noted that the actual oil consumption computation reported as the end of test oil consumption has always been reported correctly. After discussion and clarification, Mr. Charlie Leverett and Mr. Mike Kasimirsky made the following motion:

Motion #5 Charlie Leverett / Mike Kasimirsky – All end of test milliliters low reporting on form 5 will be recorded using the End-of-test reporting format (final oil sump level – 236 – 472) as outlined in the 100 hour end of test oil level column on the oil level worksheet. Passed Unanimous.

Process controller
Mr. Sid Clark presented industry data showing the acceptable valves and actuators that have been used throughout the industry on various process controllers. He also presented a table outlining the recommended process controller component configuration. (**Attachment #7**) The panel discussed allowable configurations and made the following motion.

Motion # 6: Mike Kasimirsky / Charlie Leverett – Incorporate the list of recommended valves and actuators that have been successfully incorporated on the fluid process control modules into section 6.6 of the procedure. Passed Unanimous

The following items were considered general housekeeping and discussions involved general information and motions for procedural clarification.

Valve cover gasket material
It was noted that the silicone material for the valve cover gaskets had changed. The new material (Black) has been used in the past and is a more robust material, which resists shrinkage in high temperature applications. No part number change is required and the panel agreed no action was necessary for approval of its use.

Block cleaning prior to honing
The panel discussed the need for cleaning highly oxidized oily deposits from the engine block in the spray booth and or the Better Engineering Parts Washer prior to honing. The

panel decided that Charlie Leverett would look into this matter as the Honing Task Force Chairman and take appropriate action if necessary.

Crankshaft Main Bore Mandrel
The panel discussed the required usage of the main bore mandrel. The following motion was made:

Motion- Charlie Leverett / Sid Clark – Make the usage of the crankshaft main bore alignment checking mandrel optional in the procedure. Passed Unanimous

Paint removal from test rings
The panel discussed the requirements to remove paint identification markings from engine test parts, i.e., crankshafts, connecting rods, blocks, and piston rings. The panel decided it was not necessary to remove the paint identification markings on the crankshafts, connecting rods and engine blocks, however, it is necessary to remove the paint from the piston rings prior to testing. The following motion was made.

Motion Charlie Leverett / Pat Lang – Require that all piston ring paint identification markings be removed using acetone followed by cleaning with a soft cloth and mineral spirits. Passed Unanimous

Dow Corning Silicone Sealer
The panel discussed the use of Dow corning silicone sealer on the front harmonic balance lip seal in the engine front cover. It was noted that the test sponsor had previously approved of the use of this sealer to aid in preventing the seal from backing out of the front cover. The following motion was made:

Motion Charlie Leverett / Sid Clark – Add the use of the Dow Corning RTV Sealer, grade 3154 in addition to the currently used GM Black Silicone Sealer to the procedure. Passed Unanimous

OHT Test Oil Filter
It was noted that the correct oil filter was not listed in table A2.1. The following motion was made:

Motion Charlie Leverett / Pat Lang – Add the OHT oil filter part number OHT3F-057-3 to table A2.1. Passed Unanimous

Main Blots
Mr. Dwight Bowden indicated that one laboratory experienced crankshaft main bearing binding that apparently was eliminated by changing from used to new main bearing bolts. The panel discussed the changing of the crankshaft main bolts each test. Mr. Sid Clark noted that the main bearing bolts are not yield fasteners and his understanding was that the laboratory also changed crankshafts and engine bearings during their attempt to identify the binding problem. The following motion was made:

Motion Dwight Bowden / Charlie Leverett – Recommend to the Sequence III Panel that laboratories change main bearing bolts, using new bolts for every test. Passed Unanimous

Mr. Pat Lang opened the floor for discussion asking if any laboratories had recently experienced startup connecting rod bearing failures? Two laboratories reported experiencing failures in the past year. One of the laboratories indicated that the failure may not have been build or hardware related. The panel will continue to monitor this type of failure.

Mr. Charlie Leverett discussed laboratory instrument calibration for dual referenced stands. The question was brought up as to allowing a calibration "grand fathering" if you did an instrument calibration/run for one test type and started a calibration test for the other test type within a 30 day period (would not actually have to perform the instrumentation calibration for the second test type if it was stated within one month of the first calibration). The panel did not support this and it was tabled for discussion at a future Surveillance or O&H Meeting.

Measuring device accuracy
Mr. Mike Kasimirsky identified discrepancies in procedural requirements for pre and post measurements of test components and the actual accuracy of the measuring devices being used. The following motion was made:

Motion Mike Kasimirsky / Sid Clark – Change the required measuring instrument accuracy specification from 0.001mm to 0.01mm accuracy for the Sequence III tests. Passed Unanimous

Test Oil Assembly usage
The panel members discussed the assembly of test engines using EF-411 and test oil. The panel acknowledged the required use of EF-411 during engine assembly for the entire engine with exception of the final installation of the camshaft, which should use the actual test oil. Discussion revolved around pre test measurement of camshafts and what should be used to protect them prior to final installation. The panel agreed that the camshafts should be coated using EF-411 after pre-test cleaning and measurement. The following motions were made:

Motion Bill Nahumck / Dwight Bowden – After making pre-test measurements, the camshaft must be coated with EF-411 before being put into storage. Passed Unanimous

Motion: Pat Lang / Charlie Leverett – The camshaft must be coated using the test oil on all lobes during installation into the engine block. Upon final assembly, the test lifters should also be installed using the double dip and rotate method as outlined in the procedure using the test oil. Passed Unanimous

The panel briefly discussed the flushing procedures and how laboratories are interpreting and performing the single pass neutralization portion of the flushing procedures. This topic remains of concern and shall be discussed at a future date.

There was no old business discussion

There was no new business discussion

The meeting was adjourned at 15:34

The next meeting will be at the call of the chairman.

Sequence IIIF/G Operations and Hardware Panel Attendance List

Name/Address	Phone/Fax/E-mail	Signature
Ray Seiz 4335 Piedras Dr. W. Ste 101 SA TX 78239	210-732-8123 Ex 12 732-8480 Ray.Seizo Infineum.com	
BETO ARAIZA - TEI 12718 CIMARRON PATH SAN Antonio, Tx. 78249	210-877-0222 - Dirct 210-690-1958- TEI 690-1959-Fax BARAIZA@TEI-NET.COM	
JOE NOLES for GORDON FARNSWORTH	908-474-2796 JOE.NOLES@Infineum.com	
WILLIAM NAHNICK LUBRIZOL 29400 Lakeland Blvd Wickliffe, OH 44092	440-347-2596 440-347-4096 WMN@lubrizol.com	
LARRY HAMILTON LUBRIZOL 29400 LAKELAND BLVD WICK., OH 44092	440-347-2326 440-347-4096 LDHA@LUBRIZOL.COM	
MONICA BEYER - LUBRIZOL 29400 LAKELAND BLVD WICKLIFFE, OH 44092	440-347-2006 440-347-4096 MBEY@Lubrizol.com	
Bob Olree M/C 483-730-322 823 Joslyn Rd Pontiac, MI 48340-2920	248-857-9989 248-857-4425 robert.olree@gm.com	

Sequence IIIF/G Operations and Hardware Panel Attendance List

Name/Address	Phone/Fax/E-mail	Signature
DWIGHT BOWDEN	440. 354. 7007 (F) 440. 354. 7080 DHBOWDEN@OHTECH.COM	
Jason H. Bowden	440-354-7007 440-354-7080 Jhbowden@ohtech.com	
Michael T. Kasimirsky	412-365-1033 412-365-1047 (fax) mtk@astmtmc.cmu.edu	
Timothy L Caudill	606-329-1960 x5708 606-329-2044 TLCAUDILL@ASHLAND.COM	
Mark Mosher	856-224-2132 856-224-3628 (fax) mark.r.mosher@exxonmobil.com	
DAVID L. GLAENZER	804 788 5214 804 788 6358 dave_glaenzer@ethyl.com	
MARK SUTHERLAND FOR MARK COOPER	mawc@chevrontexaco.com	

Sequence IIIF/G Operations and Hardware Panel Attendance List

Name/Address	Phone/Fax/E-mail	Signature
TOM FRANKLIN	210 647 9446 Tom.franklin@perkinelmer.com	
Charlie Leverett	210 647-9422 charlie.leverett@perkinelmer	
Sid Clark GM Powertrain mc-483-730-322 823 Joslyn Rd. Pontiac, MI 48340-2920	248-857-9959 Fax 248-857-4425 Sidney.L.Clark@GM.com	
Johnny DeLa Zerda Perkin Elmer Auto Research 5404 Bandera Rd San Antonio TX 78238	210-523-4621 Fax - 523-4607 Johnny.delazerda@perkinelmer.com	

SEQUENCE III OPERATIONS and HARDWARE MEETING

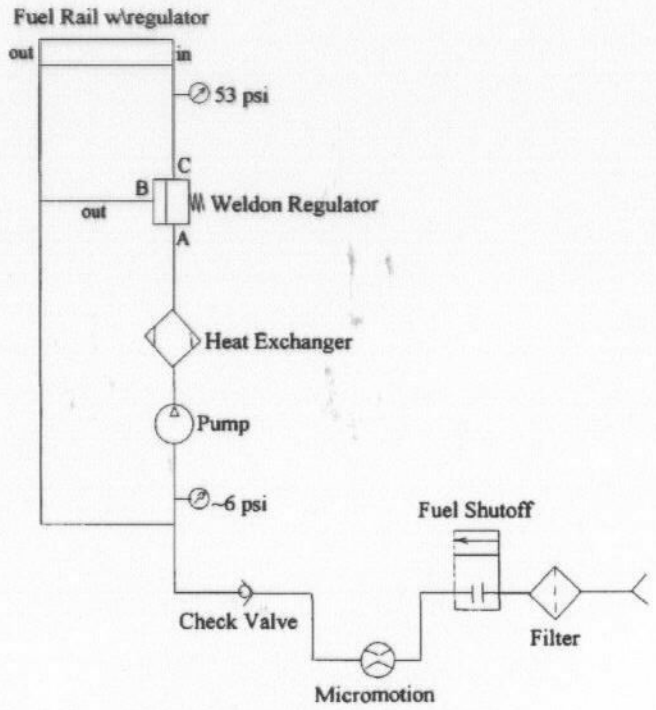
SOUTHWEST RESEARCH INSTITUTE
SAN ANTONIO, TEXAS
OCTOBER 28, 2003
SwRI Campus, Building 209
9:00 AM – 5:00 PM

1. Appointment of a meeting Secretary
2. Approval of the May 3, 2001 meeting minutes
3. Membership list

AGENDA

1. Fuel pressure specification, procedure section 6.11
2. Review rating workshop data, TMC Memo 03-074 (23 July 03)
3. Engine Block Honing
    a) PerkinElmer presentation on recent honing enhancements
    b) Review of honing task force data
    c) Watt meters
    d) Torque meter for honing head (Sunnen to calibrate all units)
4. Automatic parts washing machine
    a) PDN-50 vs. NAT-50 soap in the automatic parts washer
    b) Water change interval
5. Final documentation on specifying the fluid control rack
6. Determine the appropriate value to be reported in the "milliliters-low" field for the EOT oil level on Form 5 of IIIF/G test reports
7. New valve cover gasket (black)
8. IIIG procedure section 10.5.3.1 item 4 says to block off all coolant passages prior to putting the engine block into the parts washer; is this still necessary?
9. Is the use of the main bore mandrel still necessary?
10. Paint removal on crankshafts, connecting rods and piston rings
11. Miscellaneous procedure/ EAM corrections:
    a) New spring calibration range for IIIG
    b) Engine block part number should be 24502286 not 24506028
    c) Allow use of gray silicone?
    d) Crank position sensor shield part number change
    e) Add oil filter part number to table A2.1
    f) Section 1, sheet 5 of the EAM needs to be worded to agree with 10.5.3.1 of the ASTM procedure, regarding cleaning block
12. Replacement of main bearing bolts every test
13. Connecting rod bearing failures; are labs still seeing them?
14. Instrumentation calibration every six months; can this be adjusted for dual referenced stands?

Process Controller Fuel Flow Diagram



Fuel rail pressure controlled at 53 PSI using Weldon Regulator

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

MEMORANDUM: 03-074

DATE: July 23, 2003

TO: Sequence III Surveillance Panel

FROM: Scott Parke

SUBJECT: IIIG Rating Workshop

The IIIG rating workshop requested by the Sequence III Surveillance Panel in its June meeting was held July 15-16, 2003. Compilation of the data produced during the workshop is now completed and is available on the TMC's website at the following URL:

ftp://ftp.astmtmc.cmu.edu/refdata/gas/rating_workshop_data/iiig_2003_july/all_data.pdf

SUMMARY:

Fourteen raters attended the workshop. One calibration piston was rated followed by sixteen of the IIIG matrix pistons. The parts used in this workshop were identified by O&H Chairman Pat Lang as being of particular interest to the IIIG panel. All raters rated all parts. Among the data calculated for each piston is the standard deviation on each rated area and the range of the data for each rated area. The average across all 17 pistons for each area is shown in the table below.

	Groove 1	Groove 2	Groove 3	Land 2	Land 3	Under-crown	Thrust	Anti-thrust	Average Skirt	UWPD	WPD
pooled standard deviation	0.19	0.42	0.26	0.25	0.34	0.54	0.42	0.15	0.24	1.05	0.16
average range	0.56	1.33	0.87	0.82	1.15	1.73	1.53	0.50	0.84	3.61	0.56
pooled standard deviation (lab raters)*	0.18	0.40	0.26	0.24	0.35	0.49	0.37	0.13	0.20	1.01	0.16
average range (lab raters)*	0.53	1.23	0.87	0.74	1.12	1.55	1.25	0.41	0.66	3.44	0.55

*Data from one non-lab rater is removed from these calculations.

DISCUSSION:

Fourteen raters attended the workshop. Each rater first rated one composite calibration piston[1]. This data is analogous to the "as found" values when calibrating an instrument. The attendees reviewed the calibration piston data for areas or raters requiring discussion but did not identify anything noteworthy. They did discuss the need to pay particular attention to the skirt ratings. The peaks and valleys caused by the machining on the skirts necessitate the extra caution. The combination of deposit buildup in the valleys and

[1] A composite calibration piston is a fictitious single piston made up of rating locations taken from several real pistons (in this case, four pistons). This is done to speed the calibration process; it allows four raters to rate the "same" piston simultaneously. Also, be aware that in this context, "calibration", though referring to calibration of a rater, is *not* "Rater Calibration".

polishing of the metal caused by wear to the peaks make skirt rating especially difficult at the severity level typically being seen on IIIG pistons. This was not a problem on IIIF pistons where skirt deposits were generally milder.

Rating of the matrix pistons then began. The pistons were labeled "1" through "16" in the workshop. In the data available on the TMC website, the part identification is called "PART ID" and is formatted as: "IIIG 16 48605-6". The first number following "IIIG" is the number that identified the piston at the workshop (16 in this example). That number is followed by the TMC CMIR number to identify the matrix test the piston came from. And finally, separated from the CMIR by a "-", is the piston number from that test (piston 6 here).

Pistons 1 through 8 were rated by each rater the first day. The data was reviewed at the beginning of the second day. This review revealed a discrepancy in one rater's undercrown numbers. This rater was rating a larger area of the undercrown that included more of the clean area with the consequence being milder numbers for him. The undercrown area rated for IIIG is not spelled out anywhere. *This is an item that should be addressed in the IIIG procedure.*

Following the discussion, pistons 9 through 16 were rated. At the end of the second day, the data was again reviewed and discussed. Over the course of the workshop, many of the raters experimented with an acetate template to aid in skirt varnish rating. Paul Yanchar, a Lubrizol rater, agreed to provide copies to the workshop participants. The raters felt that this template should also be made part of the IIIG procedure.

One final note: most of the undercrown ratings for piston 6 show ratings distinctly milder than the matrix rating. One of the workshop participants wiped some liquid (possibly oil) from the undercrown of this piston and removed a substantial amount of the deposits. The data obtained before this happened is highlighted on the data sheet.

The data published for this workshop consists of one page for each part followed by one page for each rater. All data is shown both as rated merit values and as standardized values (Yi values).

Please contact me at 412-365-1036 with questions pertaining to the workshop or the data posted.

SDP/sdp/mem03-074.sdp.doc
c: F. M. Farber
M. T. Kasimirsky
S. L. Clark
IIIG Rating Workshop Participants

Distribution: email

Attachment #5

Sequence IIIG Honing Update

Presented by Sid Clark, GM Powertrain

With concurrence Charlie Leverett, Pat Lang

to ILSAC / OIL

October 21, 2003

IIIG Honing Update

- Background (Pre-Matrix)
  - Investigative study began as a IIIG Development activity in January 2003
- Initial Goals (Honing was one aspect of a total laboratory comparison)
  - Investigate surface finish parameter differences between PerkinElmer and SwRI.
  - Confirm honer calibration (wattage requirements) beyond standard bar graph display indications.
  - Work with labs to standardize procedures for Matrix testing.

Initial Comparisons

SwRI - PerkinElmer Honing Study
Exercise conducted week of January 27, 2003
Blocks honed at respective labs and sent to each other for surface finish analysis

SRI Block 03001-1		PE Block 02127-5			
SRI Ra µin		PE Ra µin		SRI Ra µin	PE Ra µin
12.7		13.5		12.2	11.6
18.5		15.3		13.9	13.0
13.5		10.0		15.7	13.1
18.0		11.5		16.0	13.1
16.2		12.4		12.2	11.7
15.9		14.1		15.2	12.7
15.8		12.8	Average	14.2	12.5

Initial Comparisons

Rk

Core roughness depth

Rvk

Reduced valley depth

Rpk

Reduced peak height

Measurement taken at SwRI						
Position	SwRI Block Rk µin	PkE Block Rk µin	SwRI Block Rvk µin	PkE Block Rvk µin	SwRI Block Rpk µin	PkE Block Rpk µin
Cyl 1	35.6	33.6	36.5	33.0	11.3	5.6
Cyl 2	45.0	41.7	55.6	33.6	14.6	14.1
Cyl 3	34.8	40.7	37.1	45.8	12.9	13.5
Cyl 4	49.5	54.8	56.8	30.5	9.2	16.6
Cyl 5	42.5	34.6	42.3	32.9	12.4	10.8
Cyl 6	41.9	42.1	47.5	42.0	8.5	17.9
Avg	41.6	41.3	46.0	36.3	11.5	13.1

Measurement taken at PE						
Position	SwRI Block Rk µin	PkE Block Rk µin	SwRI Block Rvk µin	PkE Block Rvk µin	SwRI Block Rpk µin	PkE Block Rpk µin
Cyl 1	33.5	25.8	42.1	38.3	11.4	7.0
Cyl 2	31.0	23.7	60.9	48.6	4.7	7.0
Cyl 3	25.1	31.8	31.2	47.1	8.7	7.1
Cyl 4	30.0	25.4	32.3	40.9	7.2	6.2
Cyl 5	27.1	30.3	55.4	37.0	11.9	9.4
Cyl 6	33.5	32.3	42.5	44.3	4.7	13.1
Avg	30.0	28.2	44.1	42.7	8.1	8.3

Additional Comparisons

- Analytical Comparisons
  - PDN-50 Soap
  - Laboratory H_2O
  - LP8X-55 Honing Fluid
  - Solvent
  - EF-411
  - Fuel
  - Glycol
- Engine Buildup
  - Parts cleaning
  - Honing
  - Assembly
- Test Stand Operations
  - Calibration
  - Process control
  - Installation & Start-up
  - Test operations

Post Matrix
O&H Honing Task Force

The Seq. III Surveillance Panel approved formation of a Honing Task Force on August 1, 2003

Charlie Leverett volunteered to head task force

Objectives:

1. Evaluate current specified procedure
2. Compare the specified procedure with controlled modifications
3. Determine if changes can enhance oil consumption
4. Conduct round robin surface finish analysis (Phase I)
5. Additional item, round robin honing (Phase II)

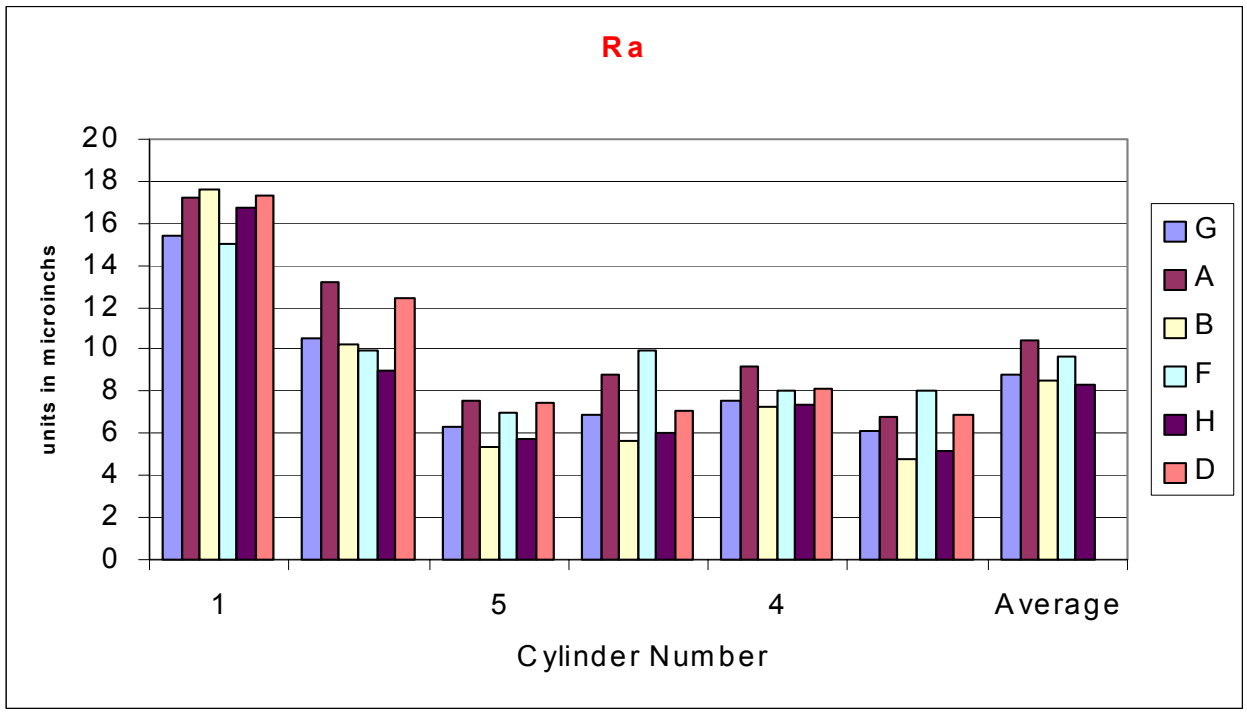
Task Force Summary

Phase I

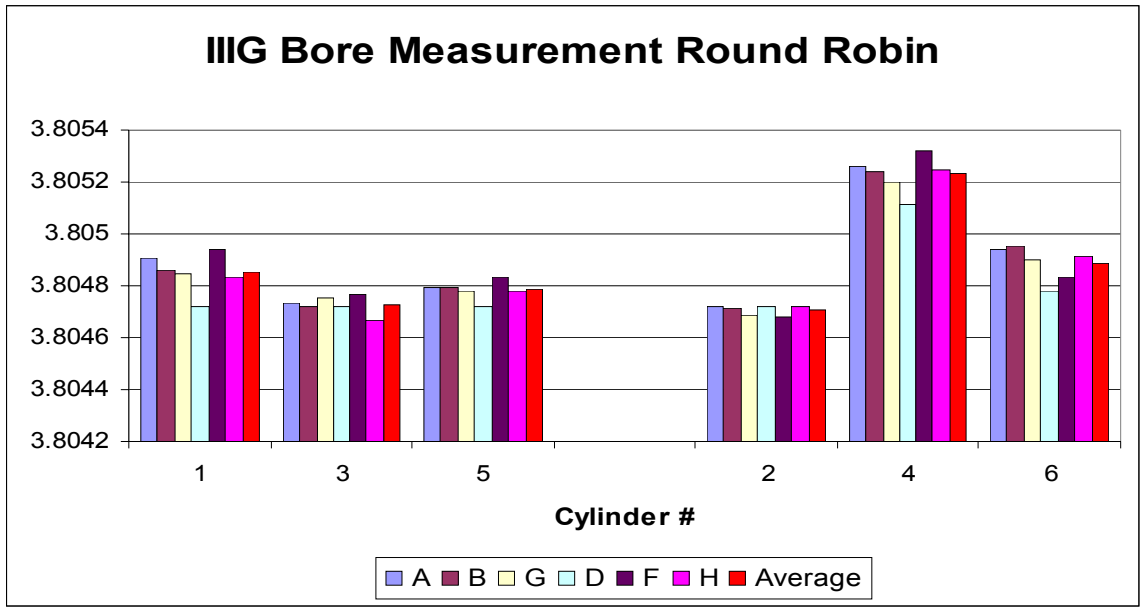
Hone a block at PerkinElmer and send it to all IIIG labs for cylinder bore measurements and surface finish analysis.

Compare results looking at repeatability within measurement instruments from lab to lab

TF Phase I Summary



TF Summary Phase I Bore Measurements



Task Force Summary

Phase II

Send one block around to all labs having each lab hone one cylinder.

Once completed, return block to San Antonio for measurement, comparison by PE and SwRI looking at Ra and Rk parameters

Phase II Summary

Phase II SwRI measurements of all Cylinders

Cylinder	1	3	5	Units
Ra	14.2	15	14.6	µin
Rq	19.5	20.3	19.8	µin
Rk	36.5	43	42.6	µin
Mr1	3.6	4	5.3	%
Rpk	9.4	7.3	10.5	µin
Mr2	82.5	84.5	85.5	%
Rvk	40.1	39.2	36.3	µin

Cylinder	2	4	6	Units
Ra	15.3	8.8	15.6	µin
Rq	21.3	11.6	22.6	µin
Rk	41.2	26.7	42.3	µin
Mr1	4.3	4.2	6	%
Rpk	12.7	5.6	7.6	µin
Mr2	83.8	85.2	84.9	%
Rvk	44.9	20	49.2	µin

Phase II PE measurements of all Cylinders

Cylinder	1	3	5	Units
Ra	12.8	12.3	12.6	µin
Rq	17.3	16.6	17.7	µin
Rk	36.4	29.3	31.7	µin
Mr1	6.5	7	7.5	%
Rpk	11.9	6.3	5.6	µin
Mr2	84.5	79.5	82.5	%
Rvk	35	32.1	39.6	µin

Cylinder	2	4	6	Units
Ra	14.1	7.7	11.6	µin
Rq	18.1	10.6	16.1	µin
Rk	35.4	19	30.5	µin
Mr1	3.5	7	5.5	%
Rpk	4.3	5.2	7.6	µin
Mr2	79.5	81.5	83	%
Rvk	33.4	22.5	34.1	µin

PerkinElmer Honing Enhancements

- During the September 2003 ILSAC / Oil meeting, John Glaser announced that PerkinElmer had done detailed research into honing procedures and as a result had resolved their oil consumption issues.
- Following the meeting discussions were held between PerkinElmer, GM and TMC concerning this change.
- PerkinElmer provided information to GM and TMC explaining the “Enhancements” they had made.

PerkinElmer Honing Enhancements

- GM & TMC conducted a lab visit at PerkinElmer & SwRI the week of October 10th .
- The objective of this visit was to observe this process on a reference engine build & start at PerkinElmer.
- Repeat the process at SwRI under instruction from Charlie Leverett with Pat Lang and compare surface finish data.
  - SwRI has not changed their honing process
- After review of these "Enhancements" all parties involved agreed that they are better classified as "Refinements" to the standard honing procedure and are within the current procedural guidelines.

Lab Visit Summary

The following memo was issued by Charlie Leverett to the IIIG Honing Task Force

Sid Clark and Mike Kasimirsky were in San Antonio this week (10/07-09) to work with me to review in detail the honing technique that was optimized by PerkinElmer recently. The PerkinElmer honing method was tried at SwRI and demonstrated that much care and significant training will need to take place in order to implement the method in a reproducible manner across the industry.

Sid Clark, Mike Kasimirsky, Pat Lang and Charlie Leverett met 10/09 to discuss the process for release of this information. It was decided a conference call was needed with Sunnen to develop a process to help assure that all hones are operating equivalently in the industry.

Current Progress

GM, PerkinElmer, & SwRI are currently working with Sunnen to provide on-site setup and calibration of all CV-616 honers.

Sunnen was asked for advice on:

1. Belt replacement and pivot lubrication intervals
2. Counter balance weight requirement standardization
3. Hone head and u-joint inspection and / or replacement intervals

Sunnen was also asked to calibrate each machines bar graph display using their portable dyno calibration unit.

Conclusion

GM feels confident that the “PerkinElmer Refinement” of the honing process has the potential of enhancing the repeatability and reproducibility of the IIIG test. However, honing is only one part of the test build and it will be both operator and honer calibration sensitive.

The group is currently outlining the process in detail for release at the upcoming O&H meeting on October 28, 2003.

The decision to conduct an industry workshop or perform individual lab visits to introduce these refinements will be decided by the Surveillance Panel on October 29, 2003

Attachment 6

Proposed Honing Guidelines

Presented to the Sequence IIIG
Operations and Hardware Subpanel

Sid Clark

October 28, 2003

Stone & Brush Shims

1. Insert the setting gage in the cylinder and adjust to snug fit.
2. Set the turret block to the standard position.
3. Place the stone assembly in the setting gage with the slide scale set at “0” .
4. Add shims as necessary to adjust to 1 to 2 on the slide scale.
5. Repeat steps 3 and 4 for the main and centering guides.
6. Place the plateau brush assembly in the setting gage with the slide scale set at “0”.
7. Add shims as necessary to adjust to 3 to 4 on the slide scale.

EHU 512 Stones

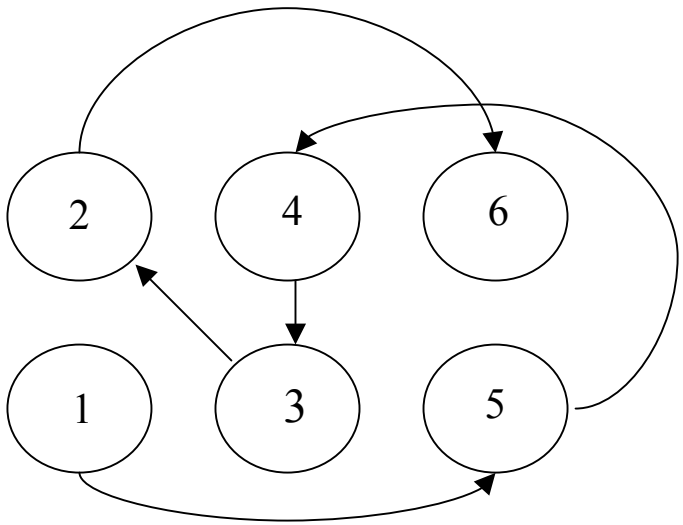
1. Insert the hone head into the cylinder and adjust the feed handle until a slight resistance is felt.
2. Adjust the feed dial to a point where it will not shut off the honer during normal operation over fifteen strokes at 25 units load.
3. Start the honer and cycle the hone head fifteen strokes at 25 units load using the micro switch on the feed dial to stop the honer so the hone head always stops at the top of the cylinder.
4. Move to the next cylinder and repeat the same switching the stone positions in the hone head between each cylinder.

Cylinder Honing Sequence

Do not hone adjacent cylinders

Honing sequence, 1, 5, 4, - 3, 2, 6

Only 15 strokes / cylinder maximum at 25 units load at any time



Chasing the Taper

1. After the initial 15 strokes in each cylinder, measure each cylinder and calculate the taper.
2. Following the honing sequence, engage the dwell 1 or 2 times during the next series of 15 strokes / each cylinder.
3. Measure each cylinder and repeat step 2 engaging the dwell as necessary to eliminate the final taper.

Do not chase taper when the cylinder size is within 0.01mm (0.0004in.) of target size

Maximum allowable taper = 0.0254mm (0.001in.)

EHU 512 Final Sizing

- Size the cylinders, 15 strokes / cylinder maximum at a time.
- Switch the stones in the hone head between each cylinder.
- Follow the honing sequence 1, 5, 4, - 3, 2, 6.
- Operate the EHU 512 stones at 25 units load.
- Stop honing with the EHU 512 stones when the cylinder size is within 0.005mm (0.0002in.) of target size.

C30-PHT-731
Plateau Hone Brush Honing

- Insert the C30-PHT-731 Brushes in the hone head.
- Follow the honing sequence.
- Set the honer on time control (45 seconds).
- Engage the honer and adjust the unit loading to 30 units.
- Do not adjust the load by rapidly releasing and re-engaging the clutch lever if the load increases above 30 units. The normal loading will increase to ~ 35 units and fall back down to 30 during the 45 seconds.
- Follow the Sequence IIIG procedure for cleaning and final assembly for test.

Sequence III
Fluid Process Control

Presented to the IIIG Operations and Hardware Subpanel

Sid Clark

October 28, 2003

Recommend Configuration

Company	Date Shipped	Lab Stand Number	Valve TBV	Valve SVF	Actuator Valvcon	Actuator Indelac	Actuator Kinetrol	Invoice Number	W. O. Number
Lubrizol	5/26/00	1		X			X	54842	41664

System	Component	Make	Model	Comments
Fuel	Pump	KFI	10210	12 VDC
	Flow Meter	Micro Motion		
	Pressure Regulator (on-rack)	Weldon	2040-200-A-170	
	Heat Exchanger	Elanco	M11	
	Check Valve	Sharpe	FNW-16	
	Solenoid Valve	Skinner	72218RN4UV00N0H222P3	
	Filter	Racor	110A	

System	Component	Make	Model	Comments
Engine Coolant	Pump	Aurora	341ABF 1-1/2 x 2 x 9	
	Flow Meter	ABB/Fisher Porter	10VT1000	1111ADH11C12AA0A has been replaced
	Heat Exchanger	Elanco	M71FL	
	Heater	Chromalox	ARTMS-1250TL	
	3-Way Control Valve	SVF	T7-6666TT150-S1	2" Valve
	2-Way Control Valve	Orion/Badger Meter	9003GCW36SV3A29L36	2" Valve (same as used on Sequence VIB)
	Inlet Line I.D. / Total Length	2"	226"	Total run from Process Controller to Engine Inlet Adapter

System	Component	Make	Model	Comments
Breather Tube	Pump	Aurora	133-BF-E03 1-3/4 x 3/4	
	Flow Meter	Sparling	FM625*	
	Heat Exchanger	Elanco	M21	
	Heater	Chromalox	3CVCHS-151	
	3-Way Control Valve	SVF	T7-6666TTSE-S1	1/2" Valve
	2-Way Control Valve	SVF	V7-6666NTSE-V60	1/2" Valve
	Back Pressure Valve	???		

System	Component	Make	Model	Comments
Oil Cooler	Pump	Aurora	133-BF-E03 1-3/4 x 3/4	
	Flow Meter	Sparling	FM625*	
	3-Way Control Valve	SVF	T7-6666TTSE-S1	1/2" Valve
	2-Way Control Valve	SVF	V7-6666NTSE-V30	1/2" Valve

Valves and Actuators

Number	Valve Mfg. & Model Number	Size	Operation	Torque
1	TBV - 11-SE1-3636-M30-TT	1/2"	2-Way	105 in/lbs
2	TBV - 11-SE1-3636-M60-TT	1/2"	2-Way	105 in/lbs
3	TBV - 51-SE1-3636-TT	1/2"	3-Way	80 in/lbs
4	TBV - 11-SE1-3636-M60-TT	2"	2-Way	570 in/lbs
5	TBV - 51-SE1-3636-TT	2"	3-Way	400 in/lbs
6	SVF - V7-6666NTSE-V30	1/2"	2-Way	45 in/lbs
7	SVF - V7-6666NTSE-V60	1/2"	2-Way	45 in/lbs
8	SVF - T7-6666TTSE-S1	1/2"	3-Way	45 in/lbs
9	SVF - V7-6666NT150-V60	2"	2-Way	600 in/lbs
10	SVF - T7-6666TT150-S1	2"	3-Way	400 in/lbs
	Actuator Model Number	**Size**	**Operation**	**Torque**
11	Indelac - SR4B-10-1VP	1/2"	2-Way	200 in/lbs
12	Indelac - SR4B-10-1VP	1/2"	2-Way	200 in/lbs
13	Indelac - SX3004B-10-1VP	1/2"	3-Way	300 in/lbs
14	Indelac - SH4007B-10-1VP	2"	2-Way	400 in/lbs
15	Inedlac - SH4007B-10-1VP	2"	3-Way	400 in/lbs
16	Valvcon - SADCX300CFS	1/2"	2-Way	300 in/lbs
17	Valvcon - SADCX300CFS	1/2"	2-Way	300 in/lbs
18	Valvcon - SADX150CFS	1/2"	3-Way	150 in/lbs
19	Valvcon - SADCX600CFS	2"	2-Way	600 in/lbs
20	Valvcon - SADCX600CFS	2"	3-Way	600 in/lbs
21	Kinetrol - 059-600AP0000C	1/2"	2-Way	250 in/lbs @ 60 PSI
22	Kinetrol - 059-600AP0000C	1/2"	2-Way	250 in/lbs @ 60 PSI
23	Kinetrol - 059-600AP0000C	1/2"	3-Way	250 in/lbs @ 60 PSI
24	Kinetrol - 079-600AP0000C	2"	2-Way	610 in/lbs @ 60 PSI
25	Kinetrol - 079-600AP0000C	2"	3-Way	610 in/lbs @ 60 PSI

SEQUENCE III OPERATIONS and HARDWARE MEETING

SOUTHWEST RESEARCH INSTITUTE
SAN ANTONIO, TEXAS
OCTOBER 28, 2003
SwRI Campus, Building 209
9:00 AM – 5:00 PM

Motions:

1. **-Motion #1**: Sid Clark / Mike Kasimirsky. – Change spec. to 365 kpa to 390 kpa for IIIF and IIIG fuel pressure. Passed. Unanimous.
2. **Motion #2:** Dwight Bowden / Mike Kasimirsky- Recommendation to the Seq. III Surv. Panel that all raters who rate Sequence III parts must attend a rater workshop within a 12 month period. If a rater misses the workshop he must attend an alternate workshop within 90 days, as defined by the TMC. Passed unanimous. Passed. Unanimous.
3. Motion #3: Accept changes for honing process and update Assy. Manual. after Sunnen has calibrated all honing machines at each lab. Labs will bring this in with a reference. Passed. Unanimous.
4. **Motion #4:** Charlie Leverett / Dwight Bowden Change soap out a minimum of every 6 months. Passed. Unanimous.
5. **Motion #5:** Charlie Leverett / Mike Kasimirsky - All EOT milliliters-low will be recorded using the EOT - 236 - 472. Passed. Unanimous.
6. **Motion#6:** Mike Kasimirsky / Charlie Leverett: Put recommendations for valves that have been successfully incorporated on the fluid control rack into section 6.6 of the procedure. Passed. Unanimous.
7. **Motion #7:** Charlie Leverett / Sid Clark. Make the use of the main bore mandrel optional. Passed. Unanimous.
8. **Motion #8:** Charlie Leverett / Pat Lang: Require that rings be cleaned with acetone and wiped with soft cloth and mineral spirits. Do not require paint removal on all other parts. Passed. Unanimous.
9. **Motion #9:** Charlie Leverett / Sid Clark: Add Dow Corning RTV grade 3154 sealer in addition to the Gm black sealer. Passed. Unanimous.
10. **Motion #10:** Charlie Leverett / Pat Lang: Add oil filter part number to table A2.1. Passed. Unanimous.
11. **Motion #11:** Dwight Bowden / Charlie Leverett: Recommend to the Seq. III Panel that labs change main bolts every test. Passed. Unanimous.
12. **Motion #12:** Mike Kasimirsky / Sid Clark. 10.11.1.1 – Change requirement of instrument accuracy from 0.001mm to 0.01mm accuracy. Passed. Unanimous.
13. **Motion #13:** Bill Nahumck / Dwight Bowden. After camshaft measurements are taken the camshaft must be coated with EF-411 before storage. Passed. Unanimous.

14. **Motion #14:** Pat Lang / Charlie Leverett: You must put test oil on cam lobes and journals before the camshaft is installed in the block. You must also double dip and rotate the lifters in test oil. Passed. Unanimous

Action Items:

1. Mike Kasmirsky will ask Scott Parke if the current description of the under crown on the piston skirt that is in the procedure is acceptable as is. If not, what changes would he like to see in the procedure?
2. Honing task force will look into calibration of hones, breaking in of stones, brushes. Determine if there is any merit in batch coding stones, brushes and fluids. Charlie will conduct a round robin (Phase III) on a block that will be honed by each lab to the new procedure.
    a. hones all calibrated.
    b. define stone break in procedure
    c. Determine if stones, brushes and fluids be batch coded.
    d. Determine what the proper counter weight for the honing machines are.
    e. Implement Phase III. The Phase II block will be re-honed by by all labs in round robin format.

    OHT will support this issue.
3. Section 11.8.5 - O&H Chairman will determine what each meter is used for and what their individual tolerances are.
4. O&H Chairman & Sid Clark will determine if any recommendation for the amount of EF-411 or test oil will be used for pre lube of camshaft is shown in past minutes.