Sequence III Surveillance Panel
WebEx Meeting Minutes
October 19, 2016
14:00 EDT

Agenda

1.0) Attendance

1.1) Sydelle Elshenawy replaces David Tsui; BP Lubricants USA Inc.

1.2) The meeting attendance is shown in Attachment 1.

2.0) Approval of minutes

2.1) August 17, 2016 posted, comments received and minutes corrected. The corrected minutes were approved without objection (Altman, Schweitzer).

3.0) Action Item Review

3.1) 05/26/2016 Meeting; Review Sequence IIIH data for honing and cylinder size parameters that were temporarily suspended at 03/29/2016 meeting. Review due in six months. This will be agenda item at face-to-face meeting in San Antonio on 11/15/2016.

4.0) Old Business

4.1) No old business was taken up during the course of the teleconference.

5.0) New Business

5.1) Sequence IIIH Batch Code 3 pistons

Jason Bowden reported on the investigation to date. Both the original report and the addendum are included in Attachment 2. In short, the manufacturer did not find any measurements that would explain the blowby that has been seen in the IIIH test. Pat Lang mentioned that the bottom chamfer on top and second grooves varies a bit (batch code III has a bigger chamfer) and he mentioned that this has been known to affect blowby in previous test types.

Todd Dvorak presented his analysis of the data provided by Jason Bowden, Attachment 3. Todd's analysis found that the waviness for batch 3 2nd ring is different than batches 1 and 2. A short discussion followed on whether or not there is any potential impact.

After additional discussion, it was determined that the chamfer differences should be investigated further.

Ed Altman presented BC2 vs. BC3 blowby data, Attachment 4. Both Ed Altman and Pat Lang noted an increase in crankcase pressure as well.

Rich Grundza provided a plot of hour one blowby by lab and reference oil, Attachment 5.

After discussion, Jeff Betz motioned (Ed Altman second) that in order to maintain calibration (or calibrate a new stand), each stand in the industry, that has not yet run a reference on BC3, must run a reference test on BC3 hardware within the next two weeks. – The motion passed 12-0-1.

Additionally, the following actions were assigned:

- Jason Bowden will work with SwRI and the hardware vendor on the chamfer issue
- Todd Dvorak will analyze the honing data.
- SwRI and IAR will compare recently run pistons to examine the chamfers
- Jeff Betz will ask Mahle about tooling ages/changes during the production run
- Dave Glaenzer will survey the labs about J-Tec calibration techniques and also investigate potentially better blowby measures

6.0) Review Action Items

6.1) No standing action items were reviewed during the course of the teleconference.

7.0) Review Scope and Objectives

7.1) The scope and objectives were not reviewed during the course of the teleconference.

8.0) Next Meeting

8.1) Teleconference scheduled for November 3, 2016.
8.2) Face to face meeting scheduled for 11/15/2016 at Southwest Research Institute in San Antonio.

9.0) Meeting Adjourned – at 3:35 pm.

Attachment 1

ASTM Sequence III Surveillance Panel (22 Voting members) date: 10/19/16

Name/Address	Phone/Fax/Email		
Ed Altman A	ed.altman@aftonchemical.com	Voting Member	Present ✓
Jeff Betz A	jeff.betz@fcagroup.com	Voting Member	Present ✓
Jason Bowden A	jhbowden@ohtech.com	Voting Member	Present ✓
Timothy L. Caudill A	tlcaudill@ashland.com Arnold	Voting Member	Present ✓
Richard Grundza A	reg@astmtmc.cmu.edu	Voting Member	Present ✓
Jeff Hsu, PE	j.hsu@shell.com	Voting Member	Present
Teri Kowalski	teri.kowalski@tema.toyota.com	Voting Member	Present
Dan Lanctot W	dlanctot@tei-net.com	Voting Member	Present ✓
Patrick Lang A	plang@swri.org	Voting Member	Present ✓
Mark Overaker	mhoveraker@jhaltermann.com	Voting Member	Present
Michael Raney	michael.p.raney@gm.com	Voting Member	Present
Andrew Ritchie A	andrew.ritchie@infineum.com	Voting Member	Present ✓
Ron Romano	rromano@ford.com	Voting Member	Present
Cliff Salvesen	clifford.r.salvesen@exxonmobil.com	Voting Member	Present
Addison Schweitzer A	addison.schweitzer@intertek.com	Voting Member	Present ✓
Greg Shank A	greg.shank@volvo.com	Voting Member	Present ✓
Kaustav Sinha, Ph.D. A	LFNQ@chevron.com Stockwell	Voting Member	Present ✓
Thomas Smith	trsmith@ashland.com	Voting Member	Present
Scott Stap	scott.stap@tgidirect.com	Voting Member	Present
George Szappanos A	george.szappanos@lubrizol.com	Voting Member	Present ✓
Haiying Tang A	HT146@chrysler.com	Voting Member	Present ✓
David Tsui	david.tsui@bp.com	Voting Member	Present

12-0-1

ATTACHMENT 2

Date: October 12, 2016

To: ASTM Sequence III Surveillance Panel

From: Jason Bowden / OH Technologies, Inc.

Re: OHT Seq. IIIH Piston Review Update for Increased Blowby Investigation

Cc: Mr. Jeff Betz / FCA US
Mr. Rich Grundza, Test Monitoring Center

Recently OH Technologies, Inc. was made aware, by the OEM test sponsor, of a shift in initial and average blowby at several labs. We were also made aware that some labs, not all, have witnessed an increase in oil consumption. We were told the shift appeared to occur with the introduction of Batch Code 3 pistons. Based on this information, OHT immediately provided samples of Batch Code 1, 2 and 3 pistons to our vendor for inspection. A thorough inspection of this material is in process. Our vendor inspected the following ring groove aspects of the piston that may influence blowby: Axial Height, Groove Diameter, Inclination, Waviness and Profile Traces. Based on the sample material inspection, our vendor determined that these parameters met print tolerance for all three batches. OHT is currently having additional parameters being inspected and reinspected. This includes, but is not limited to ring groove axial height measurements, piston diameters, etc. Both OHT and the OEM test sponsor are in direct communication throughout this process. In an effort to assist the industry, as we proceed with this investigation, OHT is willing to provide the initial inspection summary for review. The data shown below is not complete, as mentioned above, there are additional inspections taking place. The OEM Test Sponsor and OHT agree that in no way should any conclusions be made from this initial data until we have completed all inspections and reviewed all avenues for the cause of the shift the industry has witnessed.

The Seq. IIIH piston design was created during the Seq. IIIH test development by the OEM Test Sponsor and the development group. After the Seq. IIIH test was developed, OHT was approached and asked to produce batch controlled pistons using the piston drawing that was developed for the Seq. IIIH test development group. Please note that the OEM test sponsor has stated that the release of this data should not be used for a piston redesign exercise.

OHT is continuing to investigate any and all aspects that may be attributed to the increase in blowby. We appreciate your patience as we conduct a thorough review of this material.

OHT also encourages the Seq. III Surveillance Panel to also review any possible influences both hardware and lab related, that could have an influence on increased blowby and higher oil consumption. Please send any and all additional information to OHT for further review with both the Test Sponsor and our vendor(s).

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

Best Regards,

Jason H. Bowden
OH Technologies, Inc.

Attachment: OHT3H-070-1 Piston, Initial Inspection Data-Ring Groove Aspects.

Date: October 19, 2016

To: ASTM Sequence III Surveillance Panel

From: Jason Bowden / OH Technologies, Inc.

Re: Addendum to 10-12-16 OHT Seq. IIIH Piston Review Update for Increased Blowby Investigation

Cc: Mr. Jeff Betz / FCA US
Mr. Rich Grundza, Test Monitoring Center

Recently OH Technologies, Inc. was made aware, by the OEM test sponsor, of a shift in initial and average blowby at several labs. We were also made aware that some labs, not all, have witnessed an increase in oil consumption. We were told the shift appeared to occur with the introduction of Batch Code 3 pistons. Based on this information, OHT immediately provided samples of Batch Code 1, 2 and 3 pistons to our vendor for inspection. A thorough inspection of this material is in process. Our vendor inspected the following ring groove aspects of the piston that may influence blowby: Axial Height, Groove Diameter, Inclination, Waviness and Profile Traces. Based on the sample material inspection, our vendor determined that these parameters met print tolerance for all three batches. OHT is currently having additional parameters being inspected and reinspected. This includes, but is not limited to ring groove axial height measurements, piston diameters, etc. Both OHT and the OEM test sponsor are in direct communication throughout this process. In an effort to assist the industry, as we proceed with this investigation, OHT is willing to provide the initial inspection summary for review. The data shown below is not complete, as mentioned above, there are additional inspections taking place. The OEM Test Sponsor and OHT agree that in no way should any conclusions be made from this initial data until we have completed all inspections and reviewed all avenues for the cause of the shift the industry has witnessed.

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OHT also encourages the Seq. III Surveillance Panel to also review any possible influences both hardware and lab related, that could have an influence on increased blowby and higher oil consumption. Please send any and all additional information to OHT for further review with both the Test Sponsor and our vendor(s).

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

Best Regards,

Jason H. Bowden
OH Technologies, Inc.

Attachment: OHT3H-070-1 Piston, Initial Inspection Data-Ring Groove Aspects.

Batch	Serial #	Axial Height			Groove Diameter			Inclination			Waviness		
		Top	2nd	Oil	Top	2nd	Oil	Top	2nd	Oil	Top	2nd	Oil
1	102	Pass	Pass	Pass	88.29	86.59	89.16	-16.8	-8.5	-15.1	0.011	0.006	0.016
	307	Pass	Pass	Pass	88.31	86.59	89.17	-13.3	-5.4	-7.4	0.009	0.008	0.014
	319	Pass	Pass	Pass	88.32	86.59	89.17	-13.8	-4.4	-8.1	0.011	0.005	0.015
	598	Pass	Pass	Pass	88.32	86.59	89.16	-11.9	-5.1	-6.6	0.01	0.004	0.012
2	663	Pass	Pass	Pass	88.32	86.61	89.22	-6.6	-11.8	-10.3	0.008	0.007	0.011
	829	Pass	Pass	Pass	88.31	86.62	89.22	-8.6	-11.8	-16.4	0.012	0.007	0.015
	870	Pass	Pass	Pass	88.3	86.63	89.23	-11.5	-16.5	-9.7	0.014	0.009	0.01
	887	Pass	Pass	Pass	88.3	86.63	89.23	-9.1	-14.1	-10.4	0.008	0.007	0.013
3	339	Pass	Pass	Pass	88.3	86.62	89.22	-9	-6.5	-9.5	0.015	0.014	0.02
	904	Pass	Pass	Pass	88.33	86.6	89.21	-9.5	-6.4	-6.9	0.012	0.01	0.014
	955	Pass	Pass	Pass	88.3	86.62	89.22	-8.5	-6.4	-7.6	0.013	0.011	0.014
	1545	Pass	Pass	Pass	88.29	86.62	89.21	-7.2	-7.2	-9.4	0.012	0.013	0.016
Nominal		1.24	1.24	2.04	88.49	86.79	89.29	-10	-10	-10	0.02	0.02	0.02
Upper Tolerance		0.015	0.01	0.01	0	0	0	8	8	8			
Lower Tolerance		-0.015	-0.01	-0.01	-0.2	-0.2	-0.2	-8	-8	-8			

Note: Green indicates the measured parameter meets print tolerance.

All units of measure are millimeter except for inclination which is in minutes.

The axial heights of the ring grooves were checked with a pin gauge at minimum and maximum tolerance as a go / no go operation.
Ring groove inclination and waviness were taken in 4 quadrants.

Table 3: Addition Measurements

Batch	Serial #	Axial Height			Measured Diameter		
		Top	2nd	Oil	DN	D2	D3
	102	1.232	1.234	2.047	96.002	95.990	95.519
	307	1.233	1.236	2.048	96.001	95.987	95.528
	319	1.230	1.237	2.049	96.003	95.990	95.515
1	598	1.230	1.240	2.047	96.003	95.993	95.523
	663	1.231	1.238	2.048	96.000	95.990	95.527
	829	1.231	1.237	2.049	96.001	95.993	95.530
	870	1.231	1.242	2.048	96.002	95.991	95.536
2	887	1.231	1.232	2.047	96.003	95.994	95.532
	339	1.230	1.235	2.046	96.004	95.995	95.537
	904	1.229	1.237	2.049	96.002	95.994	95.530
	955	1.230	1.240	2.049	96.001	95.993	95.527
3	1545	1.232	1.238	2.049	96.001	95.993	95.533
Nominal		1.24	1.24	2.04	96.000	95.988	95.528
Upper Tolerance		0.015	0.01	0.01	0.005	0.007	0.024
Lower Tolerance		-0.015	-0.01	-0.01	-0.005	-0.007	-0.024

All units of measure are in millimeter

Note: Green indicates the measured parameter meets print tolerance.

Initial Inspection Data_Ring Groove Measurements for OHT3H-070-1 Piston

Date: 12-Oct-16

Batch	Serial #	Axial Height			Groove Diameter			Inclination			Waviness		
		Top	2nd	Oil	Top	2nd	Oil	Top	2nd	Oil	Top	2nd	Oil
1	102	Pass	Pass	Pass	88.29	86.59	89.16	-16.8	-8.5	-15.1	0.011	0.006	0.016
	307	Pass	Pass	Pass	88.31	86.59	89.17	-13.3	-5.4	-7.4	0.009	0.008	0.014
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	829	Pass	Pass	Pass	88.31	86.62	89.22	-8.6	-11.8	-16.4	0.012	0.007	0.015
	870	Pass	Pass	Pass	88.3	86.63	89.23	-11.5	-16.5	-9.7	0.014	0.009	0.01
	887	Pass	Pass	Pass	88.3	86.63	89.23	-9.1	-14.1	-10.4	0.008	0.007	0.013
3	339	Pass	Pass	Pass	88.3	86.62	89.22	-9	-6.5	-9.5	0.015	0.014	0.02
	904	Pass	Pass	Pass	88.33	86.6	89.21	-9.5	-6.4	-6.9	0.012	0.01	0.014
	955	Pass	Pass	Pass	88.3	86.62	89.22	-8.5	-6.4	-7.6	0.013	0.011	0.014
	1545	Pass	Pass	Pass	88.29	86.62	89.21	-7.2	-7.2	-9.4	0.012	0.013	0.016
Nominal		1.24	1.24	2.04	88.49	86.79	89.29	-10	-10	-10	0.02	0.02	0.02
Upper Tolerance		0.015	0.01	0.01	0	0	0	8	8	8			
Lower Tolerance		-0.015	-0.01	-0.01	-0.2	-0.2	-0.2	-8	-8	-8			

Green indicates the measured parameter meets print tolerance.

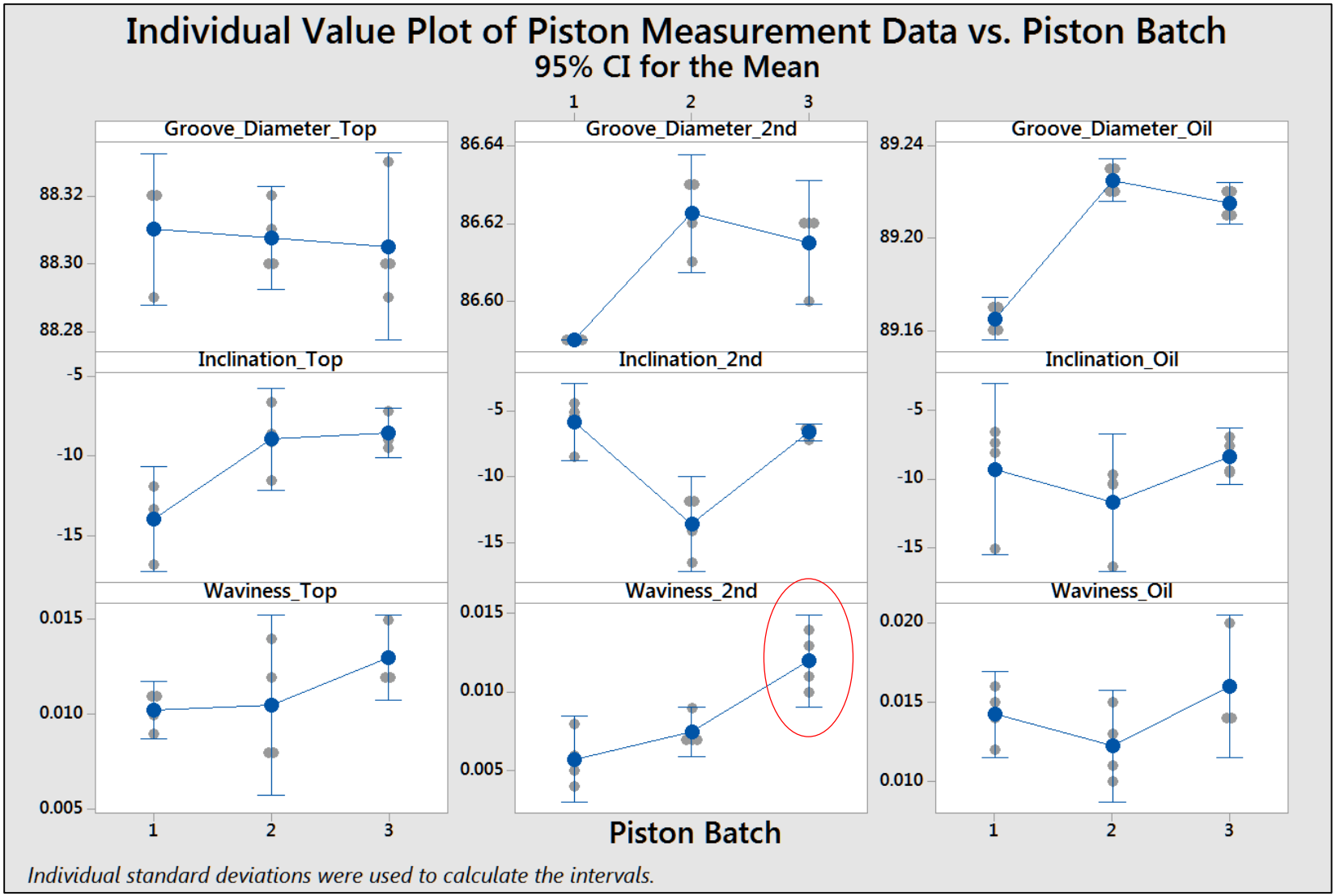
All units of measure are millimeter except for inclination which is in minutes.

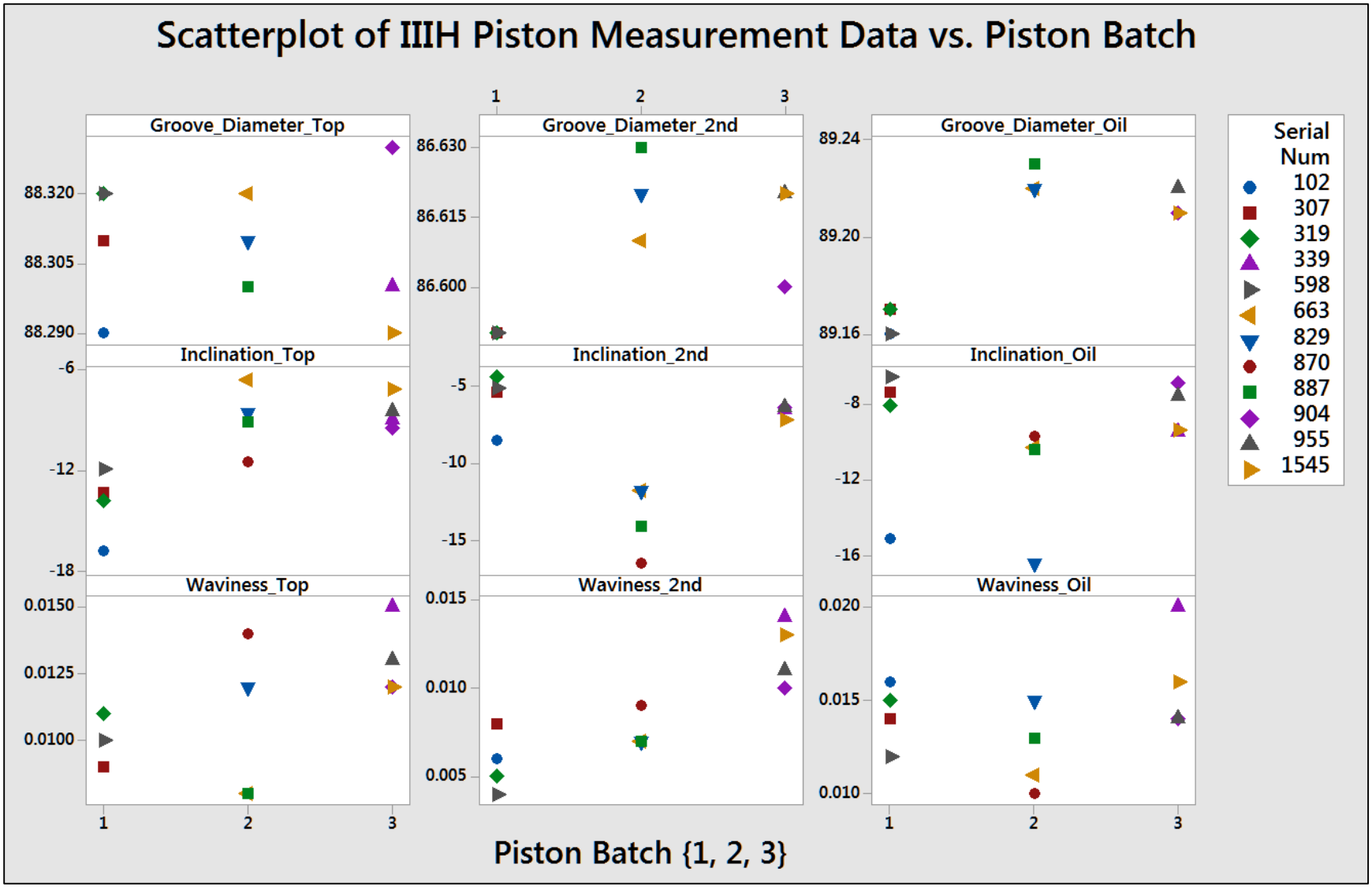
The axial heights of the ring grooves were checked with a pin gauge at minimum and maximum tolerance as a go / no go operation. OHT is having acutal measurements taken as well.

Ring groove inclination and waviness were taken in 4 quadrants.

Disclaimer: The OEM Test Sponsor and OHT agree that in no way should any conclusions be drawn from this initial data until we have completed all inspections.

ATTACHMENT 3




Scatterplot of IIIH Piston Measurement Data vs. Piston Batch
Groove_Diameter_Top
Groove_Diameter_2nd
Groove_Diameter_Oil
Inclination_Top
Inclination_2nd
Inclination_Oil
Waviness_Top
Waviness_2nd
Waviness_Oil
88.320
88.305
88.290
86.630
86.615
86.600
89.24
89.20
89.16
-6
-12
-18
-5
-10
-15
-8
-12
-16
0.0150
0.0125
0.0100
0.015
0.010
0.005
0.020
0.015
0.010
1
2
3
Piston Batch {1, 2, 3}
Serial Num
102
307
319
339
598
663
829
870
887
904
955
1545

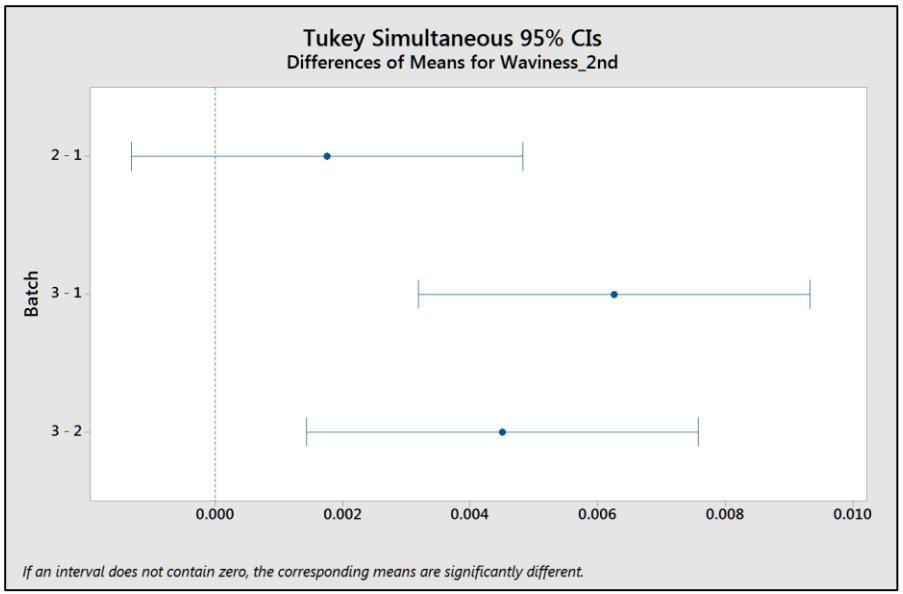
General Linear Model: Waviness_2nd versus Batch

```
Method
Factor Information
Factor  Type   Levels  Values
Batch   Fixed       3  1, 2, 3

Analysis of Variance
Source   DF    Adj SS    Adj MS  F-Value  P-Value
  Batch   2  0.000083  0.000042    17.21    0.001
Error     9  0.000022  0.000002
Total    11  0.000105

Model Summary

        S    R-sq  R-sq(adj)  R-sq(pred)
0.0015546  79.27%     74.66%      63.15%
```

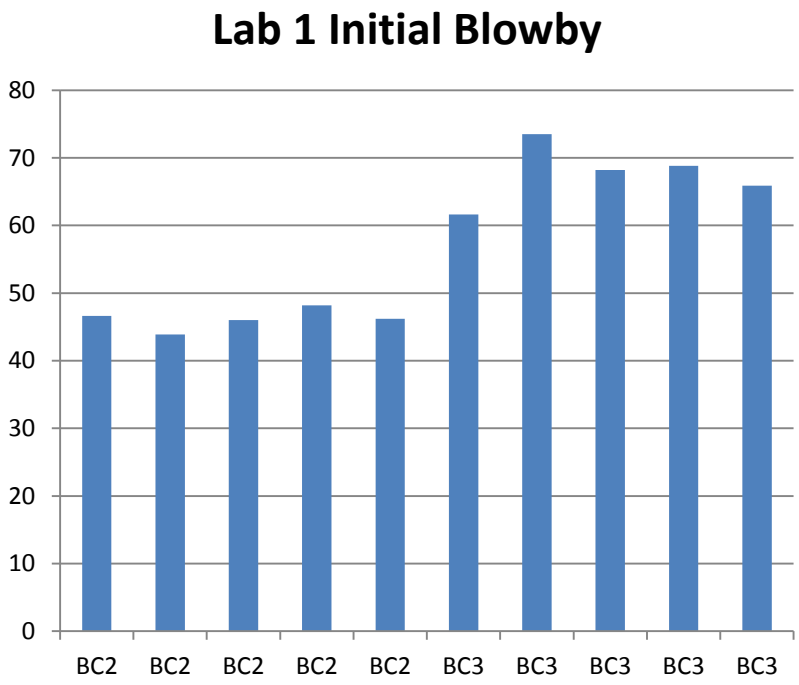


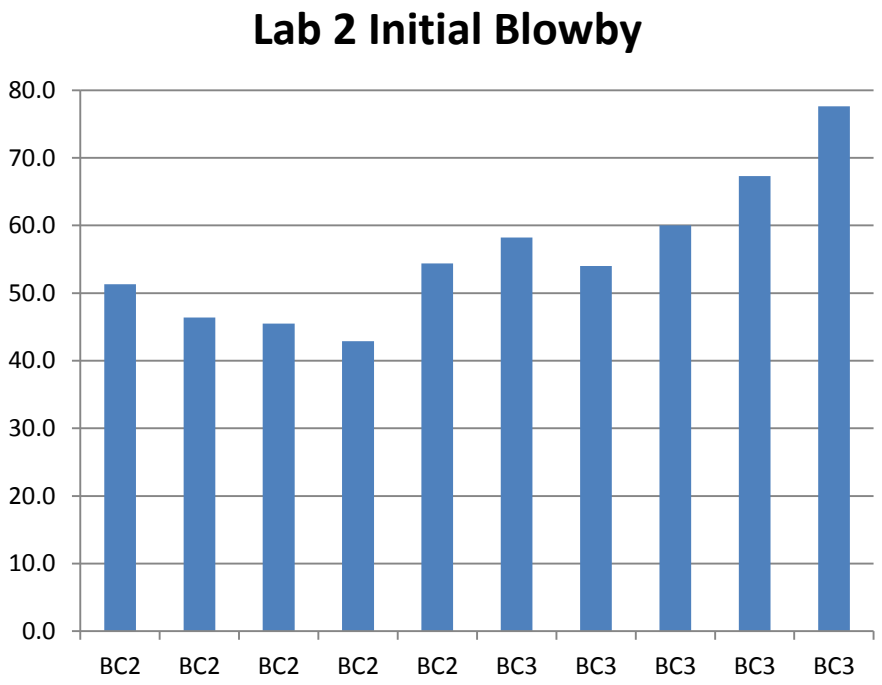
Conclusion: Analysis suggests that batch 3 piston is different than batch 2 and batch 1

ATTACHMENT 4

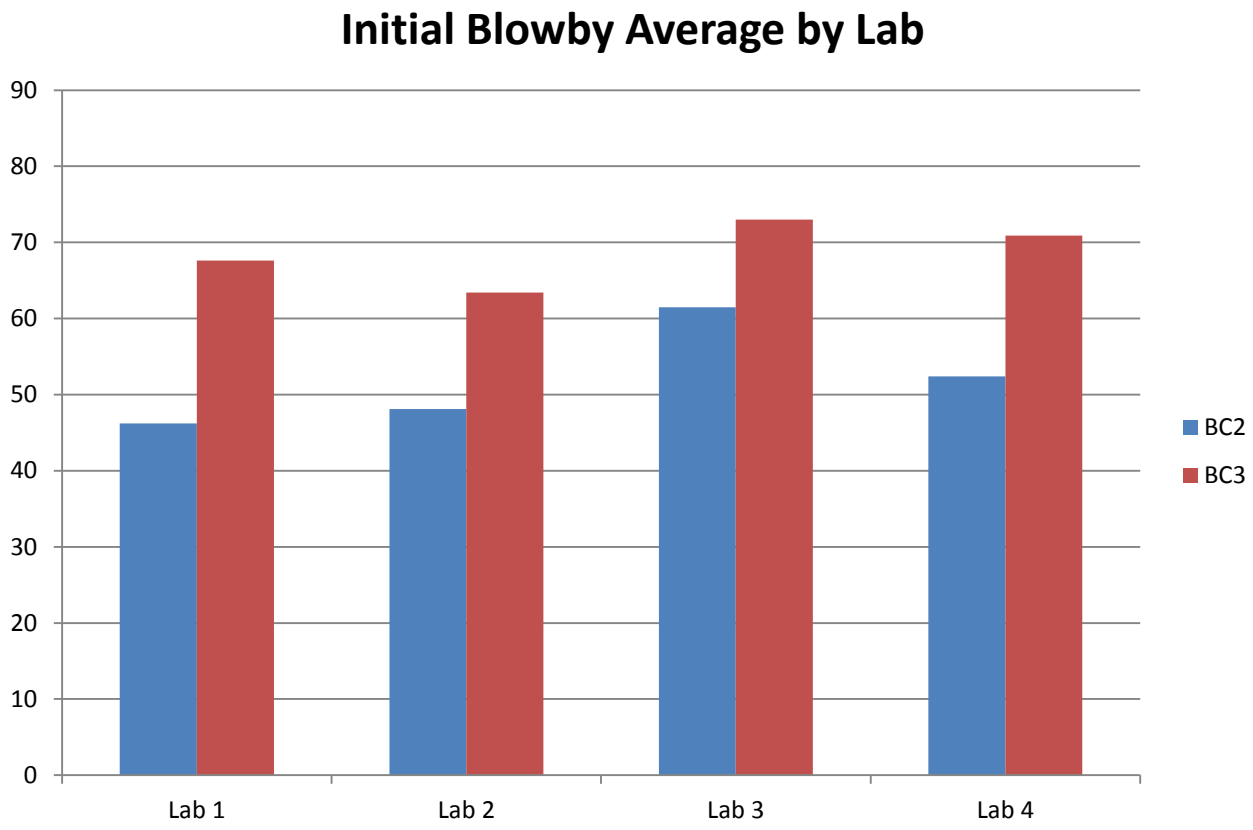
IIIHBlowby BC2 VS BC3 Pistons

Last Five BC2 / First Five BC3

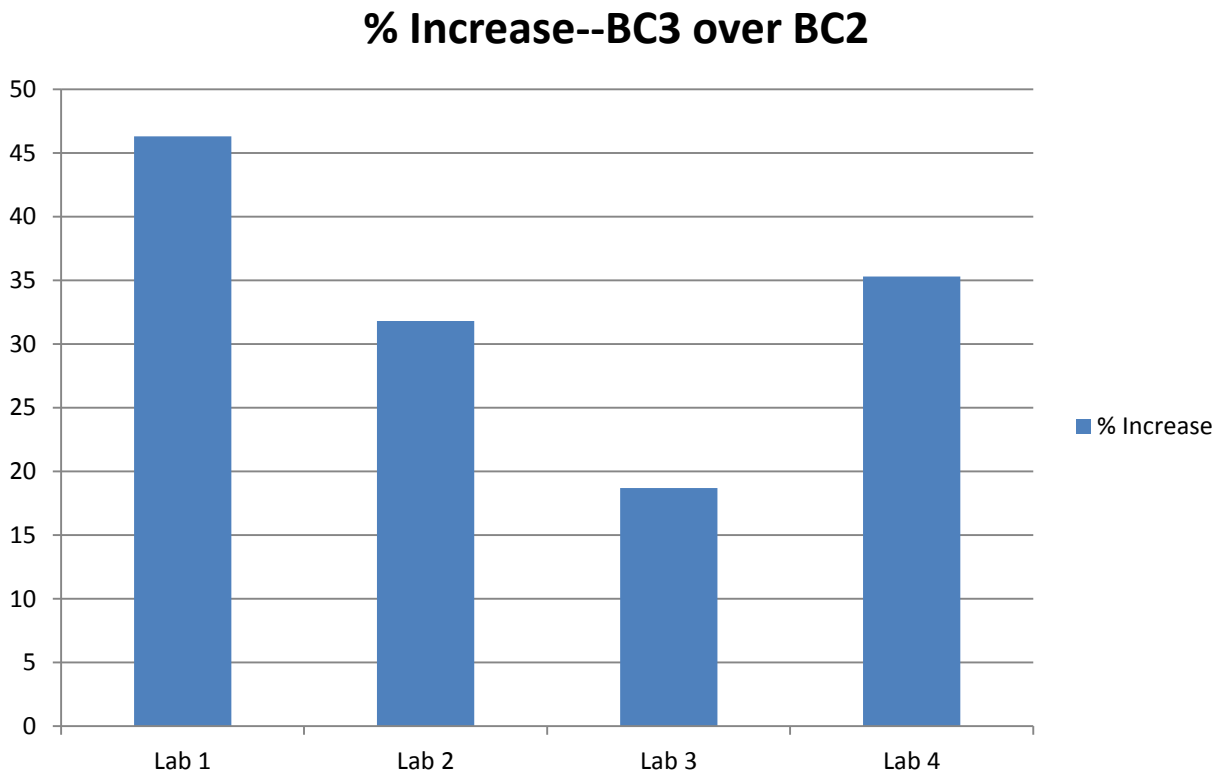




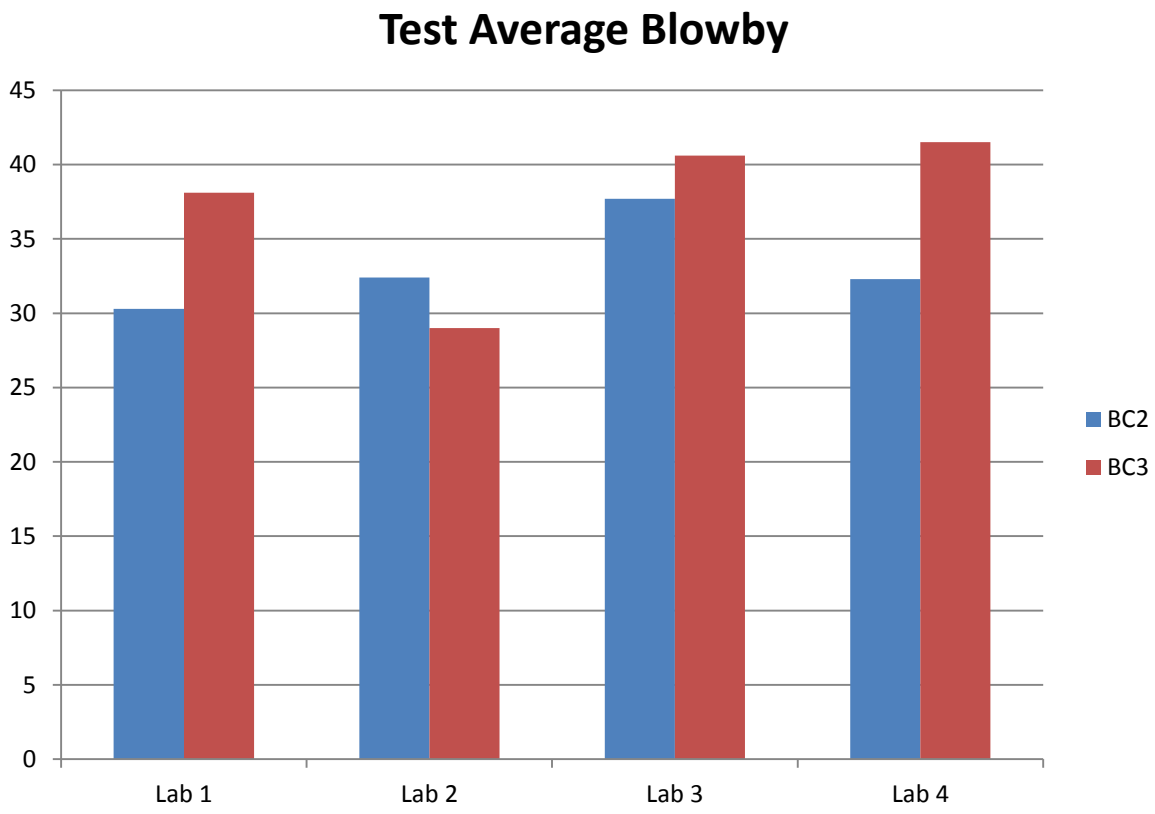
Average Initial Blowby BC2/BC3



Initial Blowby % Increase



5 Test Average Blowby



ATTACHMENT 5