Sequence III Surveillance Panel
Meeting Minutes
November 15, 2016
San Antonio, Texas

1.0) Attendance

The attendance is shown in **Attachment 1**.

2.0) Chairman Comments

Chairman Dave Glaenzer announced his retirement. The surveillance panel expressed their thanks for his many years of service. Robert Stockwell will assume the role of chair upon the next meeting.

3.0) Approval of minutes – from 11/03/2016 WebEx Conference

Approved without objection.

4.0) Action Item Review

4.1) Review Sequence IIIH data for honing and cylinder size parameters that were temporarily suspended at 03/29/2016 meeting. **Dvorak**.

Todd Dvorak's presentation is shown in **Attachment 2**. After review and discussion, it was suggested that a surface finish measurement round robin be conducted. ***ACTION ITEM - Addison Schweitzer will take the lead in conducting the round robin, which will include all test labs and Chrysler.*** Discussion continued regarding the proposed specifications shown in Todd's presentation (page 26 of Attachment 2). At the conclusion of the discussion, there was general agreement to leave the suspension of RVK and RZ limits in place until the round robin is conducted and Todd Dvorak has a chance to revisit the analysis and review the proposed limits. ***ACTION ITEM – Todd Dvorak will review the round robin data and revisit the proposed specifications.*** Richard Grundza asked what the consequence is for tests reported outside the RK and RPK limits that haven't been suspended – it was determined that tests should not be run outside a standing specification and if those limits aren't met then the test is invalid. Pat Lang motioned that the RK and RPK limits also be suspended temporarily. The motion died for lack of a second.

4.2) 08/17/16 Call. Update on critical hardware. **Glaenzer.**

Dave's report is shown in **Attachment 3**. The responses from the currently calibrated lab, as of mid-October:

- One lab will run out in first quarter 2017
- One lab plans to run into first quarter 2017
- One lab expects to be at full capacity for about six months

4.3) 11/03/16 Call. **Jason Bowden** will ask if several machines are used during a batch production of pistons or if one machine is used. **Done.**

Jason Bowden reported that a batch is run on a single machine. The tooling is dedicated to the Seq. III project.

4.4) 10/19/16 Call. **David Glaenzer** will survey the labs about J-TEC use for blowby flow measurement. **Done.**

Dave Glaenzer reported that all four labs which have run Batch Code 3 pistons were queried as to conformance to Figure A3.1 of procedure, blowby gas sampling technique and calculation of correction factor. No discrepancies were noted. Three labs are using the J-TEC meter and one lab is using the GM orifice meter. Dave noted that the test procedure did not specify calibration requirements of the blowby meters.

4.5) 11/03/16 Call. **Grundza and Glaenzer, Update Jason Bowden.** Select BC2 pistons from labs with mild and severe blowby flow rates as well as BC3 pistons with severe blowby rates. Labs will clean and send to OHT for vendor measurements. **Done.**

Hardware was selected and information was sent to the test labs. The cleaning procedure was defined. The last set of pistons were received by OHT 11/14/16 and all the pistons will be sent to the vendor.

5.0) Old Business

5.1) Update from TEI; parts cleaner soap. **Lanctot.**

Mark Sutherland reported for Dan Lanctot; the vendor shipped incorrect parts cleaning soap to TEI as they quit marketing the specified soap. They will now make the specified soap on a batch basis for TEI and the supply should continue uninterrupted. ***ACTION ITEM – the panel will investigate moving to a different parts cleaning soap as the current supply is being used up.***

5.2) IIIHA/IIIHB equivalency to IIIGA/IIIGB. **Martinez**

Jo Martinez presented the update. (**Attachment 4**).

5.3) IIIH procedural items to correct

The panel quickly reviewed and accepted the following corrections to the IIIH test procedure:

From Addison Schweitzer:

- *6.7 Engine-Oil Cooling System*—The FCM controls engine oil temperature at ~~150 °C~~ 151°C by controlling the flow of engine coolant through the production oil cooler with the use of a 2-way, flow-control valve.
- 7.5 Use Ultrasonic-7[1] soap and Ultrasonic-B degreaser26 in ultrasonic parts washers to clean engine block, cylinder heads and fixed phasers. Cleaning solution shall be at a temperature of ~~150 °C ± 10 °C~~. 66°C ± 6°C or 150°F ± 10°F.
- There also appears to be an extra page for FIG. A3.1 Blowby Ventilation Setup

From Amol Savant:

- In Table 3, Coolant flow meter part no. is wrong. It should be Flow meter: R200S418NCAMEZZZZ and Transmitter: 1700I13ABMEZZZ.
- The note with Superscript 'C' for this table should go for the above flow meter model no. (we are using a diff. one : Meter: T150T644SQBAEZZZZ, Transmitter: 1700R12ABAEZZZ which exceeds the specs. In note 'C')
- Also, for the 3-way coolant temperature control valve, it was discussed and agreed upon before the beginning of precision matrix that use of 'SVF T7-6666TT150-S1 - 2 inch' (Same as in IIIG) be allowed in place of Badger meter.

Other:

- Section 12.14.1, replace barium with sodium.

These corrections will be included *in the re-ballot of the test method (see section 6 below).*

5.4) Sequence IIIH Batch Code 3 piston update. **All**

Todd Dvorak presented (**Attachment 5**) on blowby, pvis, mrv, and phos for Batch Code 3 pistons. Todd found evidence that piston batch might be significant for pvis, wpd, and mrv. Todd commented that it could possibly be another time based factor that coincides with the piston batch change.

Ankit Chaudry presented an analysis (**Attachment 6**). SwRI ran an experiment to determine if pistons are the only factor to influence the blowby changes. The experiment showed that the batch 3 pistons had the highest blowby. As a next step, SwRI will install BC2 pistons to see if the blowby returns to normal levels.

Kevin O'Malley presented (**Attachment 7**) the Batch 3 Piston data review plots from the statistics group. A long discussion regarding possible interpretations and meaning of the data took place. No general consensus emerged from the discussion.

ACTION ITEM – Stats group will re-examine the issue, including the most recent data, and look at potential correction factors.

George Szappanos moved that if the 90 hour (eot) viscosity is less the 80 hour viscosity the test is non-interpretable. The motion died for lack of a second. More discussion ensued.

ACTION ITEM – Jim Rutherford will examine if a different ltms ei alarm consequence is viable (resetting and using fast start vs. excessive influence)

It was commented during the discussion that future batches should be introduced with reference testing, ideally with enough time to address any issues, before running out of inventory of the prior batch. ***ACTION ITEM – Ed Altman and Jim Matasic will provide a proposal at a future meeting.*** The panel might also consider adding this item to the scope and objectives.

6.0) New Business

6.1) ACC PAPTG request to separate IIIHA and IIIHB from body of procedure. **Letter from ACC PAPTG**

The letter is shown in **Attachment 8**. Andy Ritchie moved, George Szappanos seconded, that the IIIH test method be reorganized and documented with the IIIHA and IIIHB described more clearly and contained in appendices rather than the main body of the procedure. The motion carried 13-0-1.

6.2) Review and address negatives attached to IIIH test method ballot.

The compilation of negatives is shown in **Attachment 9**. Between the approved procedure corrections noted above in Section 5.3 and the approved reorganization of the procedure so that the IIIH/A/B structure matches the IIIG/A/B (Section 6.1 above), the surveillance panel believes that all negatives have been addressed. This will be communicated to the facilitator and once the appropriate revisions are made, the surveillance panel will review the full procedure before it is re-balloted. ***ACTION ITEM – TMC will communicate to Terry Bates, IIIH facilitator, the panel's disposition of all negatives as well as the desire to review the method before it is balloted.***

7.0) Review / Update Scope and Objectives

The scope and objectives were reviewed and the revised are shown in **Attachment 10**.

8.0) Next Meeting

The next meeting will be at the call of the new chairman, Robert Stockwell.

9.0) Meeting Adjourned

The meeting concluded at 4:15 pm, with a warm standing ovation for out-going Chair Dave Glaenzer in appreciation for all his efforts and leadership for the past 10 years.

ATTACHMENT 1

ASTM Sequence III Surveillance Panel (22 Voting members) date: 11/15/16

Name/Address	Phone/Fax/Email		Signature
Ed Altman	ed.altman@aftonchemical.com	Voting Member	Present
Jeff Betz	jeff.betz@fcagroup.com	Voting Member	Present JB
Jason Bowden	jhbowden@ohtech.com	Voting Member	Present
Timothy L. Caudill	tlcaudill@ashland.com	Voting Member	Present Proxy by A. Savant
Richard Grundza	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	dlanctot@tei-net.com	Voting Member	Present DL
Patrick Lang	plang@swri.org	Voting Member	Present P.L
Mark Overaker	mhoveraker@jhaltermann.com	Voting Member	Present
Michael Raney	michael.p.raney@gm.com	Voting Member	Present
Andrew Ritchie	andrew.ritchie@infineum.com	Voting Member	Present AR
Ron Romano	rromano@ford.com	Voting Member	Present
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Greg Shank	greg.shank@volvo.com	Voting Member	Present
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George Szappanos	george.szappanos@lubrizol.com	Voting Member	Present
Haiying Tang	HT146@chrysler.com	Voting Member	Present
Sydelle Elshenawy	sydelle.elshenawy@bp.com	Voting Member	Present

ASTM Sequence III Surveillance Panel (22 Voting members) date:

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Terry Bates	batesterryw@aol.com	N-V Member	Present_____
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Martin Heimrich	martin.heimrich@swri.org	N-V Member	Present_____

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Angela Willis	angela.p.willis@gm.com	N-V Member	Present_____
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ATTACHMENT 2

Surface Finish IIIH Capability Analysis

Date: November 11, 2016

Response RK

- **Lab is significant in the model for RK, meaning lab has a significant affect on the value of RK.**

Response RK

Whole Model

Effect Tests

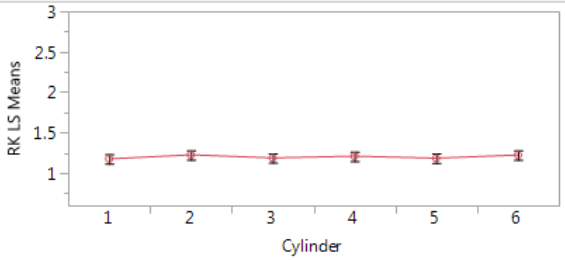
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Cylinder	5	5	0.1421532	0.5424	0.7442
Lab	4	4	4.5479755	21.6897	<.0001*

Cylinder

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
1	1.1767834	0.02968808	1.21421
2	1.2268480	0.02968808	1.26427
3	1.1889931	0.02968808	1.22642
4	1.2101060	0.02968808	1.24753
5	1.1851222	0.02968808	1.22255
6	1.2247996	0.02968808	1.26223

LS Means Plot

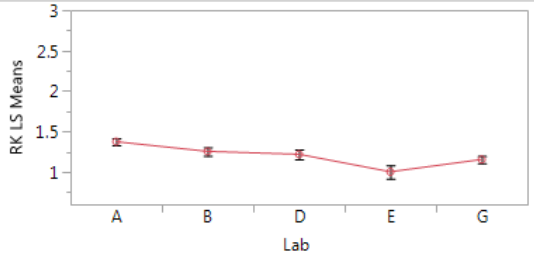


Lab

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	1.3757807	0.02144373	1.37578
B	1.2555833	0.02698277	1.25558
D	1.2203148	0.03115702	1.22031
E	1.0032667	0.04180153	1.00327
G	1.1555980	0.02267006	1.15560

LS Means Plot



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RPK Response

- **Lab and Cylinder are significant in the model for RPK, meaning lab and cylinder number have a significant affect on the value of RPK.**

Response RPK

Whole Model

Effect Tests

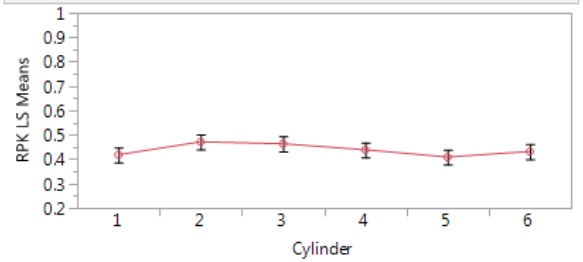
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Cylinder	5	5	0.18744435	2.5841	0.0259*
Lab	4	4	0.40552487	6.9882	<.0001*

Cylinder

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
1	0.41853198	0.01561799	0.419242
2	0.47154811	0.01561799	0.472258
3	0.46359650	0.01561799	0.464306
4	0.43875779	0.01561799	0.439468
5	0.40912876	0.01561799	0.409839
6	0.43209650	0.01561799	0.432806

LS Means Plot

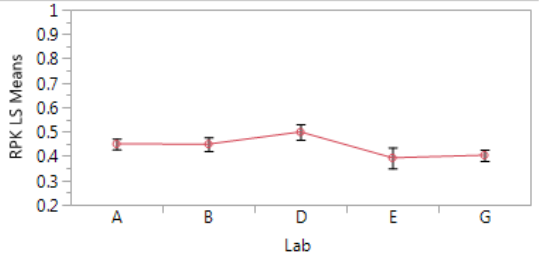


Lab

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	0.44991228	0.01128089	0.449912
B	0.44918056	0.01419480	0.449181
D	0.49900000	0.01639075	0.499000
E	0.39280000	0.02199049	0.392800
G	0.40382353	0.01192602	0.403824

LS Means Plot



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RVK Response

- **Lab is significant in the model for RVK, meaning lab has a significant affect on the value of RVK.**

Response RVK

Whole Model

Effect Tests

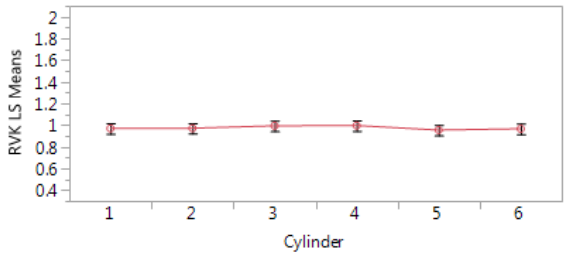
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Cylinder	5	5	0.0824664	0.4591	0.8066
Lab	4	4	3.5238546	24.5215	<.0001*

Cylinder

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
1	0.97020054	0.02457732	0.934258
2	0.97195861	0.02457732	0.936016
3	0.99447474	0.02457732	0.958532
4	0.99655538	0.02457732	0.960613
5	0.95515216	0.02457732	0.919210
6	0.96695861	0.02457732	0.931016

LS Means Plot

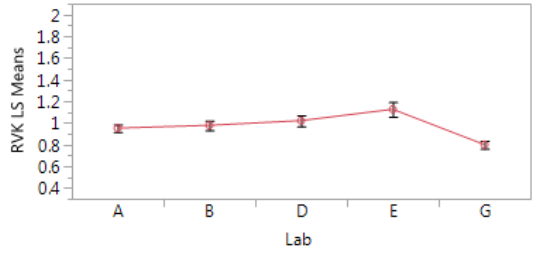


Lab

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	0.9529123	0.01775222	0.95291
B	0.9788750	0.02233772	0.97888
D	1.0215000	0.02579338	1.02150
E	1.1261000	0.03460545	1.12610
G	0.8000294	0.01876744	0.80003

LS Means Plot



RZ Response

- **Lab is significant in the model for RZ, meaning lab has a significant affect on the value of RZ.**

Response RZ

Whole Model

Effect Tests

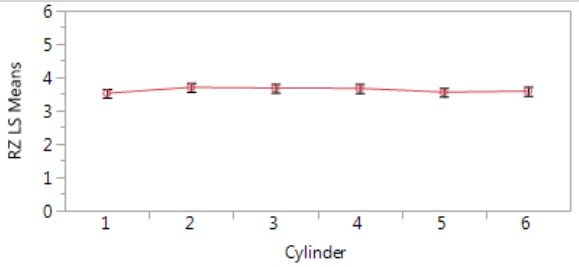
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Cylinder	5	5	1.634595	1.1641	0.3264
Lab	4	4	44.245820	39.3889	<.0001*

Cylinder

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
1	3.5266587	0.06871449	3.47031
2	3.7025942	0.06871449	3.64624
3	3.6793362	0.06871449	3.62298
4	3.6715620	0.06871449	3.61521
5	3.5589974	0.06871449	3.50265
6	3.5893200	0.06871449	3.53297

LS Means Plot

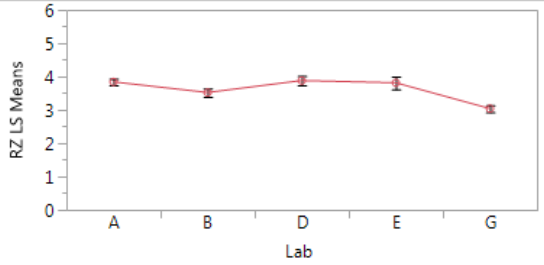


Lab

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	3.8427719	0.04963254	3.84277
B	3.5247222	0.06245291	3.52472
D	3.8831296	0.07211441	3.88313
E	3.8152667	0.09675164	3.81527
G	3.0411667	0.05247094	3.04117

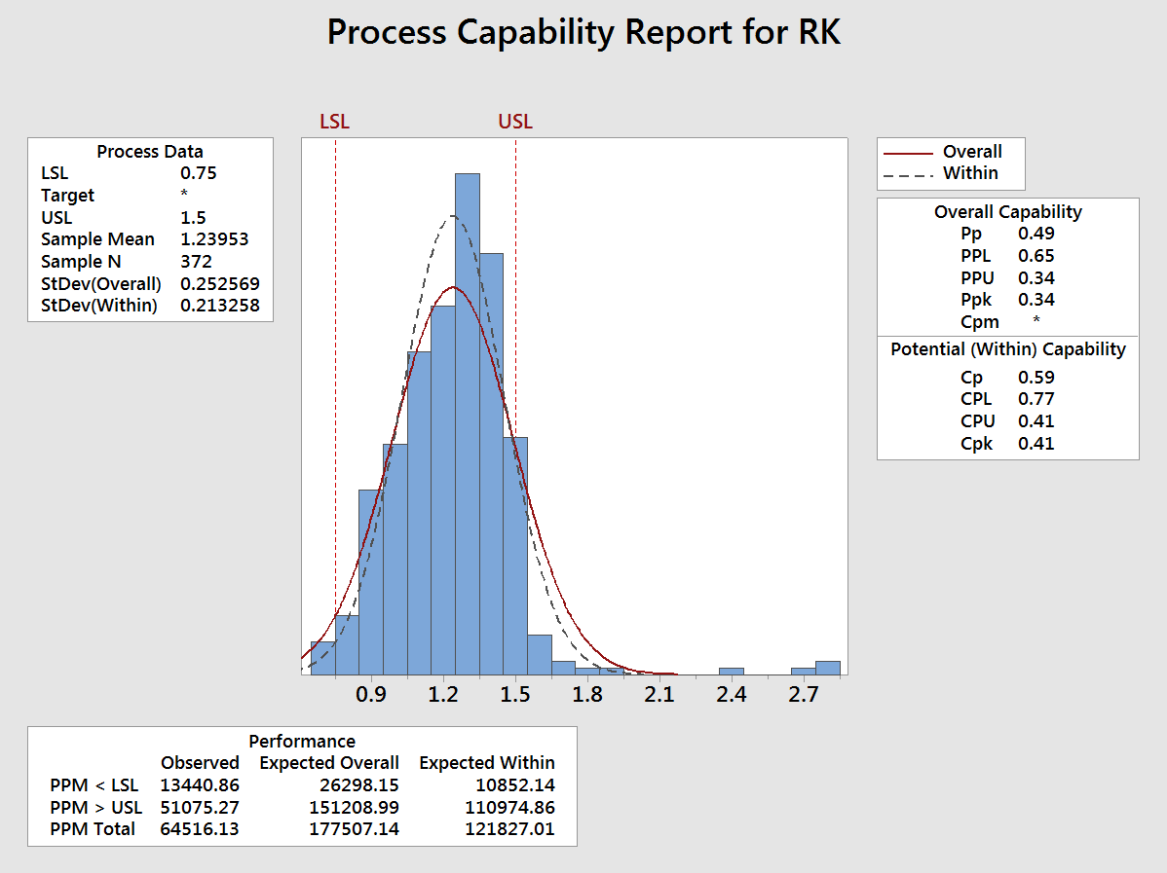
LS Means Plot



CAPABILITY ANALYSIS USING ALL DATA FROM EACH CYLINDER

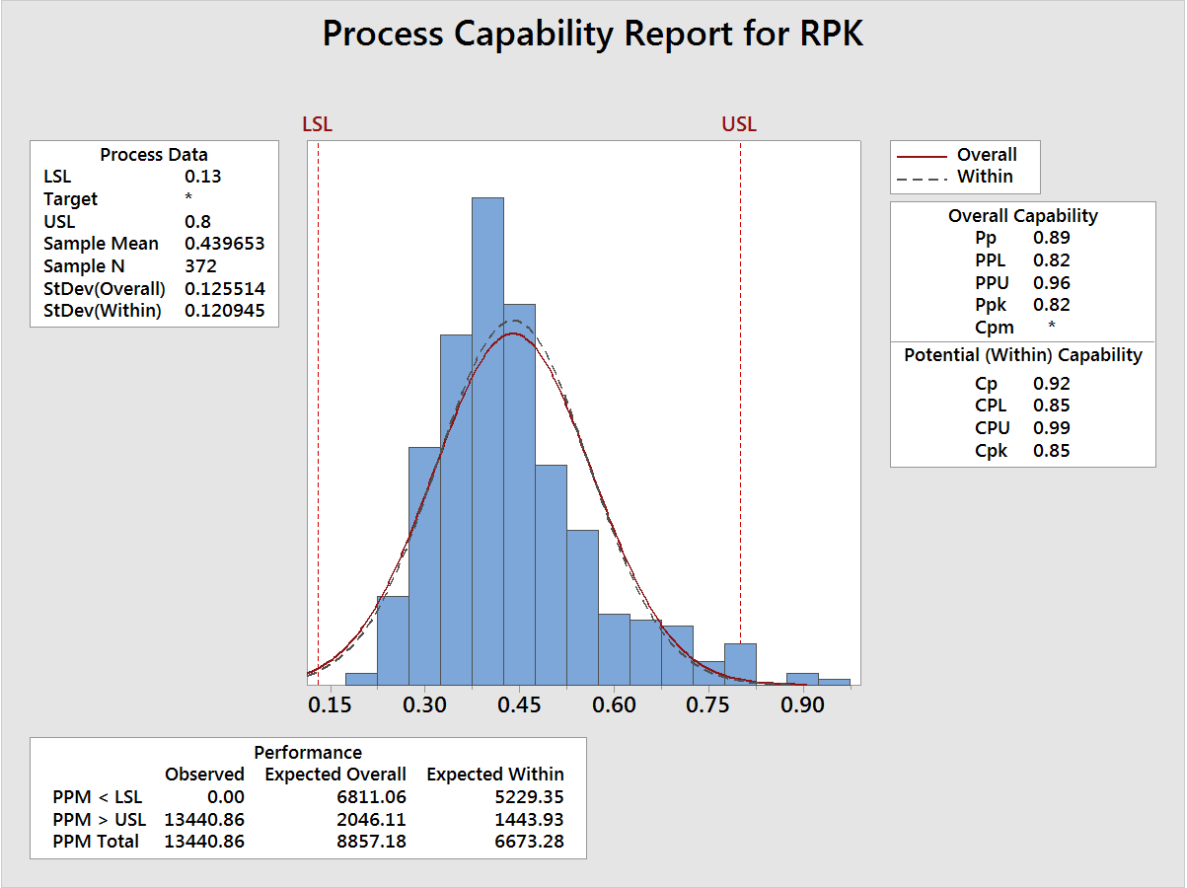
Capability Analysis Using All Data for RK

- **RK seems to be slightly on target since C_p and C_{pk} are close to being equal, but the spread for RK is too large since C_p is less than 1.**



Capability Analysis Using All Data for RPK

- **RPK seems to be on target since C_p and C_{pk} are approximately equal, but the spread for RPK is a little bit too large since C_p is less than 1.**



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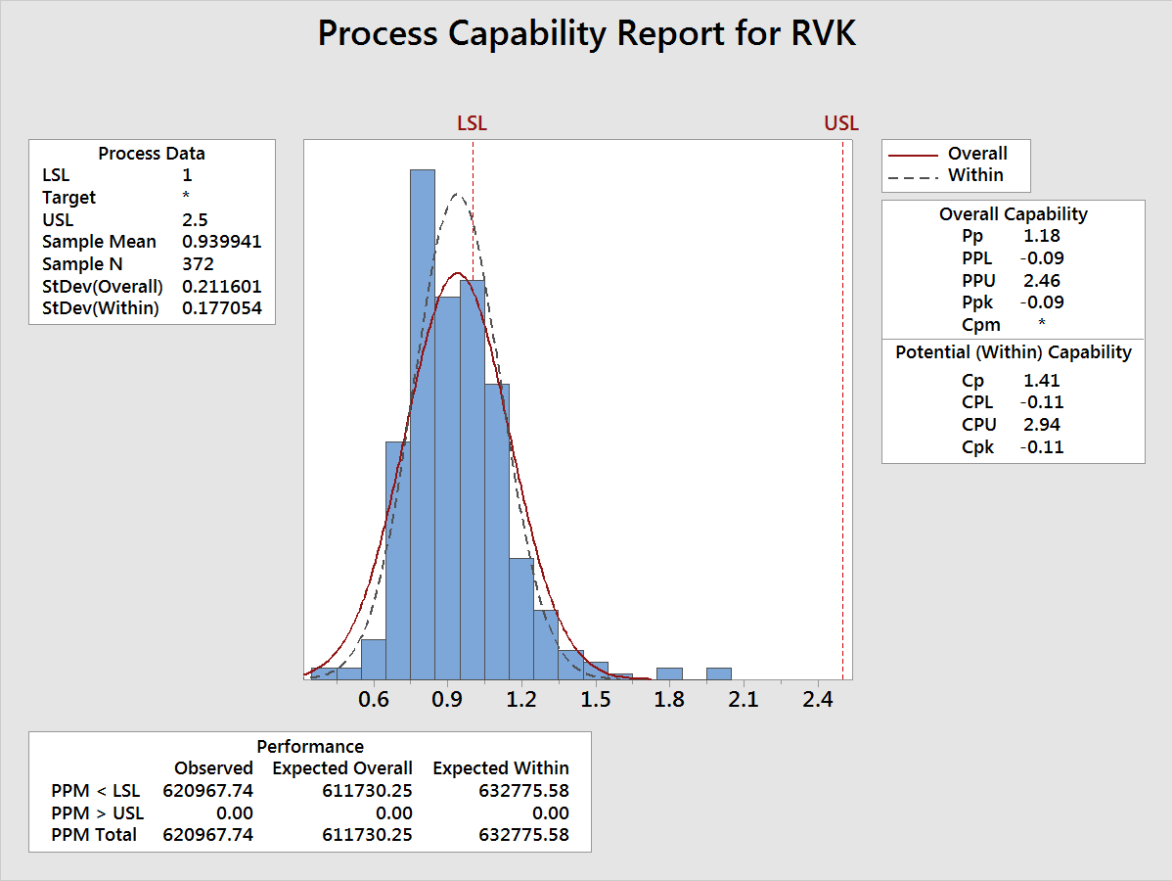
Capability Analysis Using All Data for RVK

- **RVK is extremely off target since C_p and C_{pk} are not equal, but the spread for RVK is not too large since C_p is greater than 1.**



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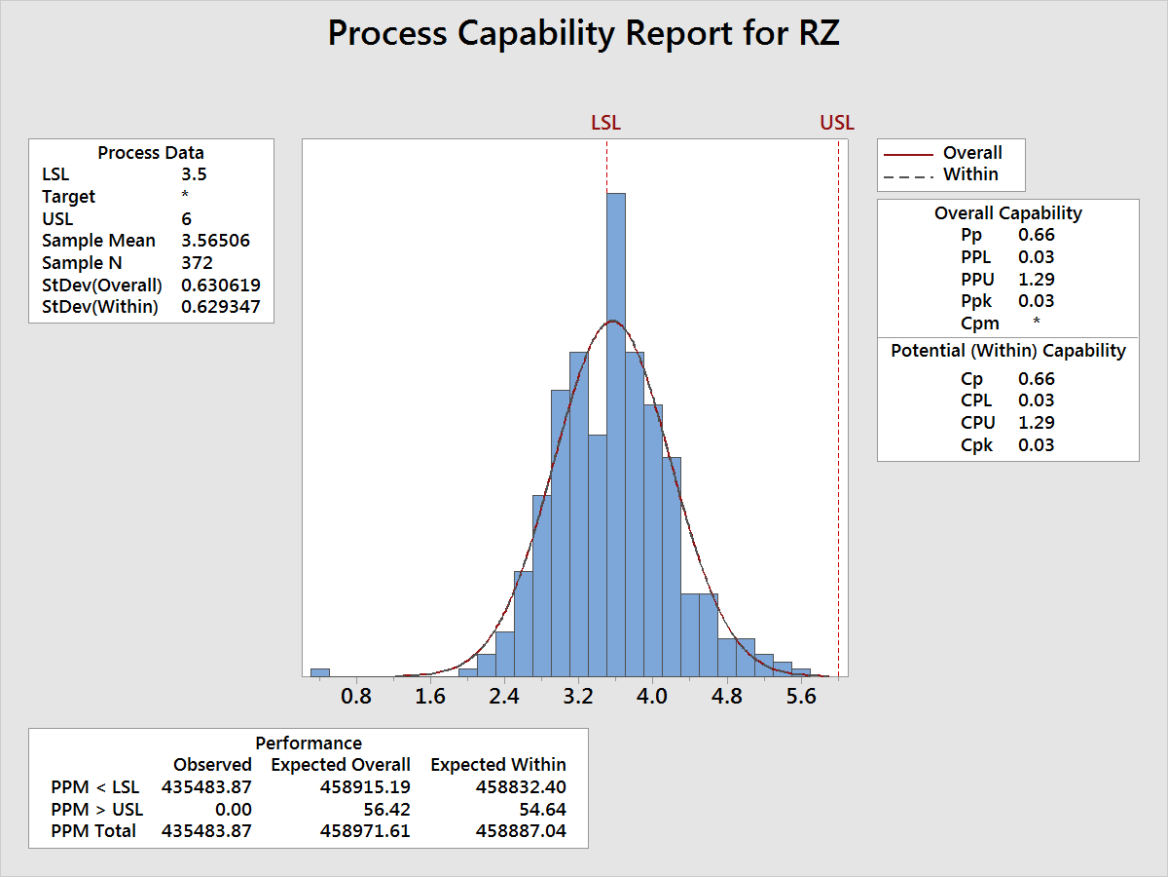
Capability Analysis Using All Data for RZ

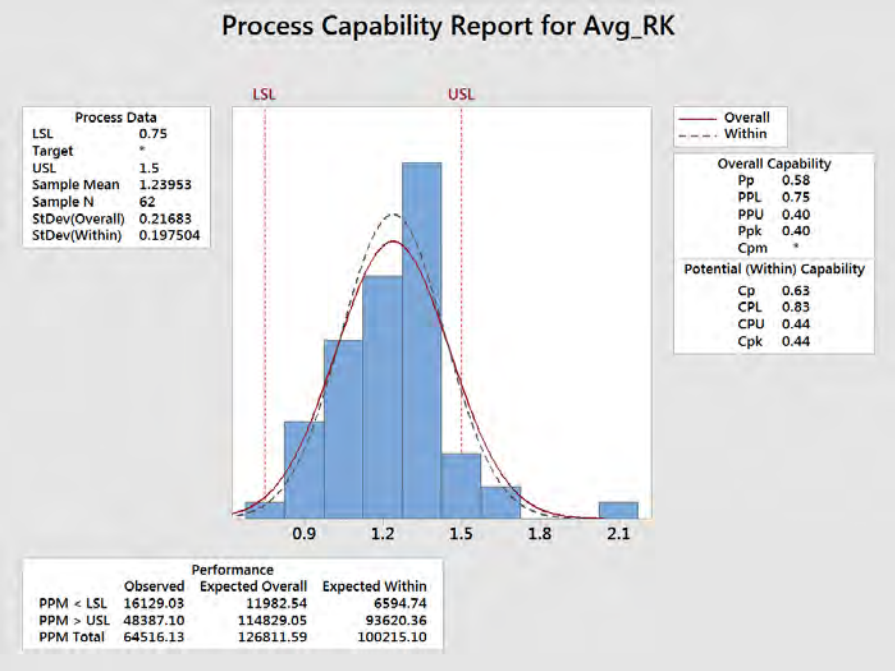
- **RZ is extremely off target since C_p and C_{pk} are not equal, and the spread for RZ is too large since C_p is less than 1.**

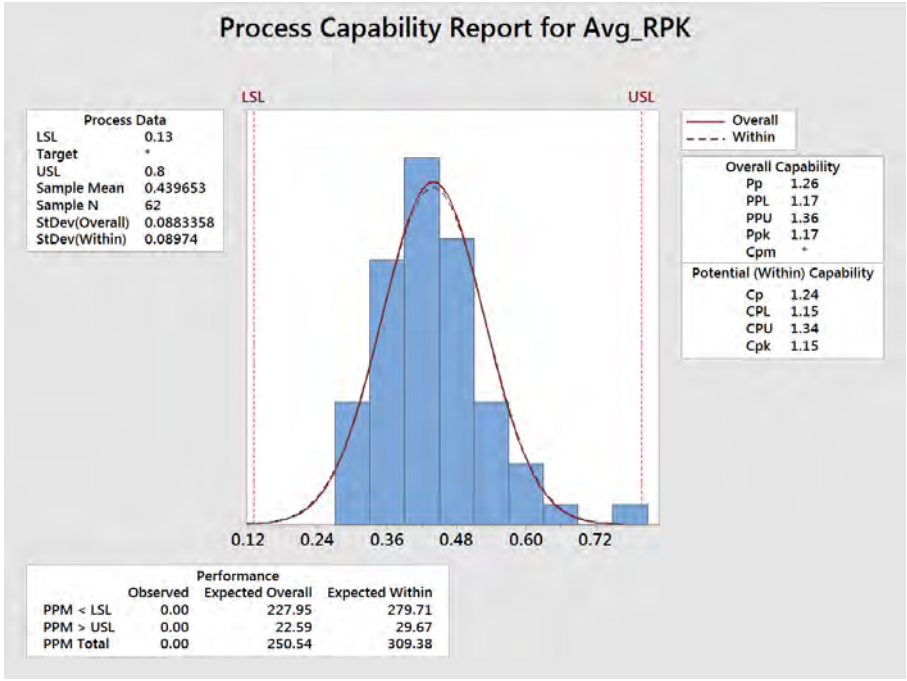


CAPABILITY ANALYSIS USING THE BLOCK AVERAGE DATA

Capability Using Average Cylinder Data for RK and RPK

- **Using the average of all six cylinders gives extremely similar results, but for RPK the spread is no longer too large since the outliers are not as prominent.**





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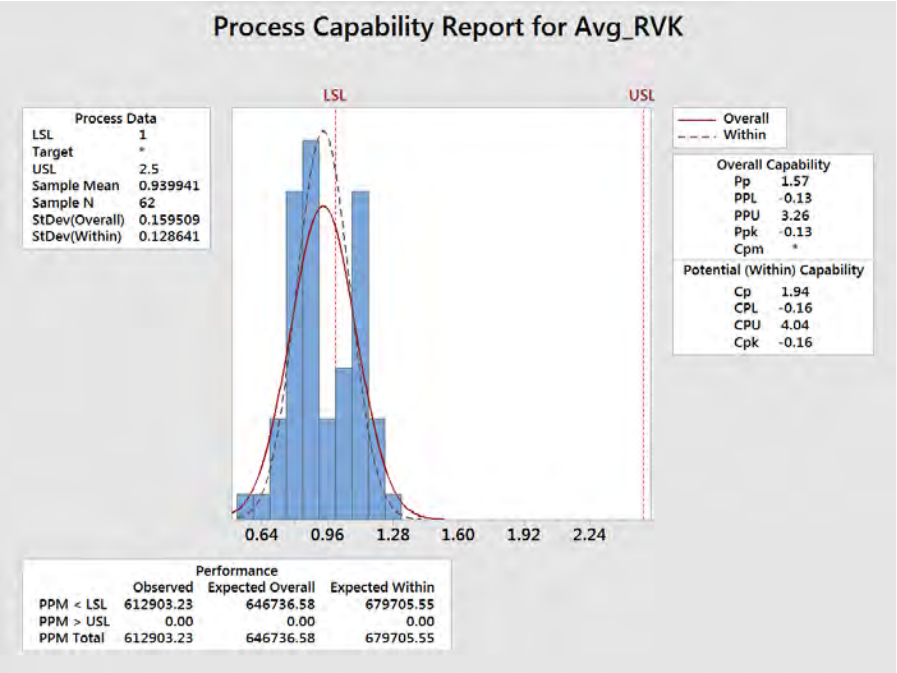
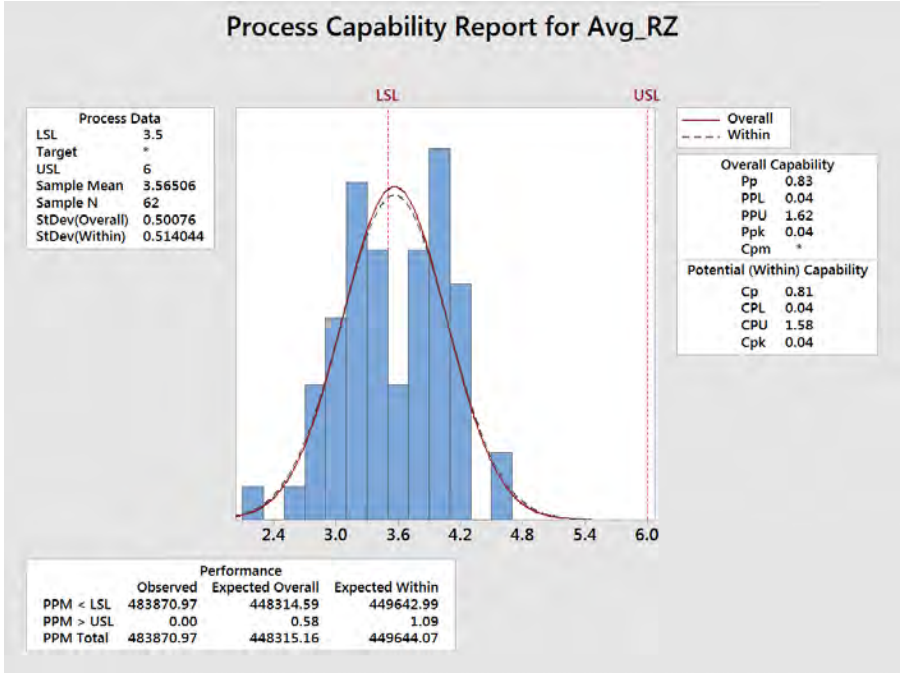
Capability Using Average Cylinder Data for RVK and RZ

- **Using the average of all six cylinders gives the same results for RVK and RZ as using all of the data.**

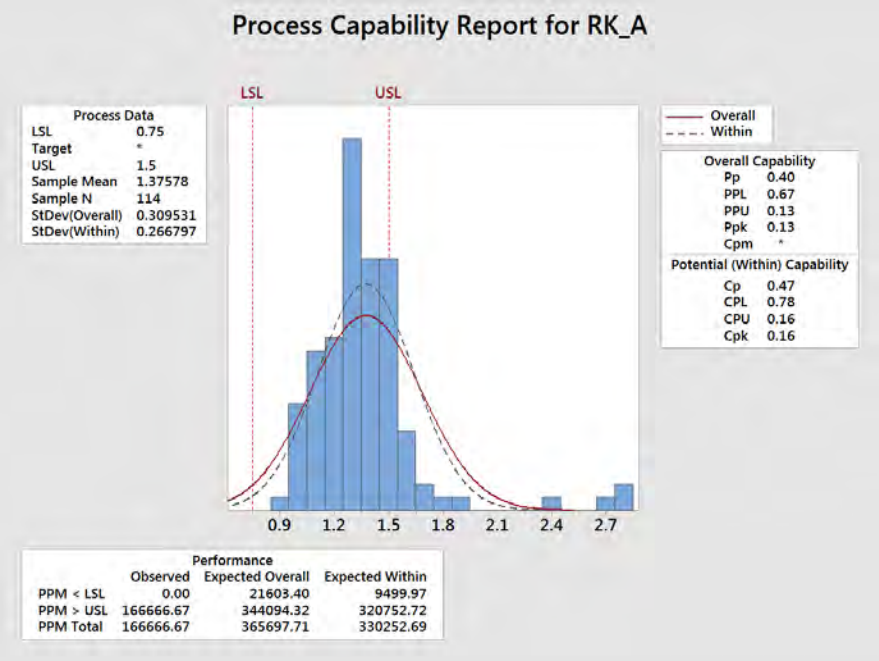


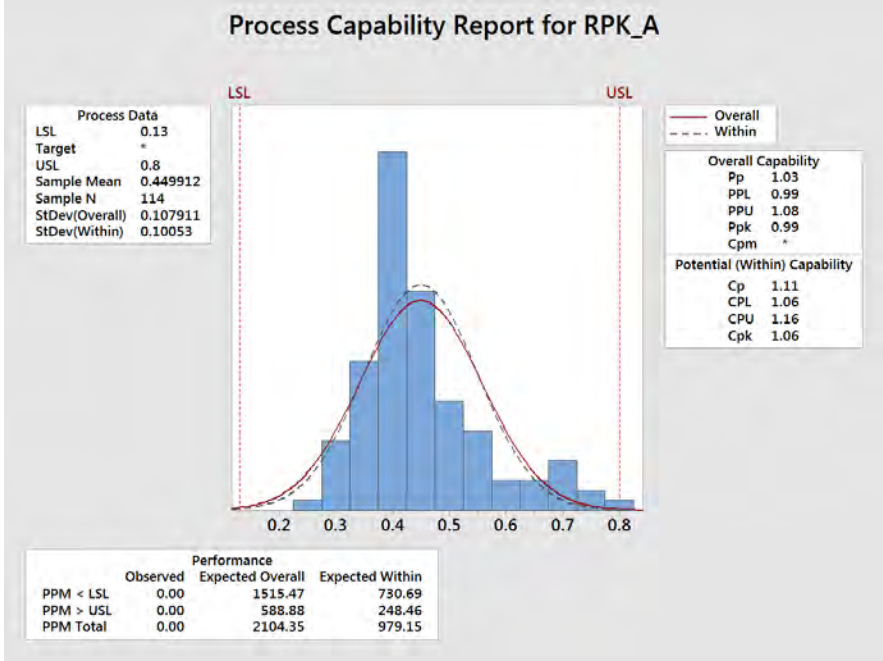


CAPABILITY ANALYSIS FOR EACH INDIVIDUAL LAB

Capability Analysis of RK and RPK for Lab A

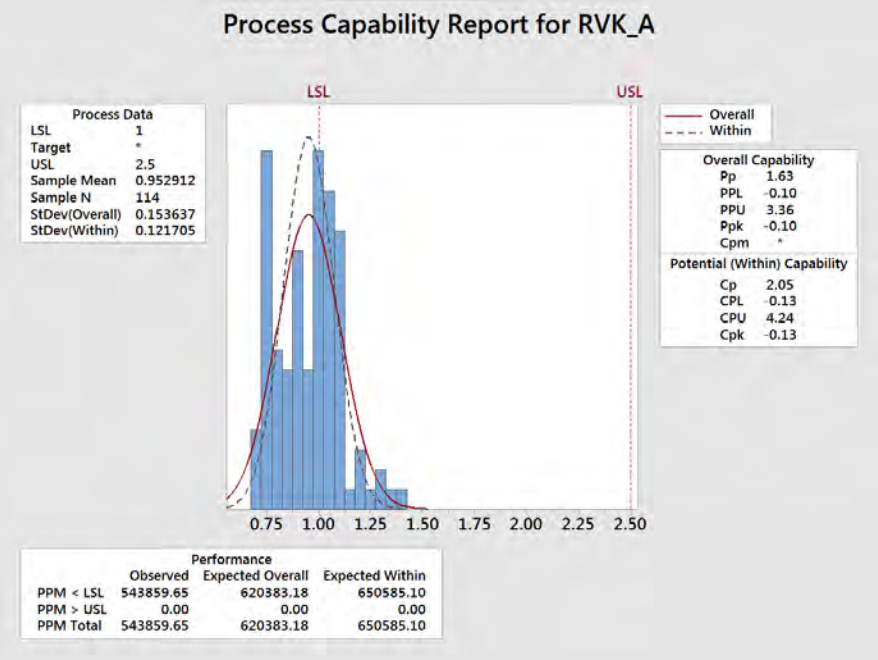
- For Lab A, RK is not on target since C_{pk} and C_p are not equal, and the spread is large since C_p is less than 1.
- For Lab A, RPK is on target and has good spread.

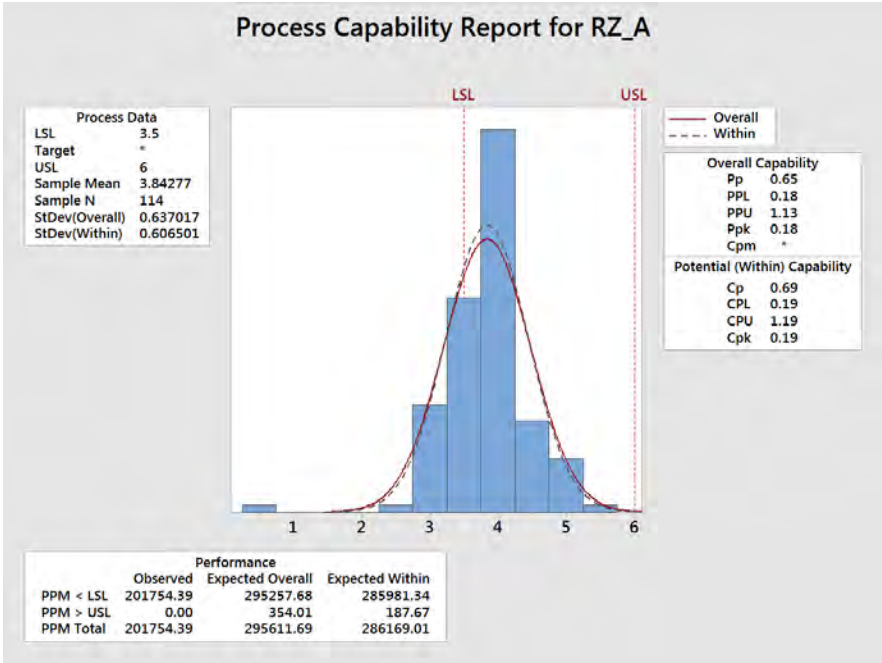




Capability Analysis for RVK and RZ for Lab A

- **For Lab A, RVK is not on target, but there does not seem to be a lot of spread.**
- **For Lab A, RZ is not on target since C_{pk} is less than C_p, and the spread is too large.**





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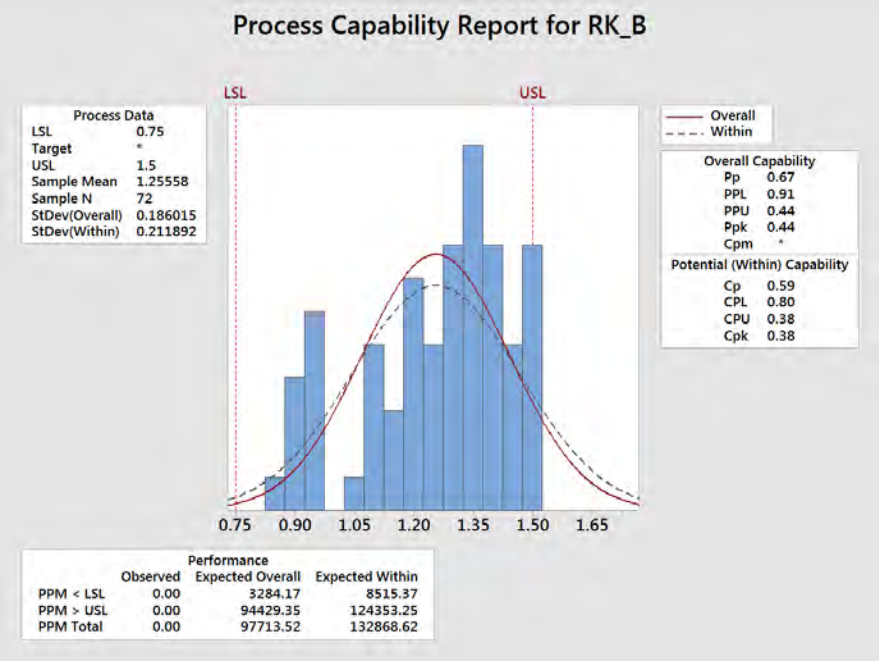
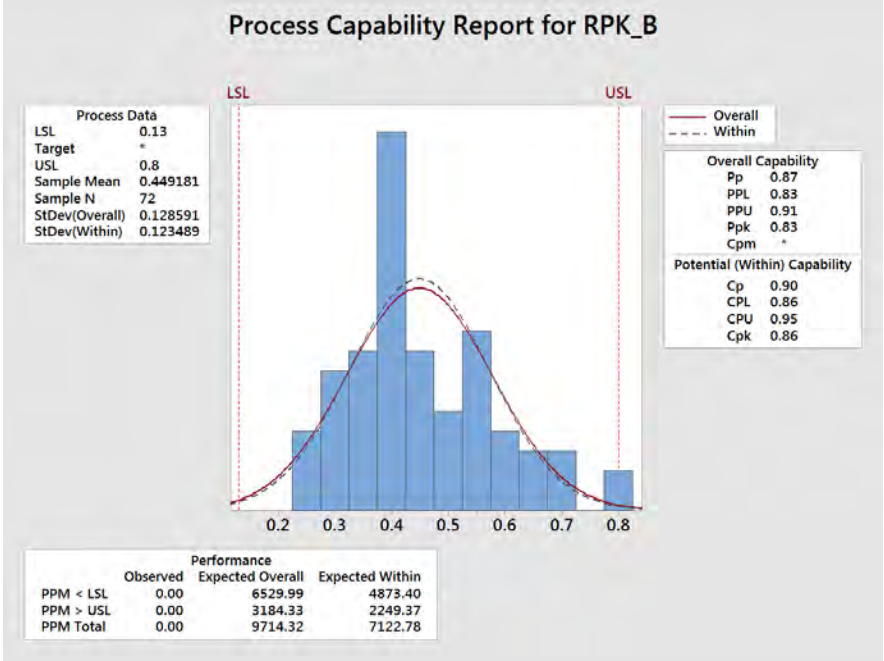
Capability Analysis for RK and RPK for Lab B

- For Lab B, RK is not on target since C_{pk} is less than C_p, and the spread is too large since C_p is less than 1.
- For Lab B, RPK is on target and the spread is only slightly large, but a few points are on the USL.





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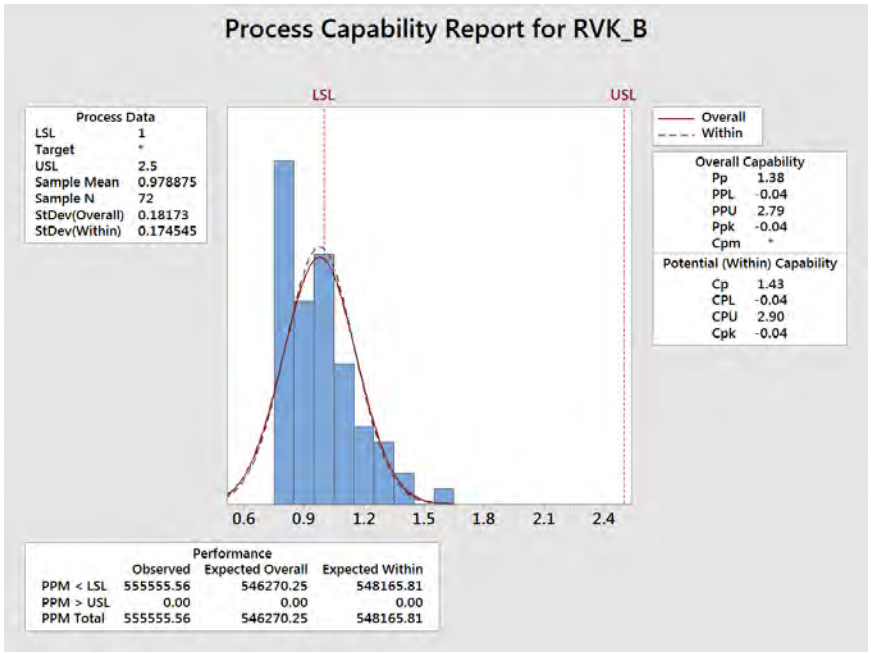
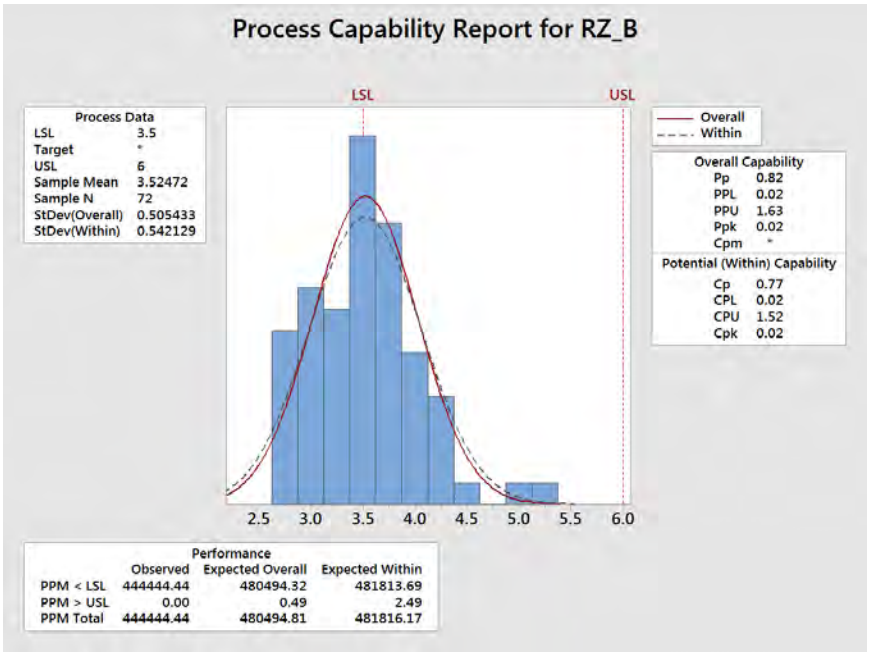
Capability Analysis for RVK and RZ for Lab B

- For Lab B, RVK is not on target since C_p and C_{pk} are not equal, but there does not seem to be a lot of spread.
- For Lab B, RZ is not on target since C_{pk} is less than C_p and the spread is a bit too large for these specification limits.





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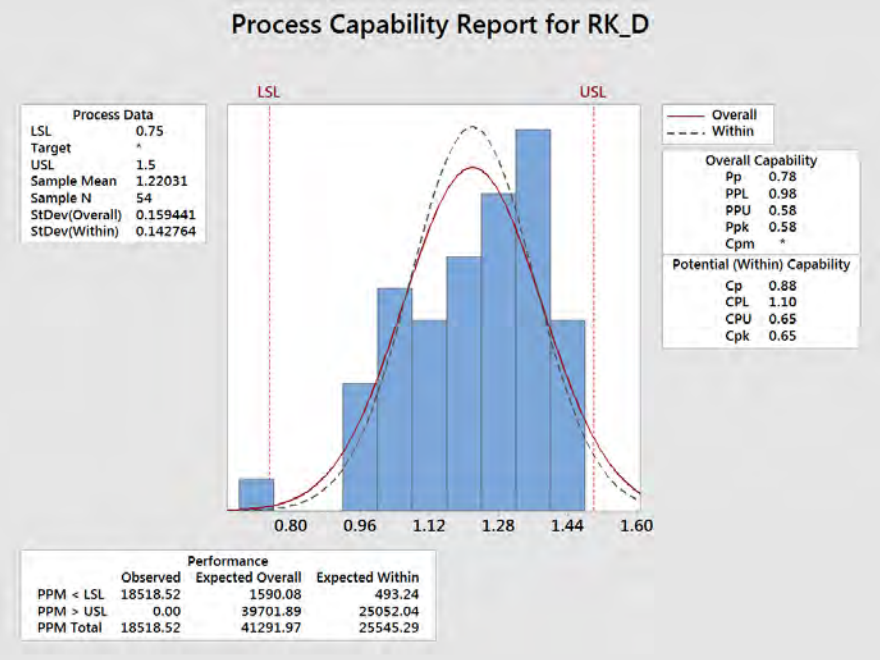
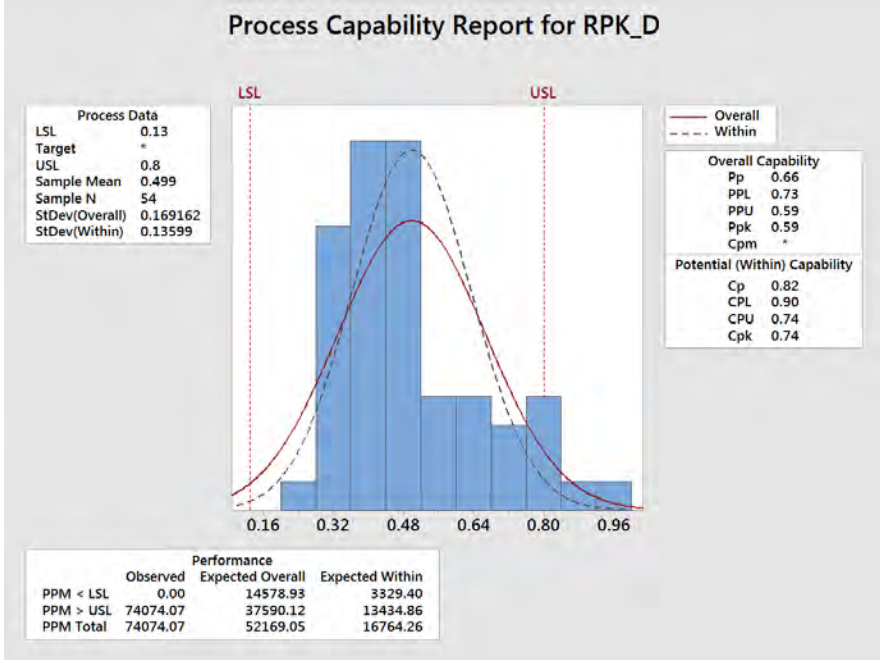
Capability Analysis for RK and RPK for Lab D

- For Lab D, RK is almost on target since C_{pk} approximately equal to C_p, but the spread is a bit too large for these specification limits.
- RPK has a slightly large spread since C_p is less than one but seems to be on target since C_{pk} and C_p are almost equal.





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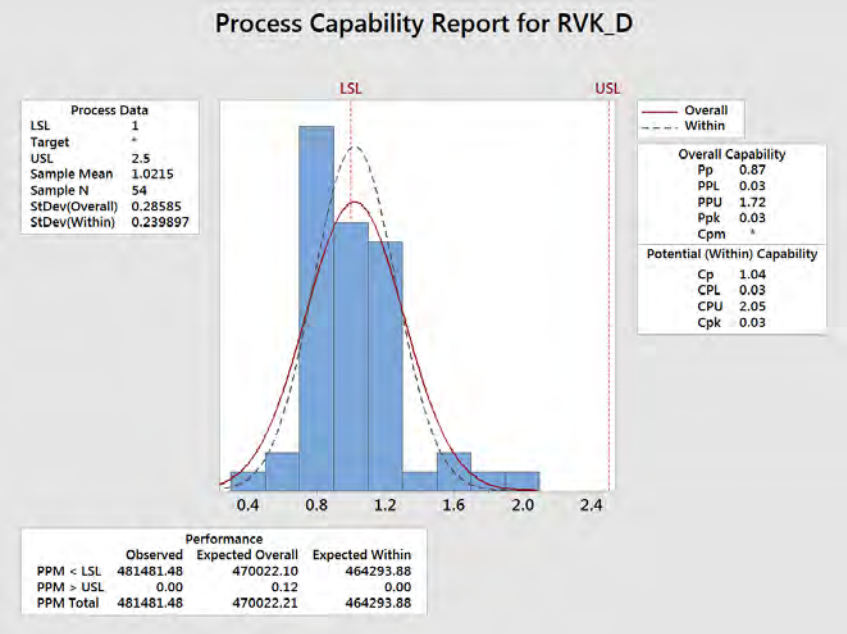
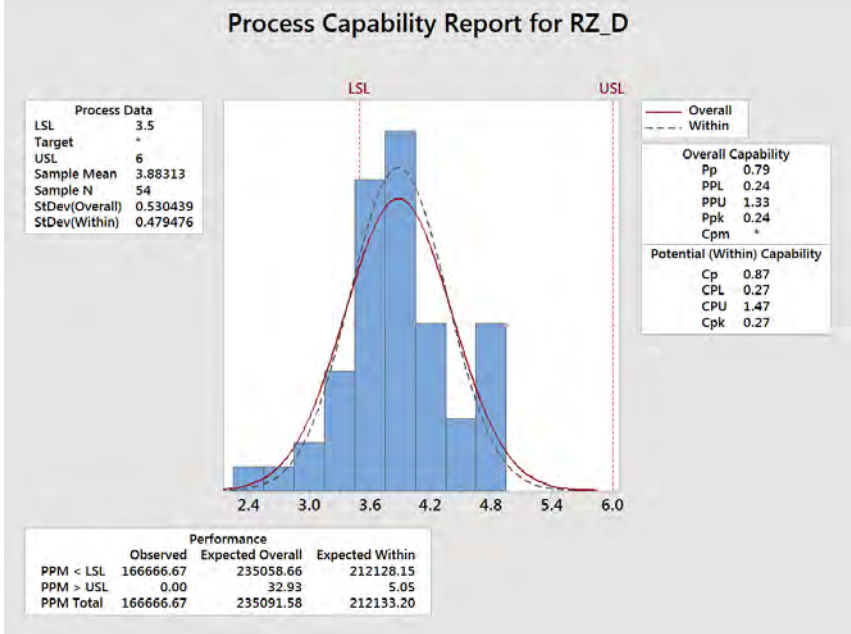
Capability Analysis for RVK and RZ for Lab D

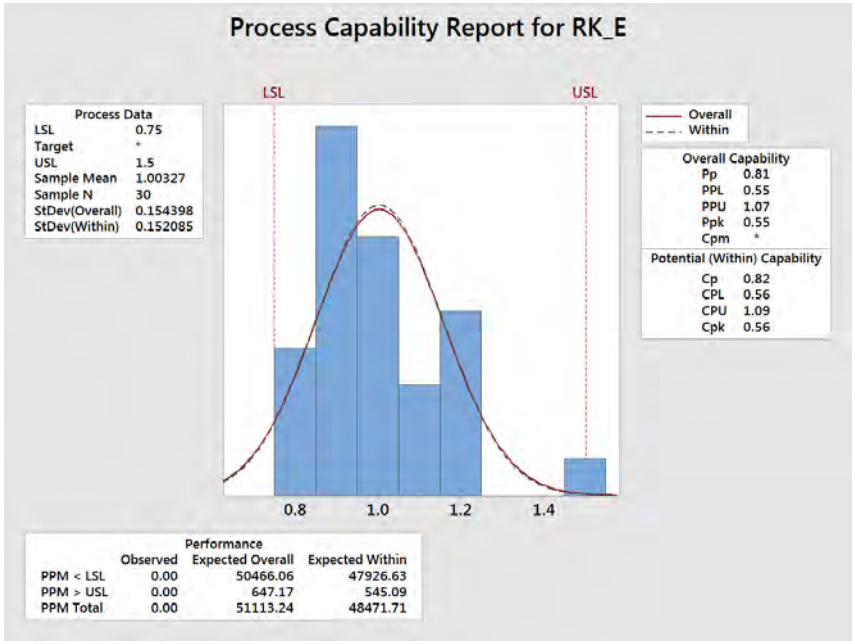
- **For Lab D, RVK is not on target causing many of the points to be below the LSL, but the spread is not too large.**
- **For Lab D, RZ is not on target since C_{pk} is less than C_p, and the spread is too large for these specification limits.**

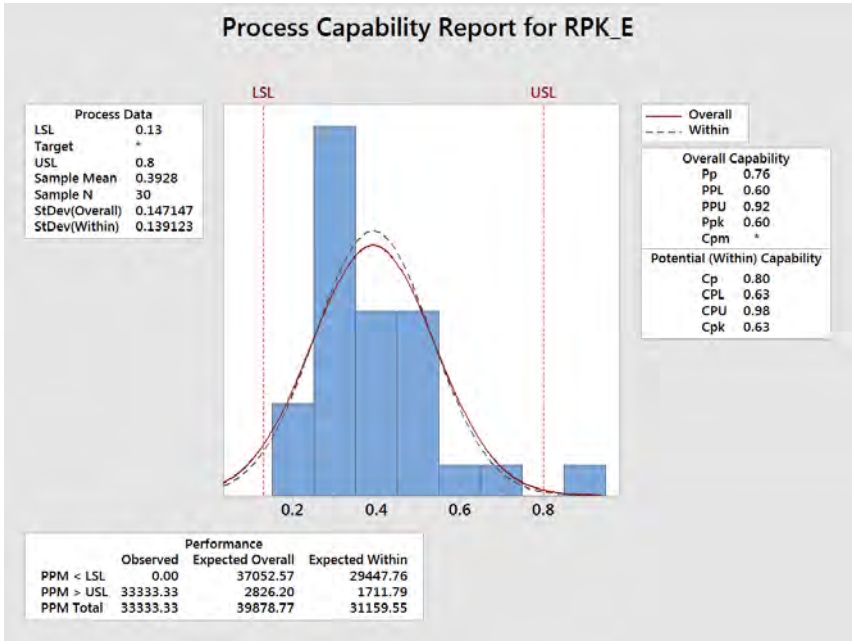




Capability Analysis for RK and RPK for Lab E

- For Lab E, RK is not on target since C_{pk} is less than C_p and the spread is too large since C_p is less than 1, but only a few points seem to be on the USL.
- For Lab E, RPK has large spread, but seems to be close to the target. A few points fall above the USL.





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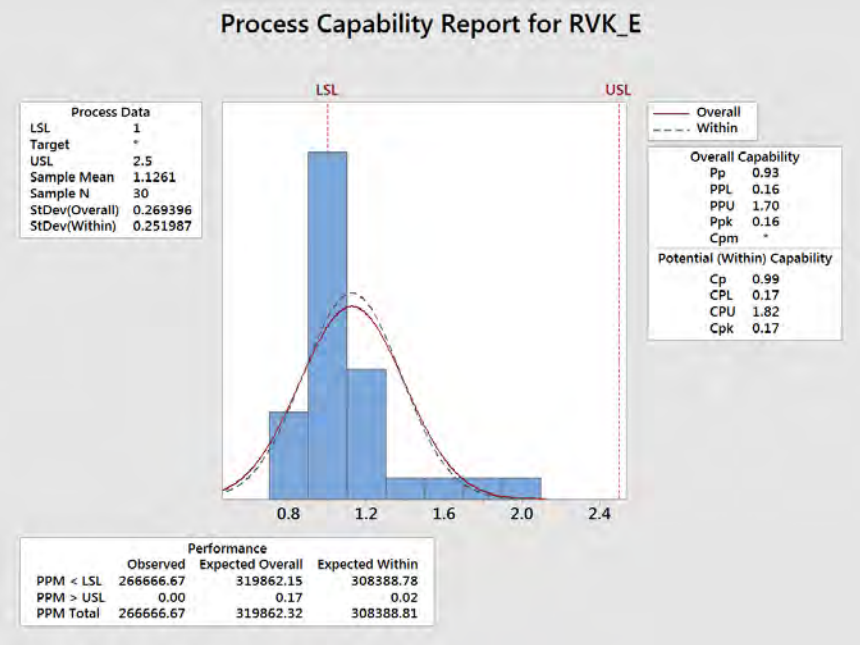
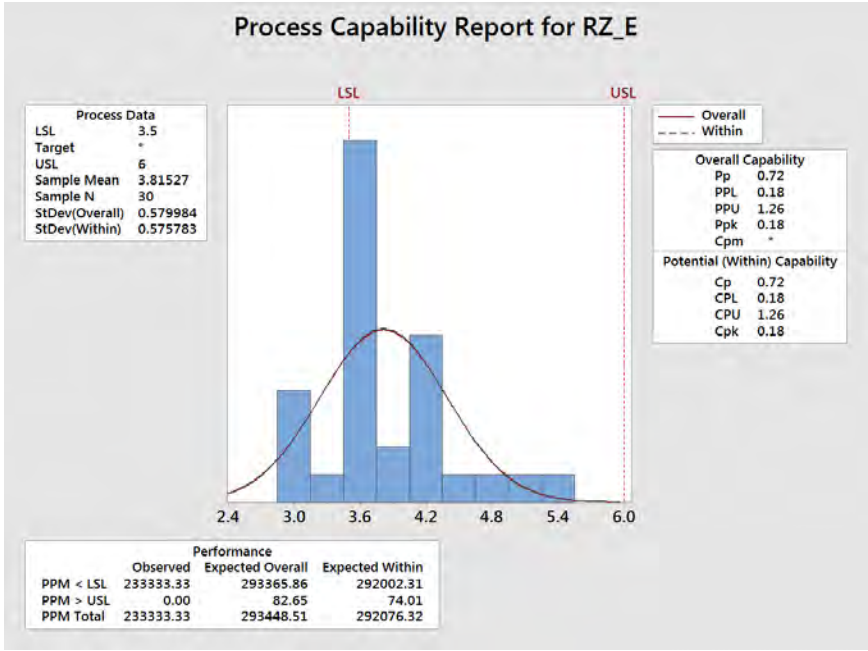
Capability Analysis for RVK and RZ for Lab E

- For Lab E, RVK is not on target since C_p is less than C_{pk}, but the spread is only slightly large.
- For Lab E, RZ is not on target, and the spread is too large for these specification limits since C_p is less than 1.





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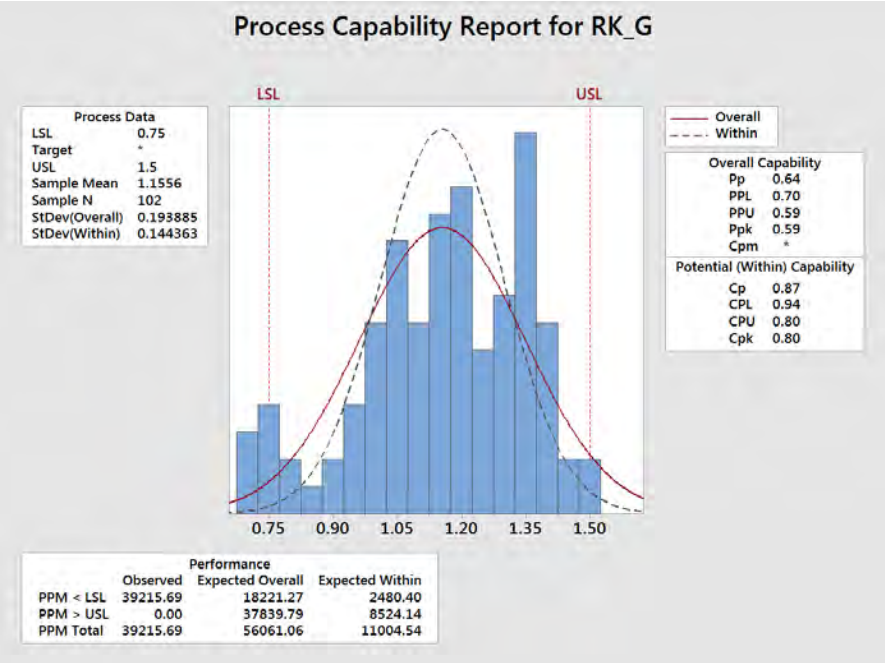
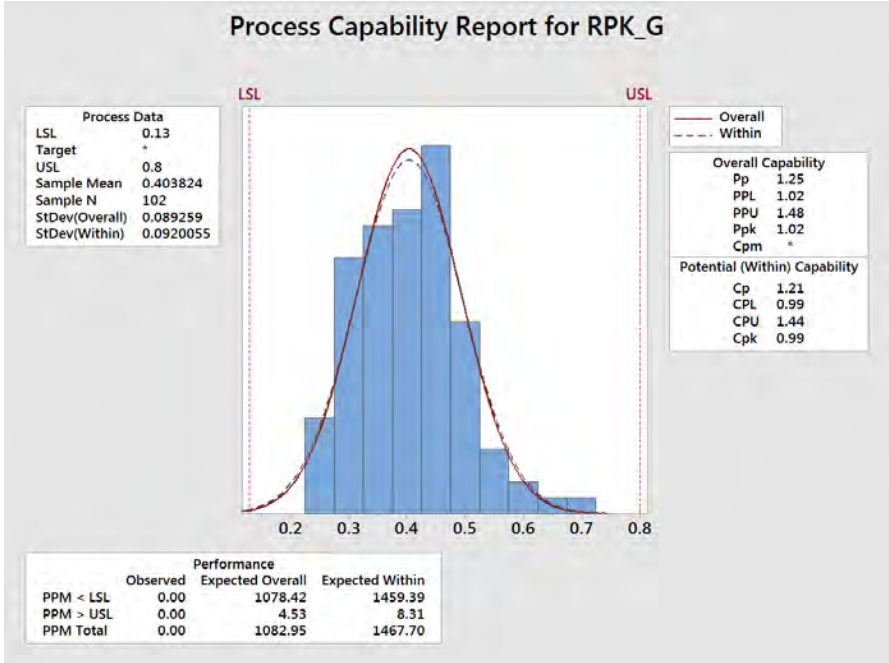
Capability Analysis for RK and RPK for Lab G

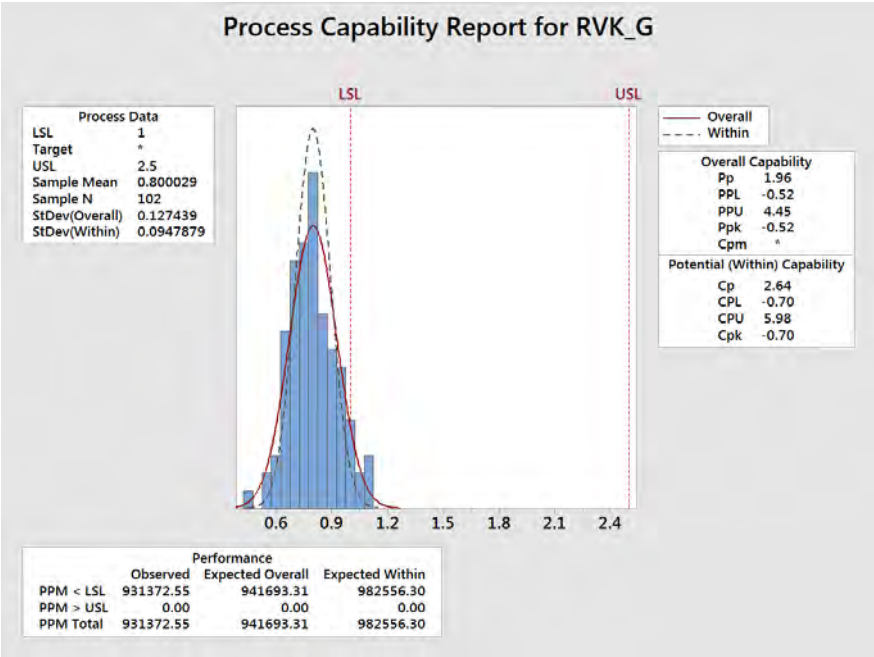
- **For Lab G, RK seems on target since C_{pk} is almost equal to C_p but the spread is slightly large.**
- **For Lab G, RPK meets the specification limits and has good spread, and only seems to be slightly off target.**

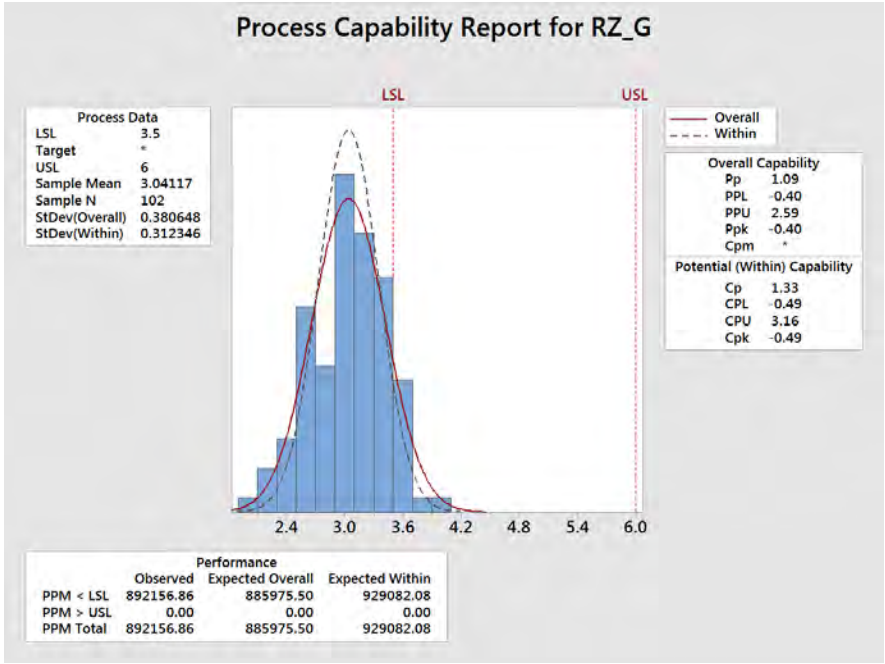




Capability Analysis for RVK and RZ for Lab G

- For Lab G, RVK is extremely off target since C_p is extremely less than C_{pk}, but the spread looks very good.
- For Lab G, RZ is extremely off target, but the spread is not too large.





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Conclusion

- Lab does seem to have an effect on the severity of each of the responses, but the overall issues trend throughout each Lab.
- RK seems to have a large spread overall and for all labs. Also overall RK is on target, but some labs seem to be more off target than others.
- RPK seems to always be on target, but overall and in a few labs the spread is a bit large (on USL side).
- RVK and RZ are extremely off target overall and for all labs. RVK seems to have good spread in all labs, but RZ seems to have large spread in all labs except G.

Specification Limits

- **Current Specification Limits:**
  - RK: 0.75 to 1.5
  - RPK: 0.13 to 0.8
  - RVK: 1 to 2.5 (temporarily suspended)
  - RZ: 3.5 to 6 (temporarily suspended)
- **Recommended Specification Limits (based on all data, mean ± 3*standard deviation):**
  - RK: 0.48 to 1.2
  - RPK: 0.06 to 0.82
  - RVK: 0.3 to 1.57
  - RZ: 1.67 to 5.46

ATTACHMENT 3

On or about August 24, 2016	IAR	SwRI	Aft	LZ	Ash	OHTech	Chevy Perf.	Sum	Runs	
#12593374 connecting rods (unused)	[redacted]							1438	240	**Rod Runs 240**
#24502168 crankshaft (unused)								12	72	**Crank Runs 72**
#24502286 cylinder block **NEVER UNUSED**								2	20	
#24502286 cylinder block **USED W/ 1 RUN**								0	0	
#24502286 cylinder block **USED W/ 2 RUNS**								0	0	
#24502286 cylinder block **USED W/ 3 RUNS**								4	28	
#24502286 cylinder block **USED W/ 4 RUNS**								2	12	
#24502286 cylinder block **USED W/ 5 RUNS**								3	15	
#24502286 cylinder block **USED W/ 6 RUNS**								33	132	
#24502286 cylinder block **USED W/ 7 RUNS**								13	39	
#24502286 cylinder block **USED W/ 8 RUNS**								45	90	
#24502286 cylinder block **USED W/ 9 RUNS**								16	16	**Block Runs 352**
#24502260**B** cylinder heads								0		
#24502260**S** cylinder heads **NEVER USED**								116	116	**Head Runs**
#24502260**S** cylinder heads **USED ONCE, still serviceable**								14	7	
#24502260**S** cylinder heads **USED TWICE, still serviceable**								95	48	
#24502260**S** cylinder heads **USED THRICE, still serviceable**								0	0	**171**
OHT3F-058-1 Rocker Arm, New								2568	214	**Rocker Runs 214**

cylinder heads **NEVER USED** Assumes **two** uses. May be more

cylinder heads **USED ONCE, still serviceable** Assumes **one more use possible**, may be more

cylinder heads **USED TWICE, still serviceable** Assumes **one more use possible**, may be more

A Has heads with three runs that may still be serviceable, but have not been measured.

ATTACHMENT 4

IIIG, IIIF - IIIH Test Equivalency Update

Slides taken from CLOG Update to AOAP on Oct. 13, 2016

Current Status

- Sequence IIIF Deposits and vis increase
  - 4 test IIIH matrix - 1006 and 433 at 2 labs
  - Testing underway
- Sequence IIIG Deposits and Vis Increase
  - Two recommendation made to API LG.
  - API LG balloting 3.7 min WPD and 150% max viscosity increase
- Sequence IIIG and IIIF wear
  - Wear statistics on IIIG and IIIF have been obtained, determined no need for replacement wear test
- Sequence IIIGA
  - Recommended that the IIIHB not be used in place of the IIIGA. Can use ROBO.
- Sequence IIIGB
  - Recommended that the IIIHB at a limit of 80.5% min be the API SN replacement for the IIIGB (LG balloting 81% min)

IIIH to IIIF Matrix

	Calibrated IIIH Stands	
Run Order	Intertek	Southwest
1	433-2 1220225-IIIH	433-2
2	1006-2 120224-IIIH	1006-2

Test Reported

Estimated matrix completion =November 4th

Testkey	Lab/ Stand	Date Completed	Oil	Viscosity Increase (%) 20	40	60	80	EOT	WPD (merits)	Average Piston Skirt Varnish (merits)	Phos. Retention (%)	MRV	Piston Batch	Comment
120225-IIIH	G2	20160923	433-2	-0.38	6.22	11.36	34.24	72.2	4.08	9.44	79.35	95,800 @-30°C	3	
120224-IIIH	G2	20160928	1006-2	12.76	40.00	180.51	N/A	952.3	2.01	7.31	75.33	N/A	3	Aborted @ 79 hrs.

SEQUENCE IIIF

TMC Oil Code	Viscosity Grade	Performance Classification	Year Introduced	Engine Test Data: Viscosity Increase @ 60h (Percent)	Viscosity Increase @ 80h (Percent)	Average Piston Varnish (Merit)	Weighted Piston Deposits (Merit)
1006	5W-30	SJ	1997	235	515	9.35	3.94
433	5W-30	SL	2000	35	37	9.30	4.59

Note: Testing is on hold until piston batch 3 severity is resolved.

CLOG gave LG two options

* 150% min viscosity increase, 4.0 WPD
* 150% min viscosity increase, 3.7 WPD
* API LG preferred the 150% / 3.7 and are taking it to ballot

	IIIG Period	WPD	PVIS
IIIG SN Limit	2009-present	4.0	150
IIIG Effective Limit		3.7	154
IIIG SN Limit in IIIH			
Based on 434-2 only	20141220 to 20150728	3.7	73
Based on 434 blends	20030812 to 20160119	3.7	126
Based on 434 and 438 blends	20030812 to 20160119	4.0	150
Probability of Pass (TMC434)	2003-2004	3.8	151

Sequence IIIHA to IIIGA

* CLOG recommended that IIIHA not be used in place of IIIGA

* ROBO is available and permitted in place of IIIHA

	IIIGA MRV Viscosity
SN Limit	60000 cP max
IIIGA/B SN Limit in IIIHA/B	
Based on 434-2 only	53476
Based on 434 blends	84264
Based on 434 and 438 blends	49609
Probability of Pass (TMC434)	85000
Probability of Pass (TMC438)	195000

Sequence IIIHB to IIIGB

* CLOG recommended that IIIHB be used in place of IIIGA with an 80.5%minimum level
* API LG decided to send to ballot a limit of 81%

	IIIGB Phos
SN Limit	79 % min
IIIGA/B SN Limit in IIIHA/B	
Based on 434-2 only	80
Based on 434 blends	82
Based on 434 and 438 blends	79*
Probability of Pass (TMC434)	82
Probability of Pass (TMC438)	79*

*Note that oil ranking is reversed in IIIHB. The estimated equivalent limit is 80-81 if the current IIIGB mean and standard deviation is used in calculation.

ATTACHMENT 5

Surface Finish & Blow-by Plots

Date: November 15, 2016

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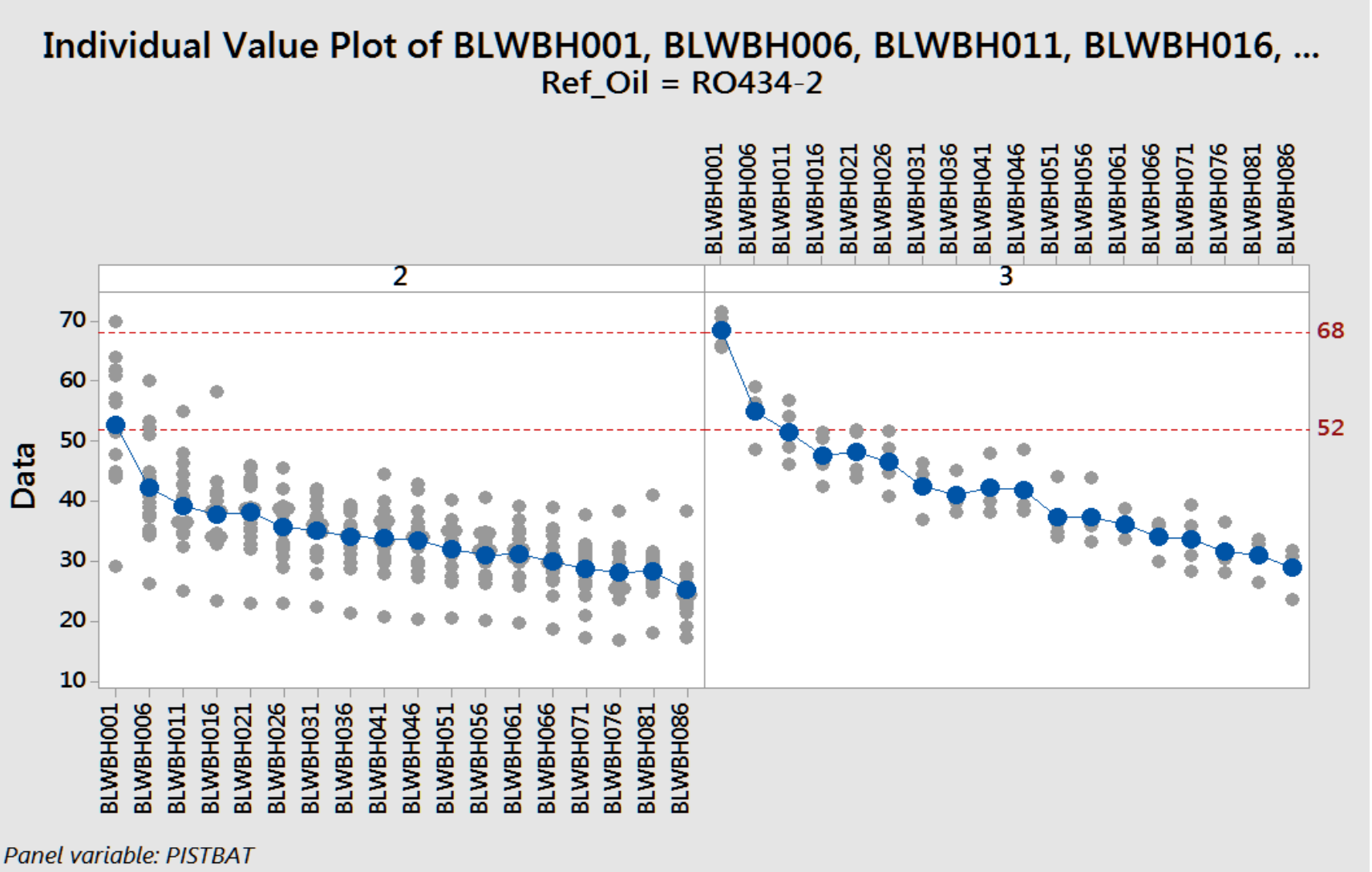
Blow-by Plot of Reference Oil 434-2



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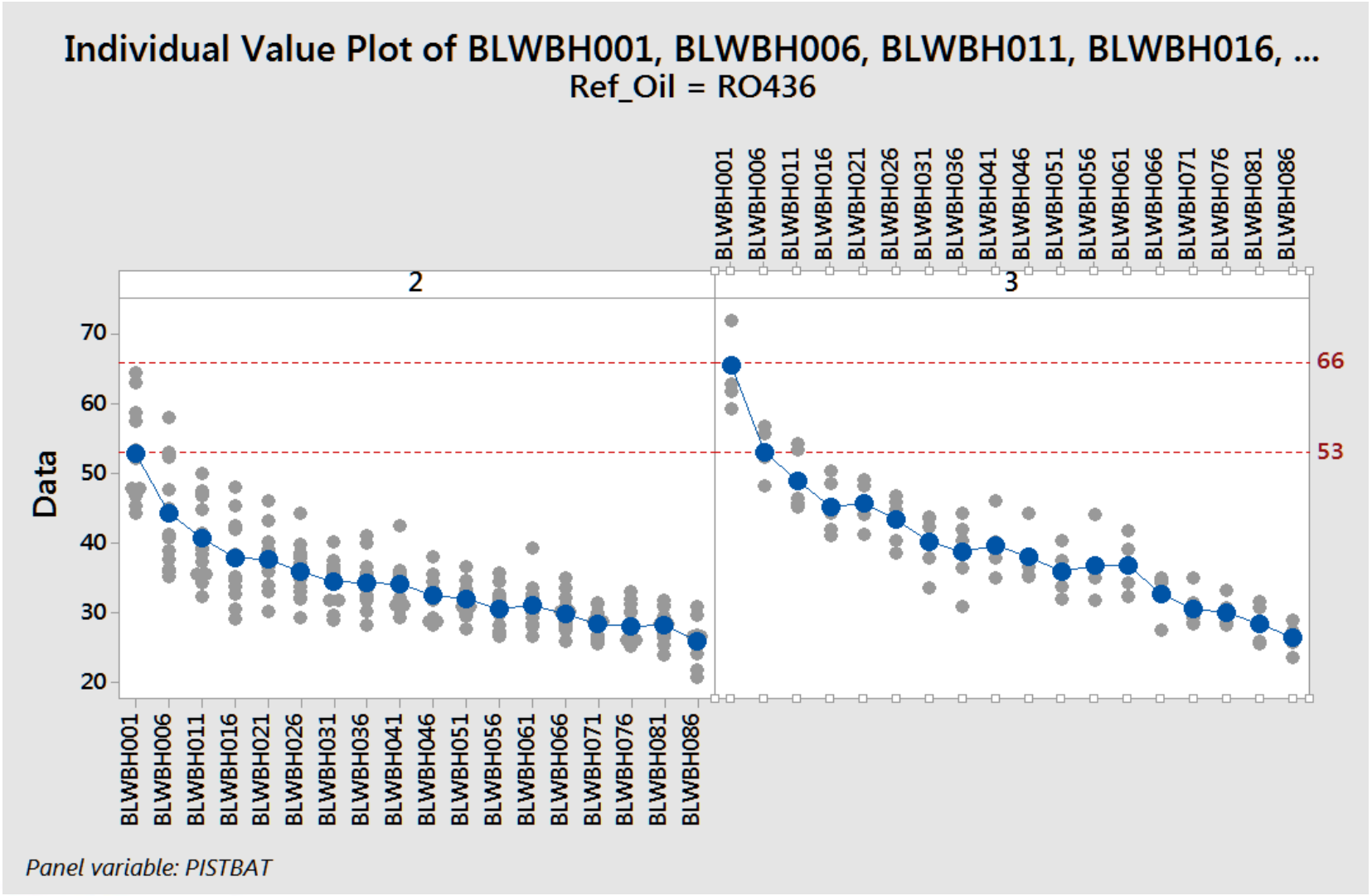
Blow-by Plot of Reference Oil 436



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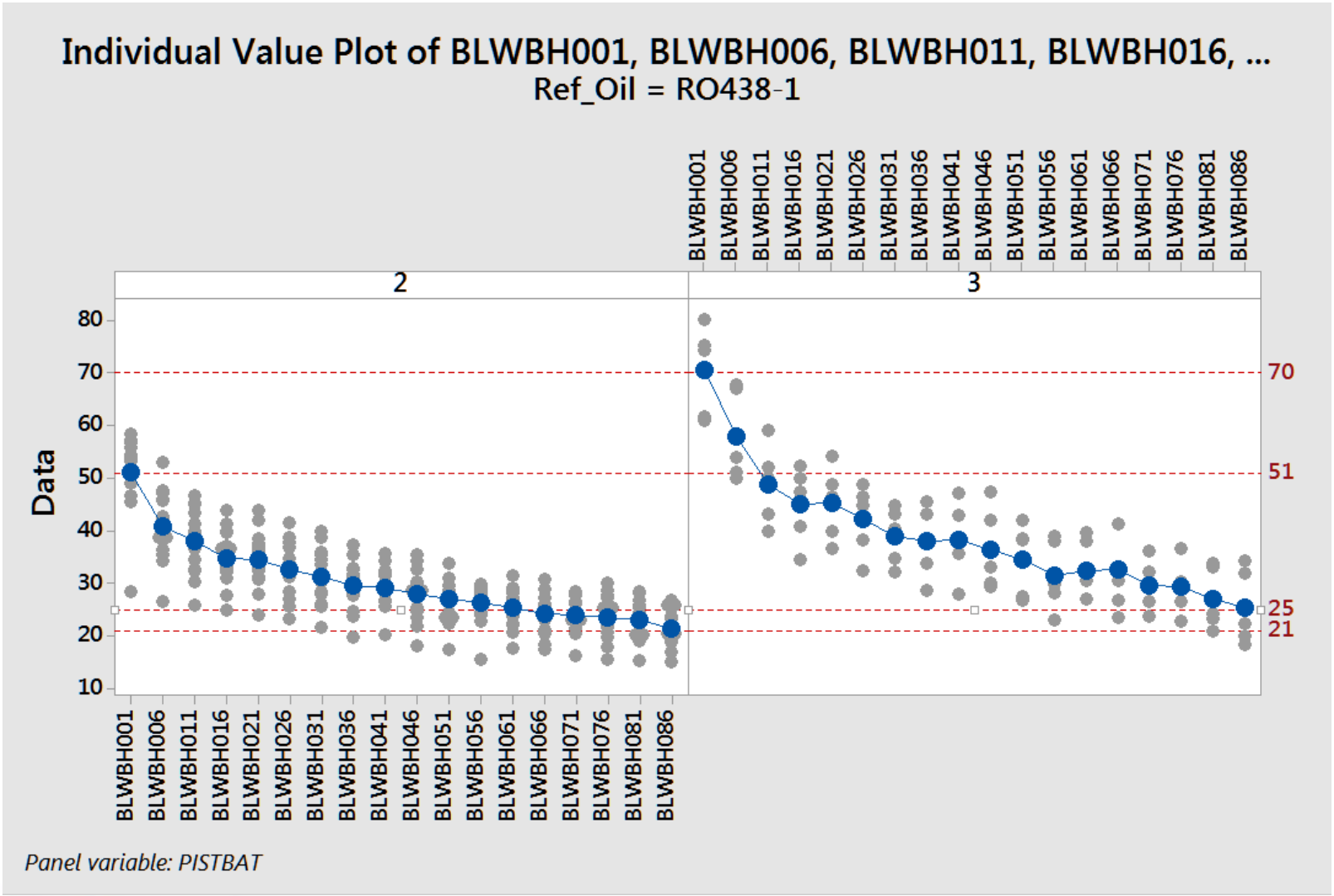
Blow-by Plot of Reference Oil 438-1



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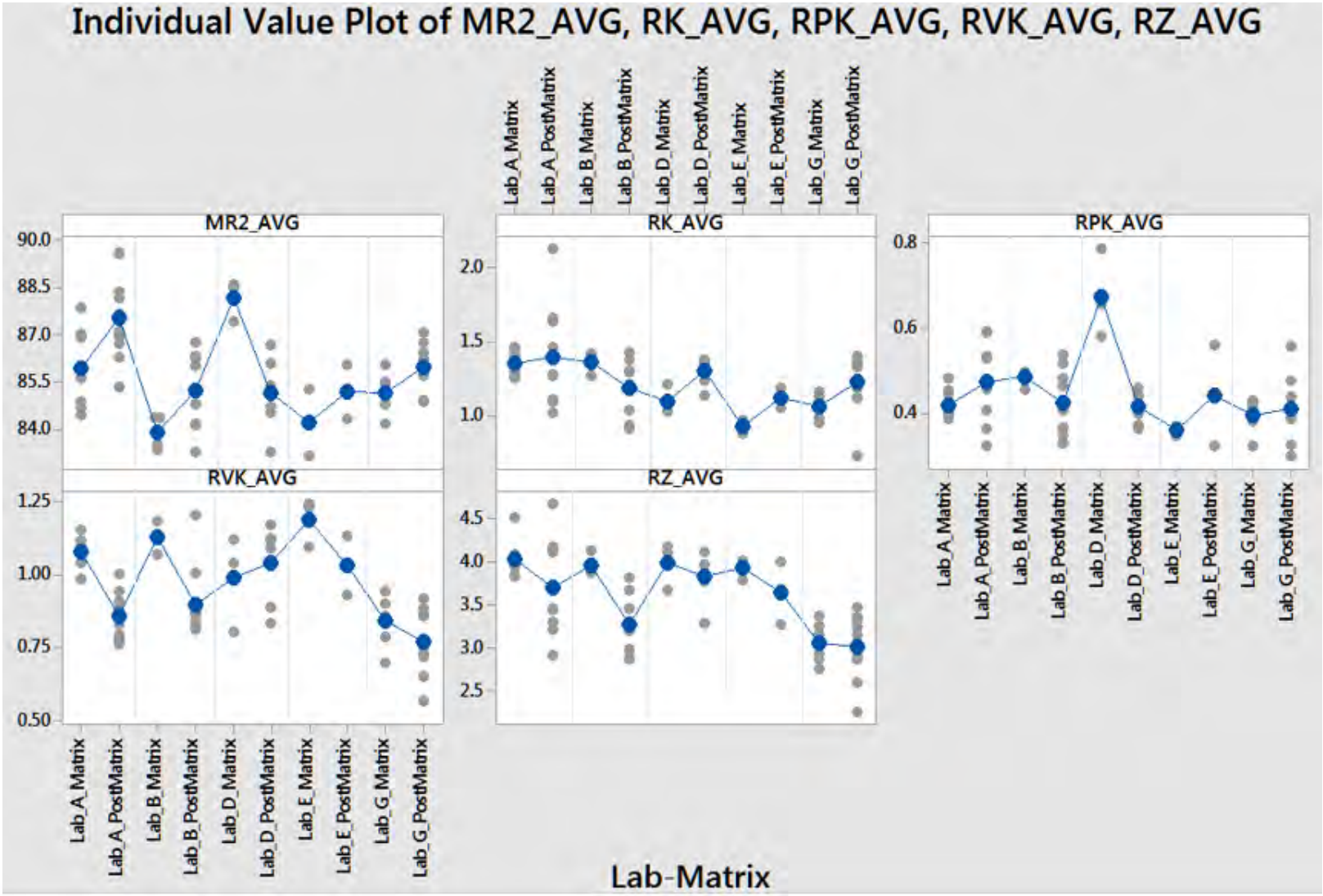
Surface Finish Plot – Matrix & Post Matrix



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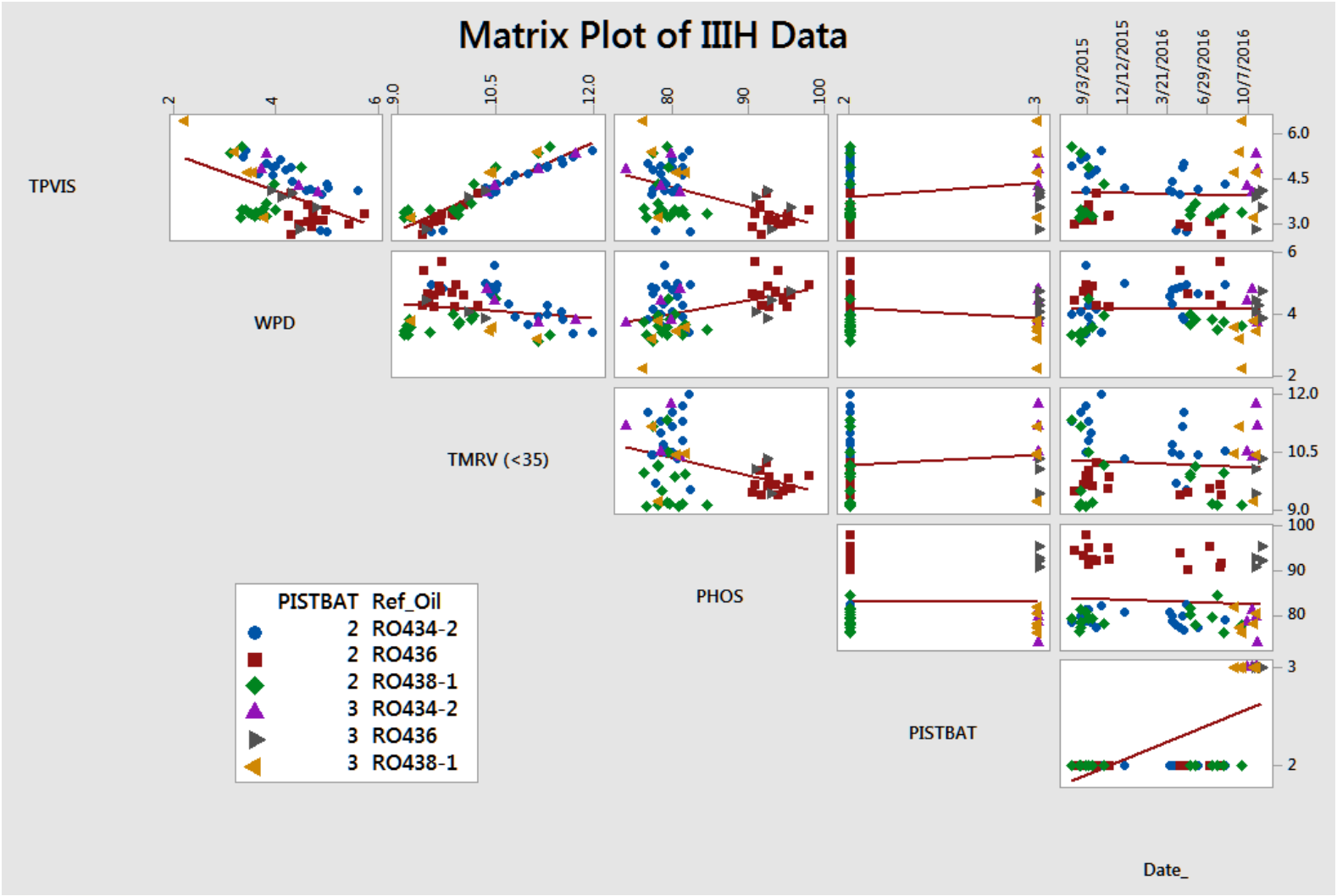
Matrix Plot of IIIH Data



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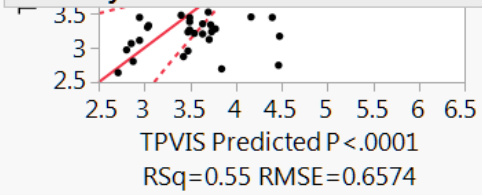
TPVIS Analysis

- Piston Batch Significant

Response TPVIS

Whole Model

Actual by Predicted Plot



Summary of Fit

Analysis of Variance

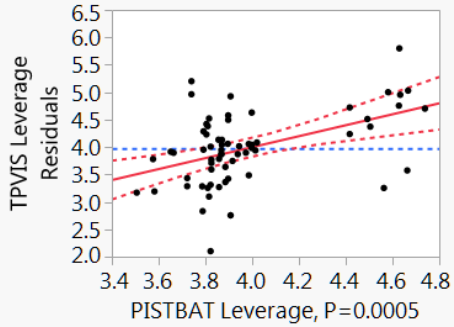
Lack Of Fit

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.1393975	0.114174	36.26	<.0001*
PISTBAT[2]	-0.420494	0.112448	-3.74	0.0005*
LTMSLAB [A]	0.0803238	0.178467	0.45	0.6546
LTMSLAB [B]	-0.152122	0.176556	-0.86	0.3931
LTMSLAB [D]	-0.191499	0.194564	-0.98	0.3298
LTMSLAB [E]	0.6335958	0.255836	2.48	0.0168*
LTMSLAB [A]:Lab_App[A1]	0.2042872	0.244814	0.83	0.4081
LTMSLAB [A]:Lab_App[A2]	0.4856329	0.266636	1.82	0.0747
LTMSLAB [A]:Lab_App[A3]	-0.179129	0.381727	-0.47	0.6410
LTMSLAB [B]:Lab_App[B1]	-0.043802	0.18906	-0.23	0.8177
LTMSLAB [D]:Lab_App[D1]	0.0944325	0.22356	0.42	0.6746
LTMSLAB [G]:Lab_App[G1]	0.032773	0.255237	0.13	0.8984
LTMSLAB [G]:Lab_App[G2]	0.7038386	0.243798	2.89	0.0058*
Ref_Oil[RO434-2]	0.4627476	0.120324	3.85	0.0003*
Ref_Oil[RO436]	-0.576365	0.128208	-4.50	<.0001*

PISTBAT

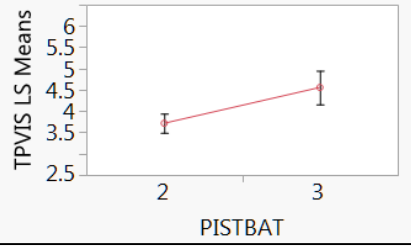
Leverage Plot



Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
2	3.7189035	0.11185833	3.87265
3	4.5598916	0.19709981	4.35826

LS Means Plot



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WPD Analysis

- Piston Batch Significant

Response WPD

Whole Model

Effect Summary

Source	LogWorth	PValue
Ref_Oil	7.267	0.00000
PISTBAT	2.367	0.00430
LTMSLAB	0.913	0.12207
Lab_App[LTMSLAB]	0.261	0.54836

Remove Add Edit FDR

Actual by Predicted Plot

Summary of Fit

RSquare	0.609389
RSquare Adj	0.497786
Root Mean Square Error	0.470899
Mean of Response	4.155469
Observations (or Sum Wgts)	64

Analysis of Variance

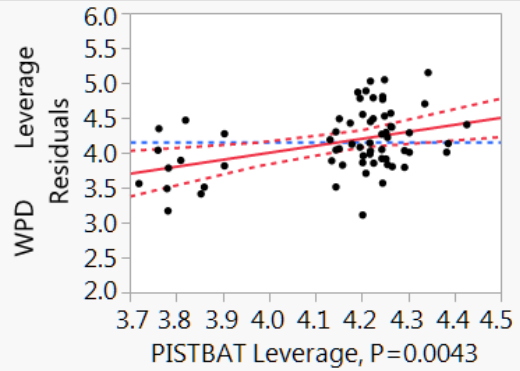
Lack Of Fit

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.0362786	0.08179	49.35	<.0001*
PISTBAT[2]	0.2412536	0.080553	2.99	0.0043*
LTMSLAB [A]	-0.113553	0.127847	-0.89	0.3788
LTMSLAB [B]	0.0661168	0.126477	0.52	0.6035
LTMSLAB [D]	0.25952	0.139378	1.86	0.0686
LTMSLAB [E]	-0.390065	0.18327	-2.13	0.0384*
LTMSLAB [A]:Lab_App[A1]	0.0299615	0.175374	0.17	0.8651
LTMSLAB [A]:Lab_App[A2]	-0.253561	0.191007	-1.33	0.1905

PISTBAT

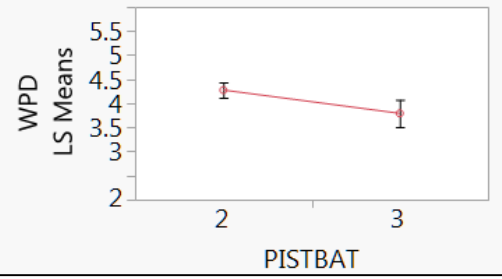
Leverage Plot



Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
2	4.2775322	0.08013064	4.22980
3	3.7950250	0.14119409	3.89000

LS Means Plot



Afton CHEMICAL

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MRV Analysis

- Piston Batch Significant

Response TMRV (<35)

Whole Model

Effect Summary

Actual by Predicted Plot

Summary of Fit

Analysis of Variance

Lack Of Fit

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	10.32296	0.11969	86.25	<.0001*
PISTBAT[2]	-0.278257	0.112467	-2.47	0.0173*
LTMSLAB [A]	0.1423199	0.163605	0.87	0.3891
LTMSLAB [B]	-0.224008	0.164248	-1.36	0.1796
LTMSLAB [D]	-0.268366	0.214235	-1.25	0.2169
LTMSLAB [E]	0.6033496	0.249328	2.42	0.0197*
LTMSLAB [A]:Lab_App[A1]	0.1341941	0.220072	0.61	0.5451
LTMSLAB [A]:Lab_App[A2]	0.1634736	0.250669	0.65	0.5177
LTMSLAB [A]:Lab_App[A3]	-0.096323	0.33955	-0.28	0.7780
LTMSLAB [B]:Lab_App[B1]	-0.023068	0.167787	-0.14	0.8913
LTMSLAB [D]:Lab_App[D1]	0.1007781	0.247196	0.41	0.6855
LTMSLAB [G]:Lab_App[G1]	-0.008132	0.228669	-0.04	0.9718
LTMSLAB [G]:Lab_App[G2]	0.58023	0.218407	2.66	0.0110*
Ref_Oil[RO434-2]	0.6347861	0.108942	5.83	<.0001*
Ref_Oil[RO436]	-0.384371	0.116195	-3.31	0.0019*

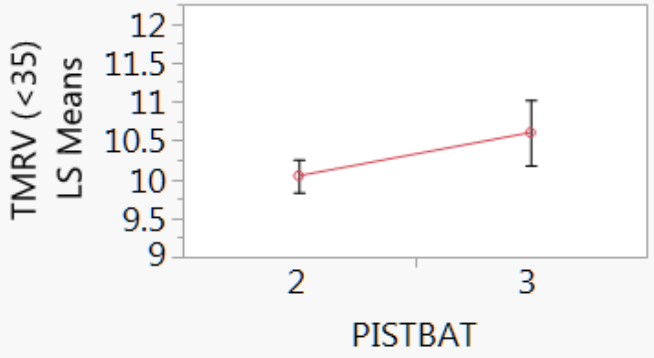
PISTBAT

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
2	10.044703	0.10398489	10.1513
3	10.601217	0.20769249	10.4456

LS Means Plot



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ATTACHMENT 6

BC 2 / BC 3 Blow-by Comparison

SOUTHWEST RESEARCH INSTITUTE®

Ankit Chaudhry

Project Engineer

November 2016

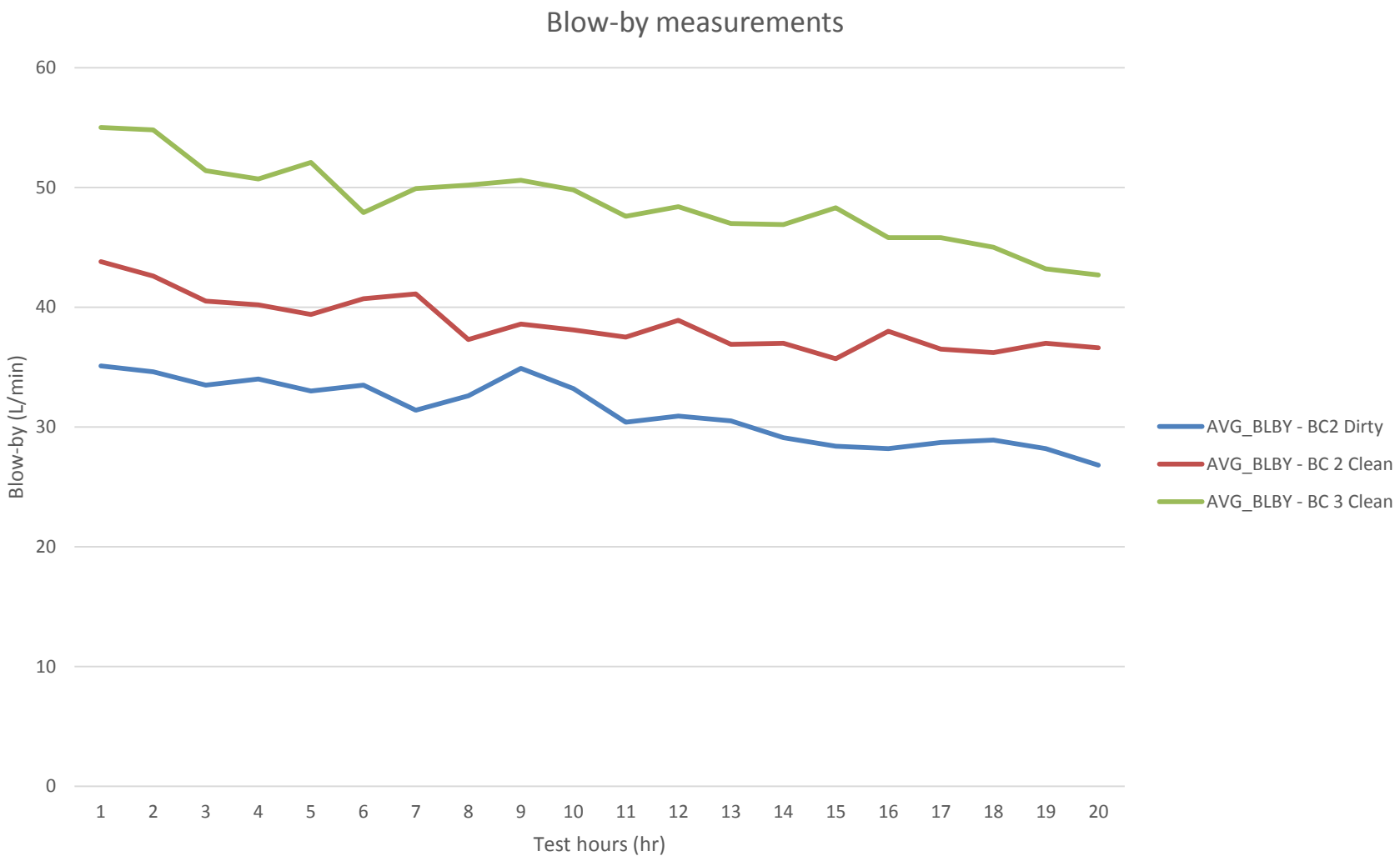
Summary of the test procedure

- Slave engine was used
  - Engine had approximately 90 hours.
  - Engine was build with batch code 2 rings and pistons.
  - Aborted test at approximately 65 hours due to extended down time.
- 1st iteration
  - Slave engine ran with batch code 2 pistons and rings.
  - Goal: Establish a base line for dirty pistons and rings.
- 2nd Iteration
  - Slave engine was rebuild with ultrasonic cleaned batch code 2 pistons and rings.
  - Goal: To obtain data on used but cleaned batch code 2 pistons and rings
- 3rd Iteration
  - Slave engine was rebuild with ultrasonic cleaned batch code 3 pistons and batch code 2 rings.
  - Goal: To make sure that the pistons are the only thing that influenced the blow-by measurements.

Test procedure continued

- Fresh charge of same oil was used for each iteration.
- Initial run-in was performed for each iteration.
- Oil levels were measured for each iteration.
- All the iteration ran using the batch code 2 rings to keep the ring to cylinder wall interface consistent.
- New blow-by hoses were used for each iteration.

Blow-by Measurements



Observations

- There was no oil consumption.
- Blow-by readings for clean BC 2 pistons were higher than dirty BC2 pistons, possibly driven by deposits.
- There was a change in blow-by when batch code 3 pistons were installed.
- What's next?
  - Likely to install BC2 pistons back in the engine to determine if blow-by returns to a lower level.
  - Consider machining chamfers?

For Additional Information

Ankit Chaudhry
Gasoline Lubricant Evaluations Section

Southwest Research Institute

Engine Lubricants Research Department,

Fuels and Lubricants Research Division

6220 Culebra Road

P.O. Drawer 28510

San Antonio, TX USA 78228-0510

(210) 522-2820

Visit us on the world wide web at:

http://www.swri.edu/4org/d08/d08home.htm

ATTACHMENT 7

Sequence IIIH Batch 3 Piston Data Review

Statistics Group

Nov. 11, 2016

Statistics Group

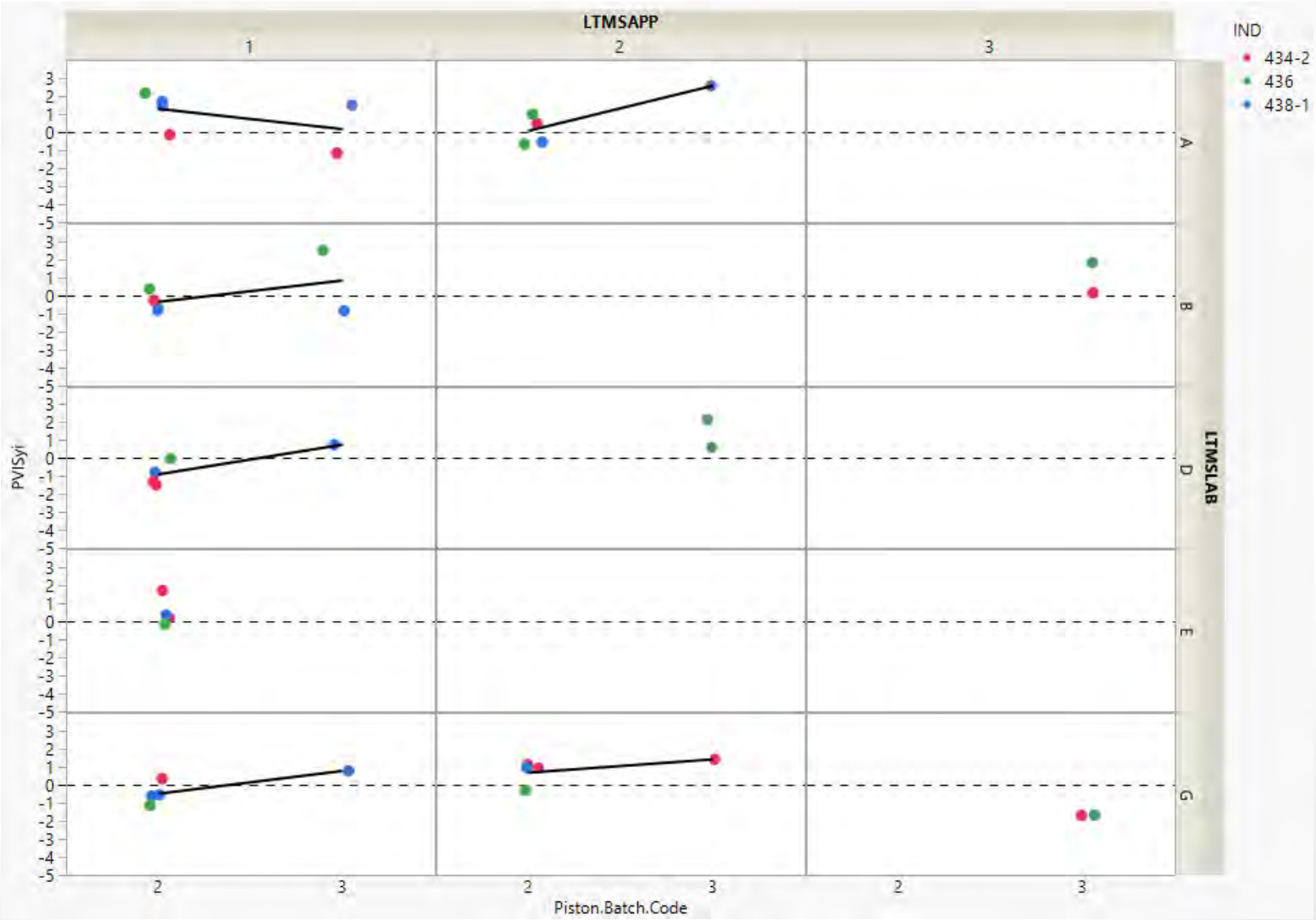
- Arthur Andrews, ExxonMobil
- Doyle Boese, Infineum
- Jo Martinez, Chevron Oronite
- Kevin O'Malley, Lubrizol
- Martin Chadwick, Intertek
- Richard Grundza, TMC
- Lisa Dingwell, Afton
- Todd Dvorak, Afton
- Travis Kostan, SwRI

IIIH Batch 2 and 3 Piston Data

	Batch 3			Batch 2
Oil	Current	Remaining	Total	Current
434-2	4	0	4	20
436	5	1	6	14
438-1	5	1	6	16
Total	14	2	16	50

PVISyi
(Batch 3 Pistons vs Batch 2 Target data only)

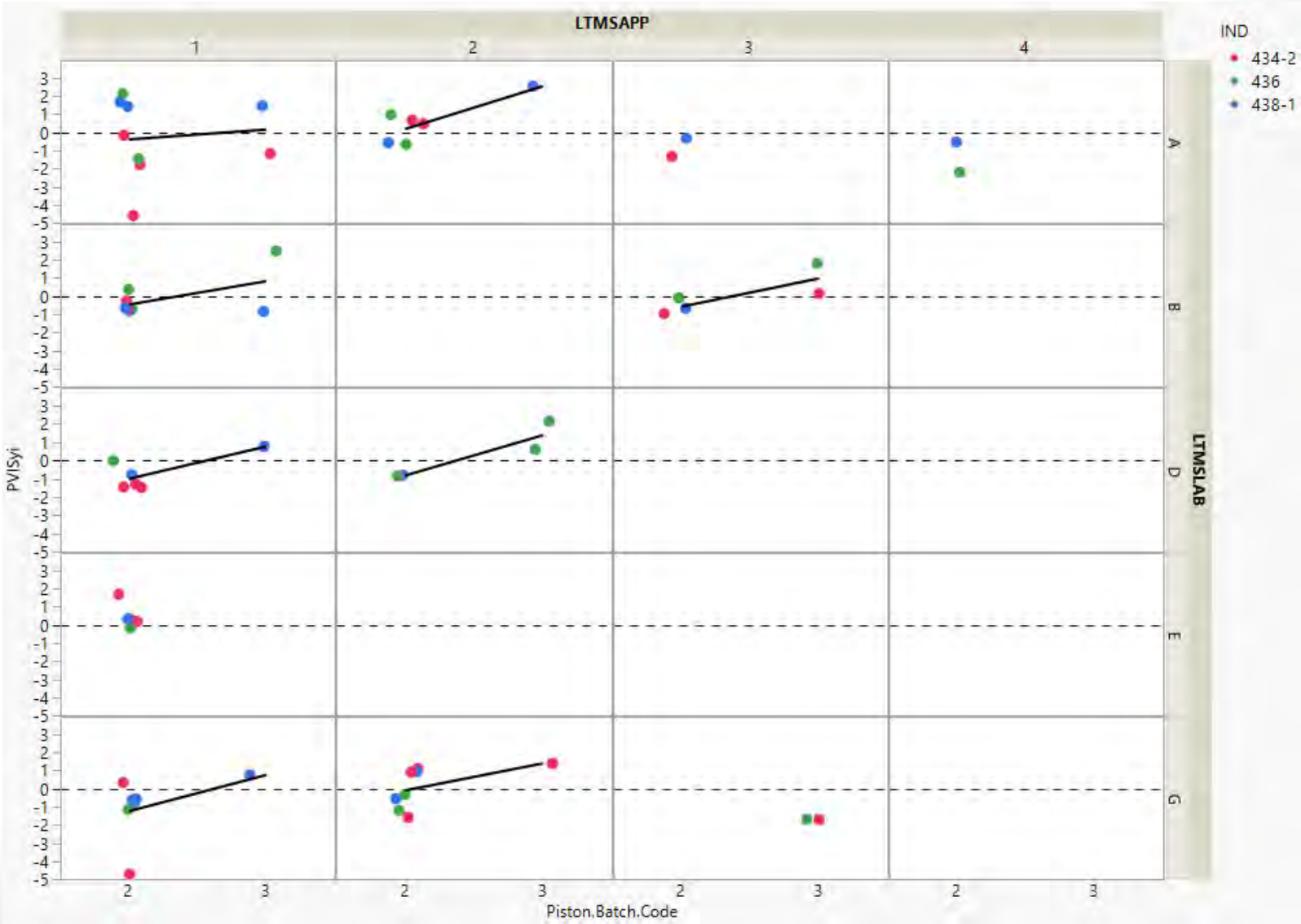
Severe



Mild

PVISyi
(Batch 3 Pistons vs All Batch 2)

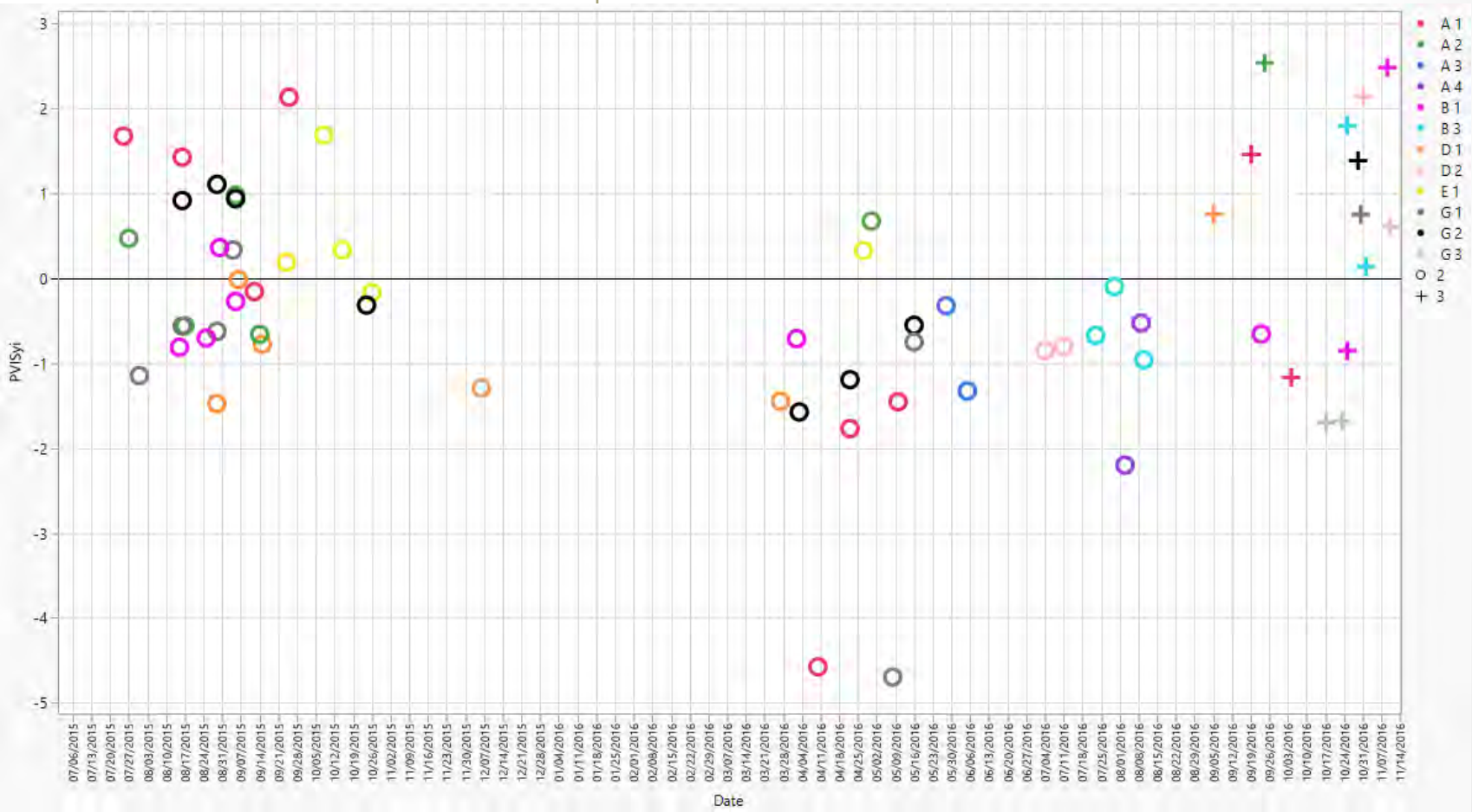
Severe



Mild

PVISyi

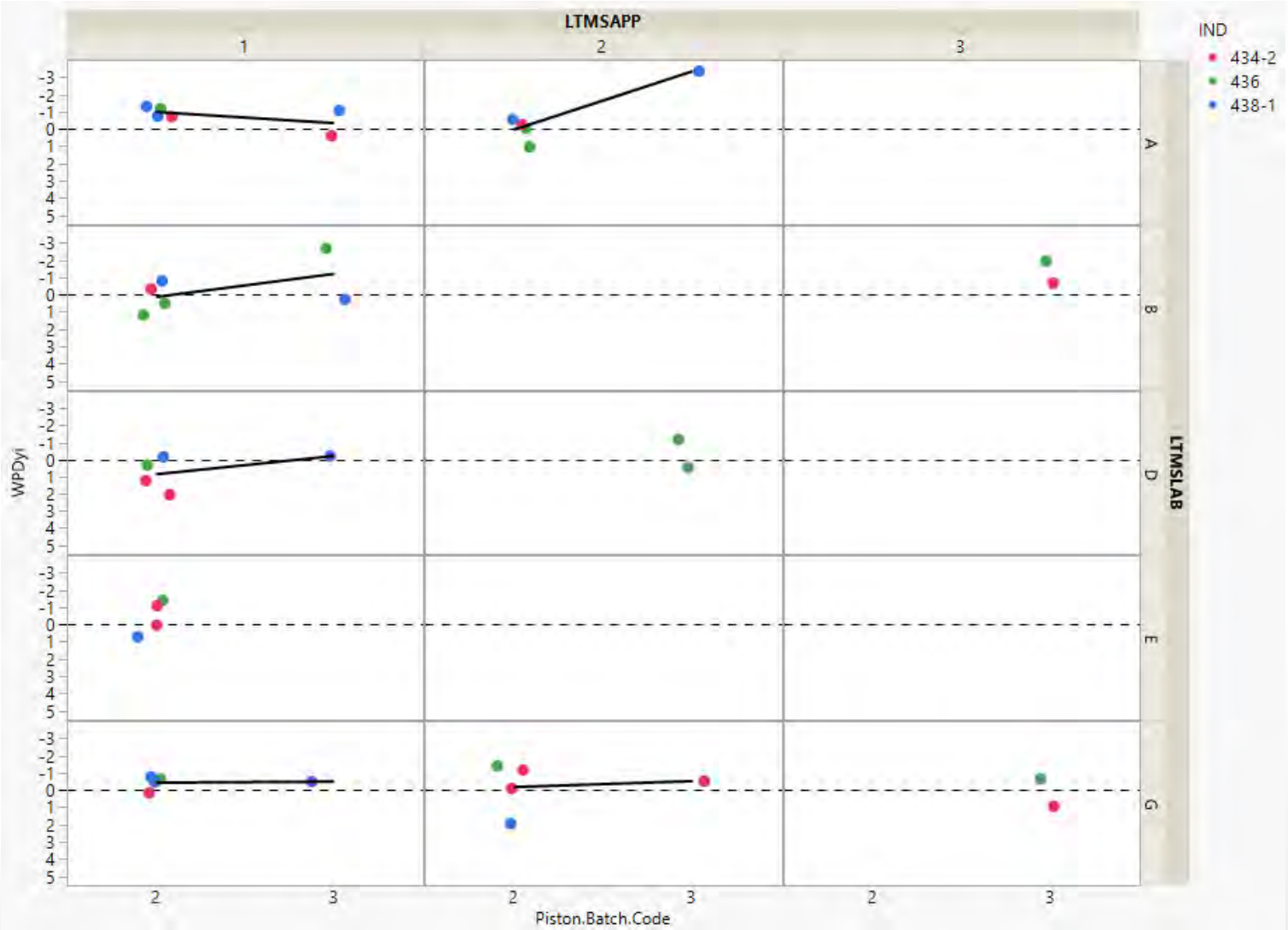
Severe Target Setting



Mild

WPDyi
(Batch 3 Pistons vs Batch 2 Target data only)

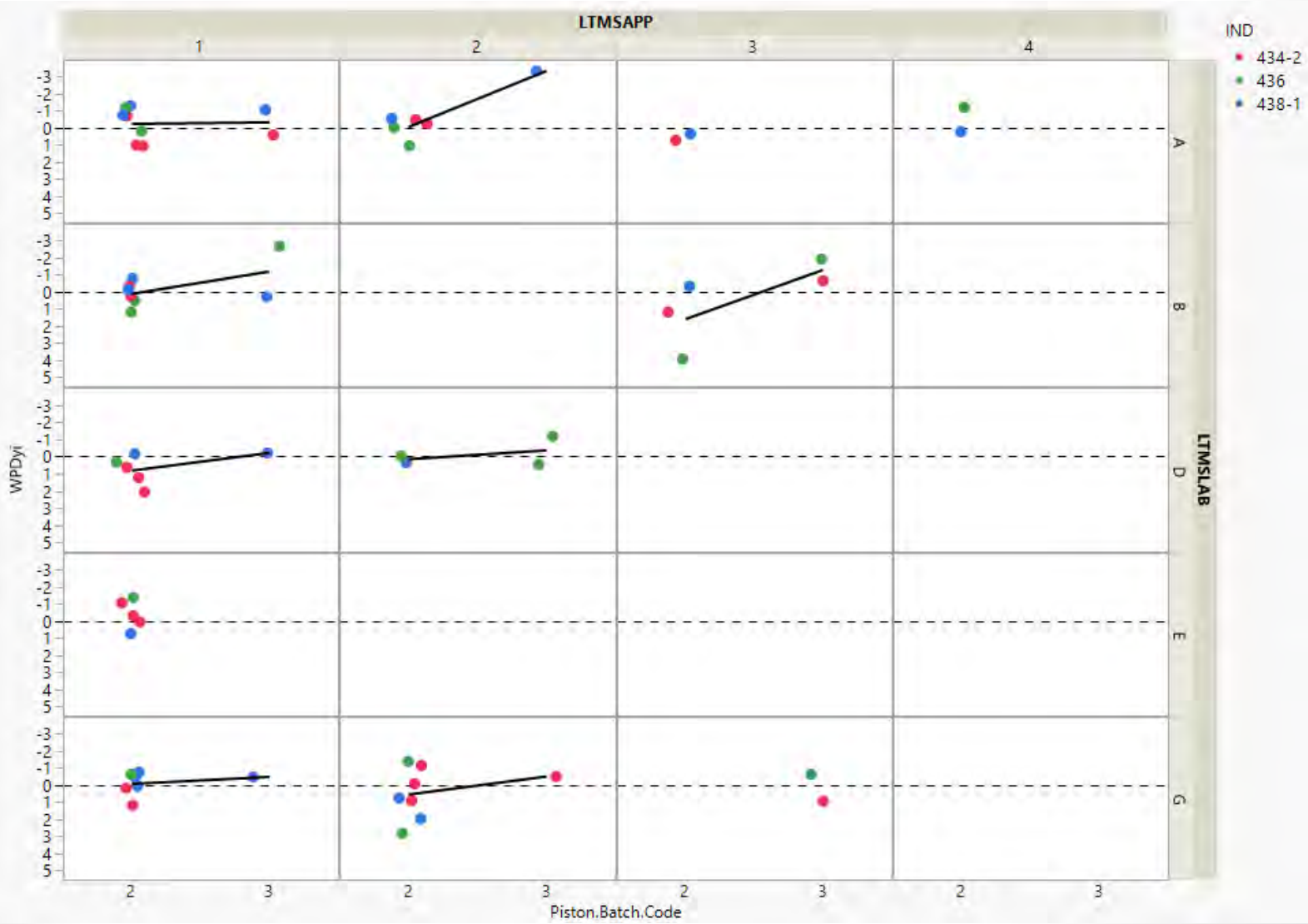
Severe



Mild

WPDyi
(Batch 3 Pistons vs All Batch 2)

Severe

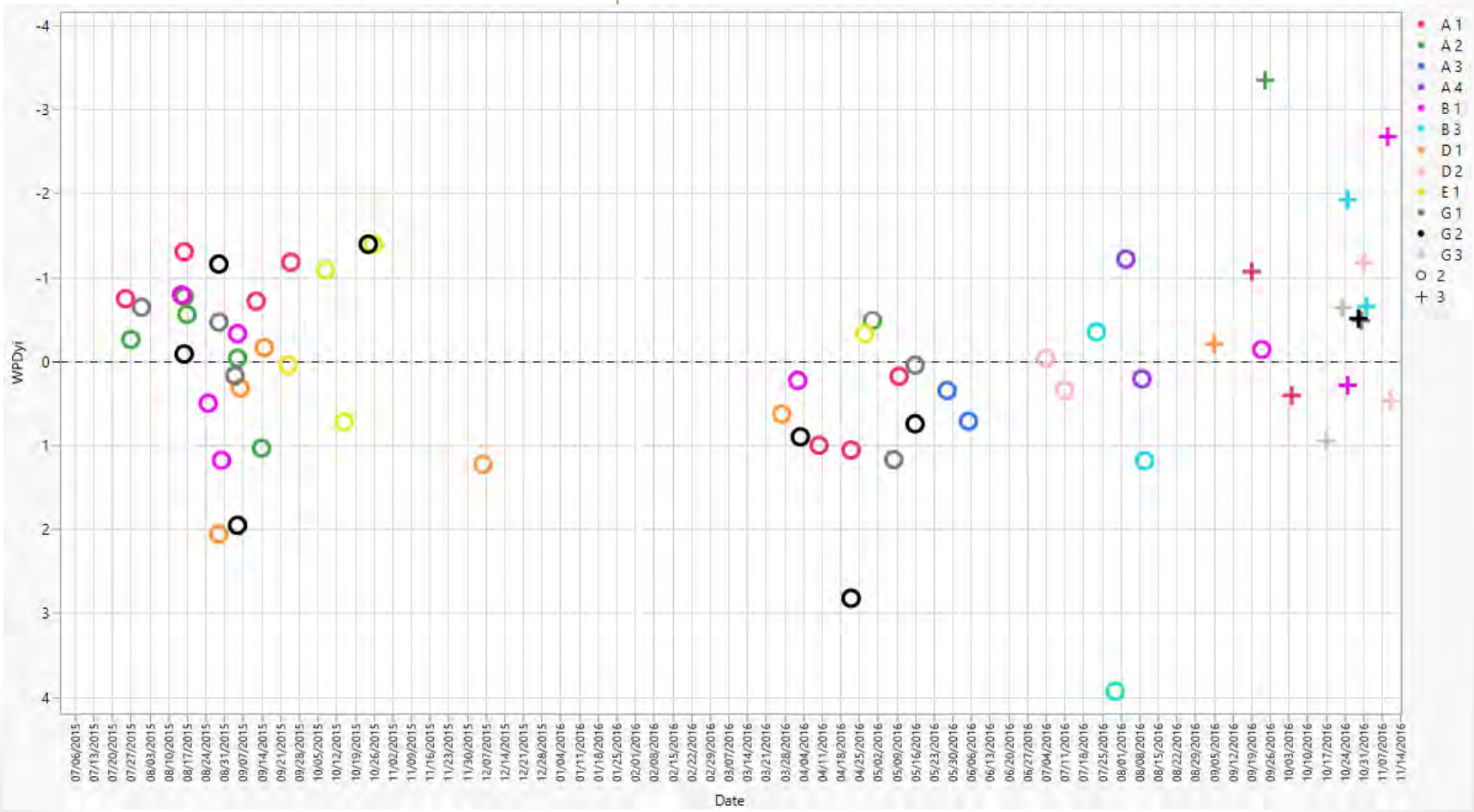


Mild

WPDyi

Target Setting

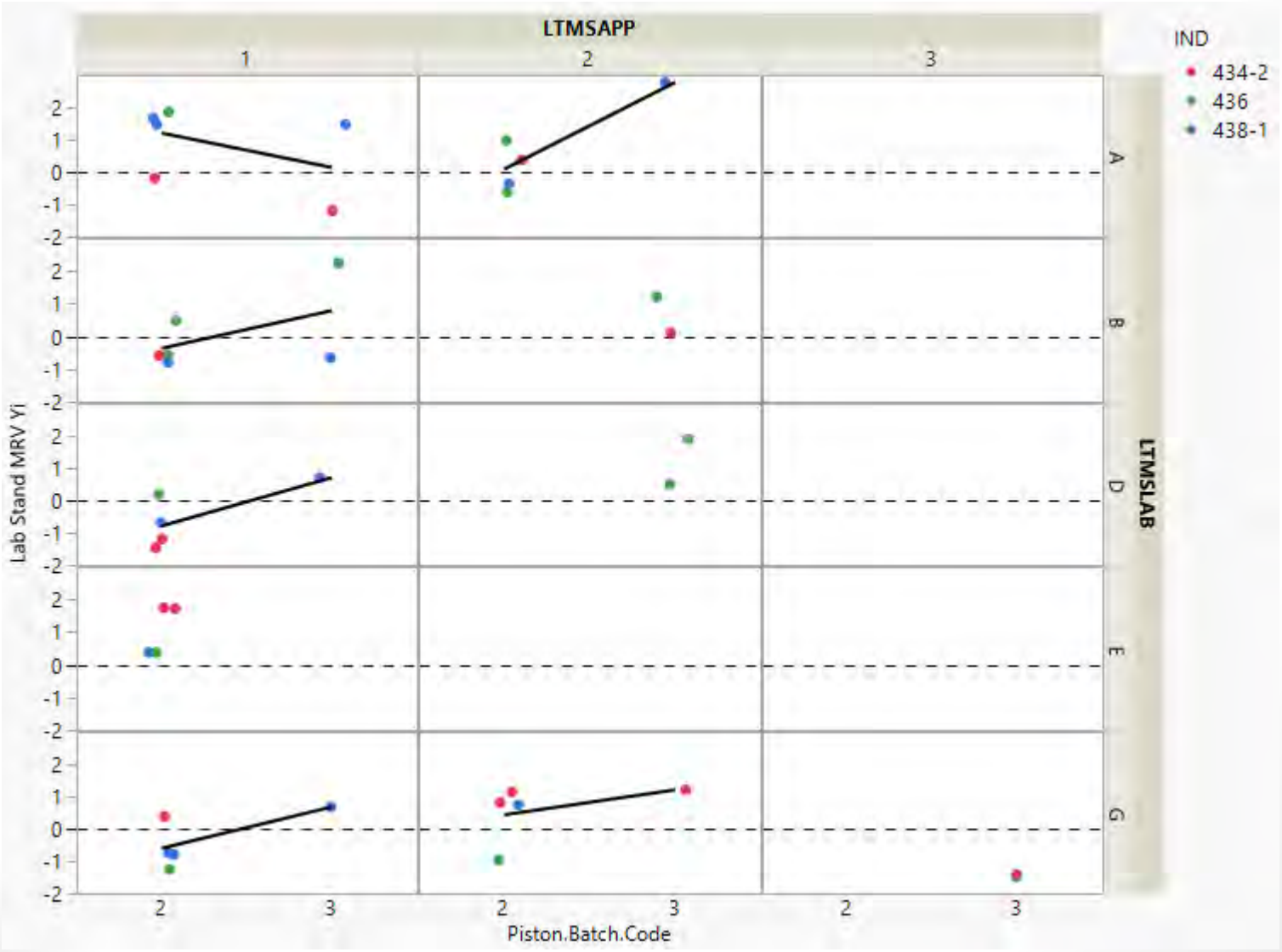
Severe



Mild

MRVyi
(Batch 3 Pistons vs Batch 2 Target data only)

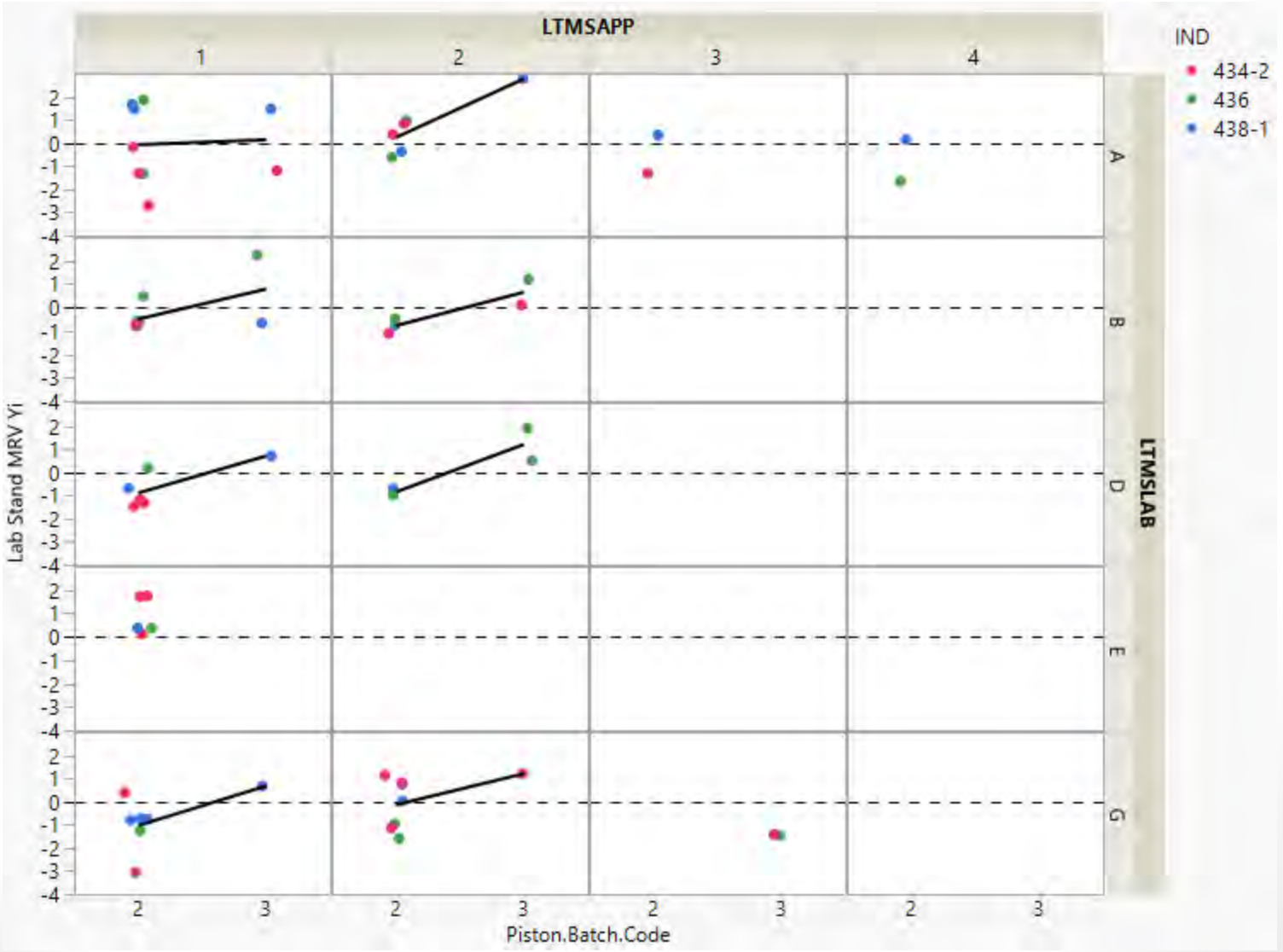
Severe



Mild

MRVyi
(Batch 3 Pistons vs All Batch 2)

Severe

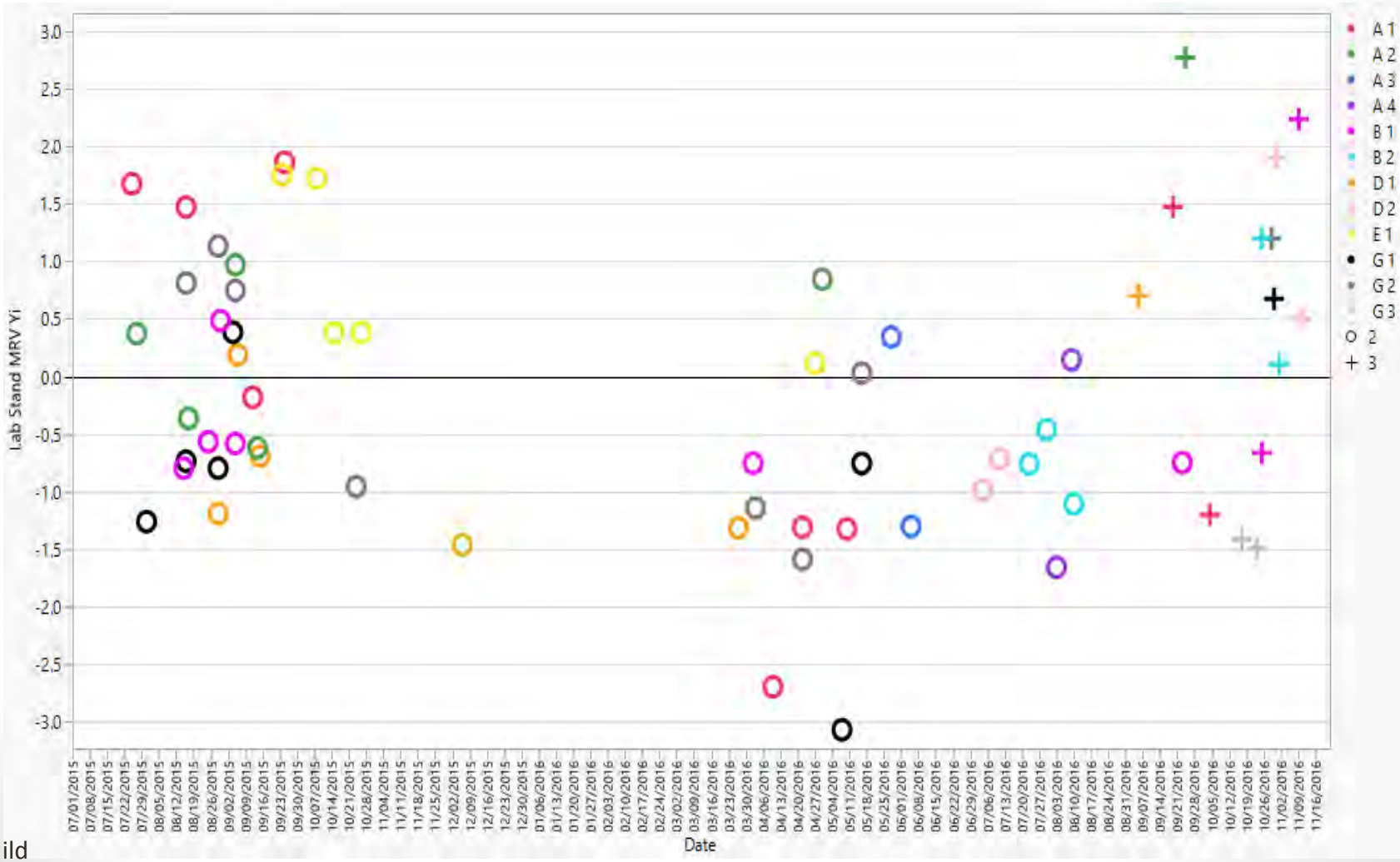


Mild

MRVyi

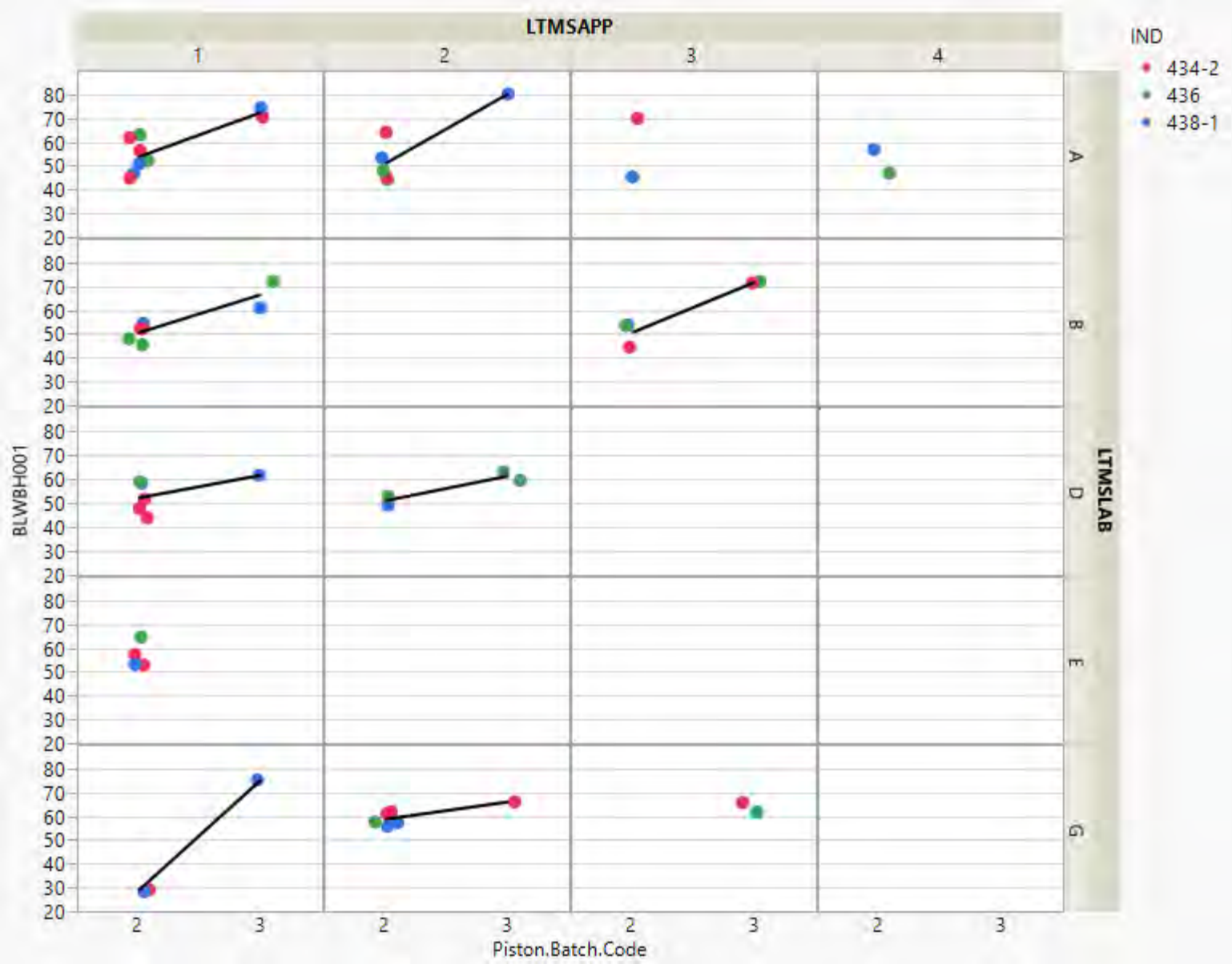
Target Setting

Severe

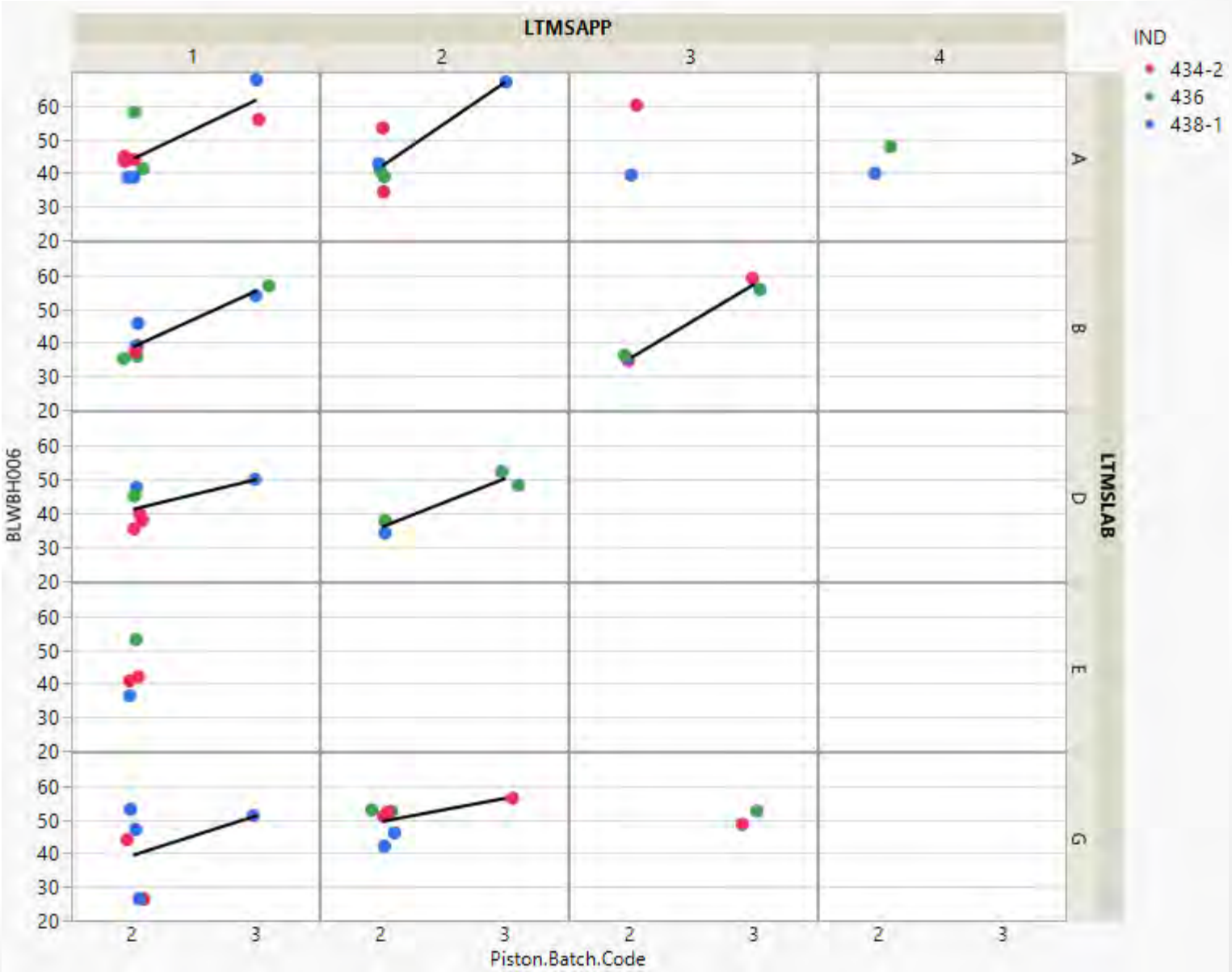


Mild

BLWBH001


LTMSAPP
1
2
3
4
IND
434-2
436
438-1
BLWBH001
LTMSLAB
A
B
D
E
G
Piston.Batch.Code

BLWBH006


LTMSAPP
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3
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IND
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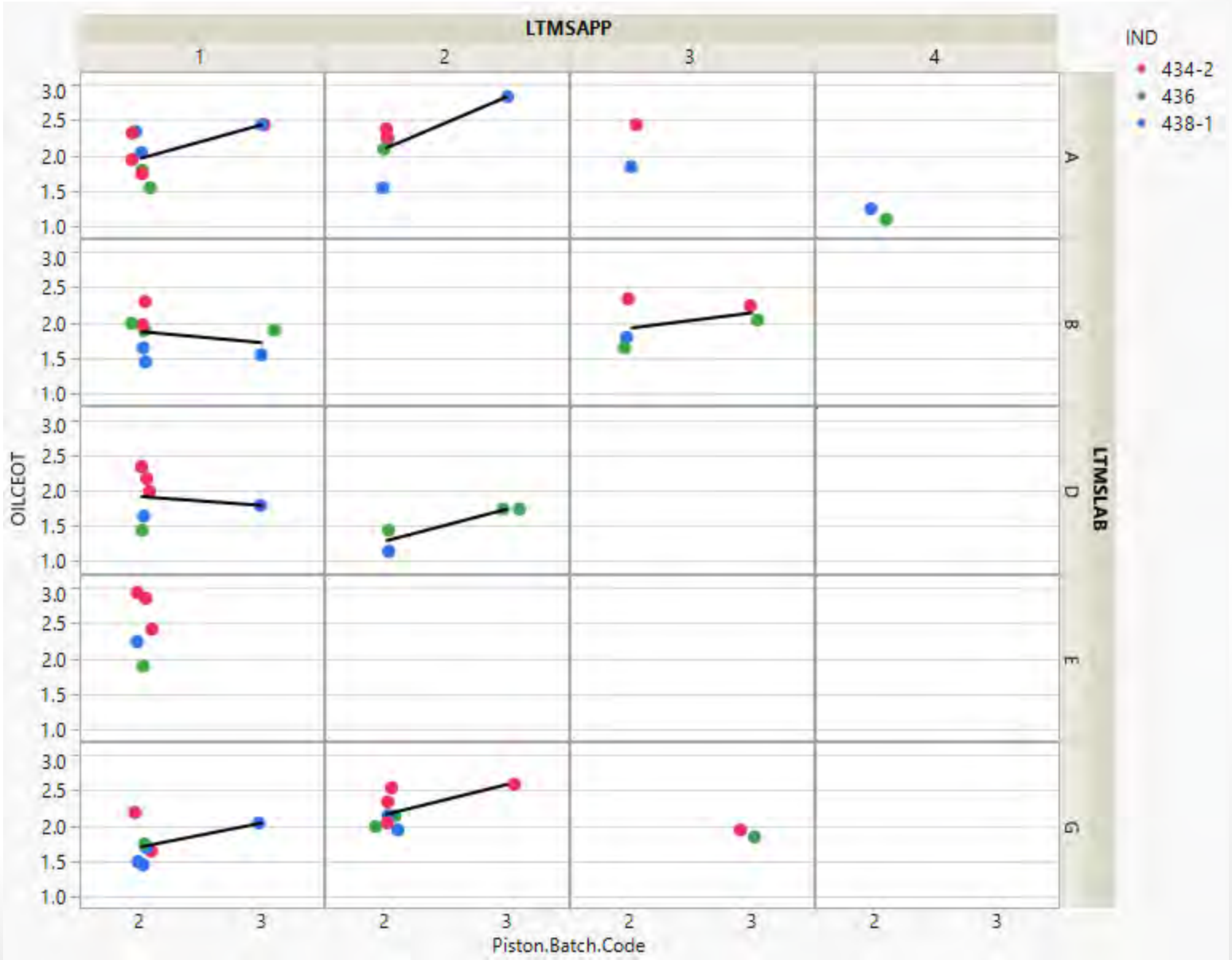
436
438-1
BLWBH006
LTMSLAB
A
B
D
E
G
Piston.Batch.Code

OILCEOT


LTMSAPP
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2
3
4
IND
434-2
436
438-1
OILCEOT
3.0
2.5
2.0
1.5
1.0
A
B
D
E
G
LTMSLAB
2
3
Piston.Batch.Code

ATTACHMENT 9

American Chemistry Council

Sent via email
November 4, 2016

To: Dave Glaenzer, Seq III ASTM Surveillance Panel Chair

Cc: Joe Franklin, ASTM D2.B0 Chair
Bill Buscher, ASTM D2.B01 Chair
Frank Farber, Secretary ASTM D2.B0

RE: Sequence IIIH Test Procedure and Report Form Documentation

On behalf of the American Chemical Council (ACC) Product Approval Protocol Task Group (PAPTG) we want to inform you of our expectation that the Sequence IIIH ASTM test procedure and report form documentation should mirror the format of the Sequence IIIG (ASTM D7320), including separate Appendixes and Report Forms for the Sequence IIIHA & IIIHB procedures.

On September 7, 2016, ACC PAPTG reached consensus to initiate registration of the Sequence IIIH, Sequence IIIHA and Sequence IIIHB engine tests, including retroactive registration to April 15, 2016. Each are recognized as separate and distinct tests in the ACC Code of Practice. Each may be registered and reported separately. We believe the ASTM test procedure should align with the test registration procedure.

Please let us know the actions and timing of the Sequence III Surveillance Panel regarding this matter.

Regards,

Dan Pridemore

Dan Pridemore
PAPTG Chair

Doug Anderson

Doug Anderson
PAPTG Manager

ATTACHMENT 9

Negative

Ballot Number: D02.B0 (16-06) Close Date: NOVEMBER 6, 2016

Item Number: 001 Test Method For Evaluation of Automotive Engine Oils in the Sequence IIIH, Spark-Ignition Engine WK53774
(REFERENCE Z3520Z)
TECHNICAL CONTACT: Terence W Bates
BATESTERRYW@AOL.COM
441513421193

Member's Name: Brent Calcut

Address: Afton Chemical
2000 Town Center
SOUTHFIELD MI 48075

Phone Nr: 2483500640 Fax Nr:

Email Address: brent.calcut@aftonchemical.com

File Attachment:

Statement:

Section	Statement
General	The Sequence IIIH test procedure should be formatted and documented in the same way as the Sequence IIIG procedure. More specifically: • Sequence IIIHA should be described more clearly as a separate procedure and included as an Appendix, rather than buried in Sections 12.12 and 12.13, with separate report form. • Sequence IIIHB should be described more clearly as a separate procedure and included as an Appendix, rather than buried in Section 12.14, with separate forms. These procedures are currently separated within the Seq. IIIG procedure and specified as separate tests within existing API and ILSAC specifications, including in the draft ILSAC GF-6A and GF-6B specifications. The ASTM test procedure should allow these tests to be specified, registered and referenced separately. ACC has already purposefully instituted separate registration. Additionally, these changes to the structure of the Sequence IIIH procedure will unnecessarily increase referencing cost and timing. Continuing to format and document the Sequence IIIHA and IIIHB test procedures does not preclude any of these parameters from being included in future specifications. Section 14.12.1 should not reference barium as a detergent metal. Suggest deleting the reference to barium.

Negative

Ballot Number: D02.B0 (16-06) Close Date: NOVEMBER 6, 2016

Item Number: 001 Test Method For Evaluation of Automotive Engine Oils in the Sequence IIIH, Spark-Ignition Engine WK53774
(REFERENCE Z3520Z)
TECHNICAL CONTACT: Terence W Bates
BATESTERRYW@AOL.COM
441513421193

Member's Name: Betsy Kaplan

Address: BP International Ltd

15 Doreen Drive

OCEANPORT NJ 07757

Phone Nr: 7325567268 Fax Nr:

Email Address: BETSY.KAPLAN@BP.COM

File Attachment:

Statement:

Section **Statement**

BP opposes the requirement in the Sequence IIIH Test Method that "full-scale calibration testing shall be conducted at a 6 – month interval or after 15 tests, whichever comes first". As the Sequence IIIH is written, full-scale calibration testing will require the engine test stand be also referenced for "Apparent Viscosity by the Mini Rotary Viscometer", also known as the Sequence IIIHA. A reference oil for Apparent Viscosity was not a requirement for referencing a Sequence IIIG test stand. We do not feel it is correct to include this reference parameter in a Sequence IIIH stand as Apparent Viscosity is not a necessary parameter for passing a basic Sequence IIIH.

Negative

Ballot Number: D02.B0 (16-06) Close Date: NOVEMBER 6, 2016

Item Number: 001 Test Method For Evaluation of Automotive Engine Oils in the Sequence IIIH, Spark-Ignition Engine WK53774
(REFERENCE Z3520Z)
TECHNICAL CONTACT: Terence W Bates
BATESTERRYW@AOL.COM
441513421193

Member's Name: Charlotte Kehoe

Address: BP Europa SE
Querenburger Strasse 46
Bochum 44789
Germany

Phone Nr: 49 234 315 4280 Fax Nr:

Email Address: charlotte.kehoe@se1.bp.com

File Attachment:

Statement:

Section **Statement**

BP opposes the requirement in the Sequence IIIH Test Method that "full-scale calibration testing shall be conducted at a 6 – month interval or after 15 tests, whichever comes first". As the Sequence IIIH is written, full-scale calibration testing will require the engine test stand be also referenced for "Apparent Viscosity by the Mini Rotary Viscometer", also known as the Sequence IIIHA. A reference oil for Apparent Viscosity was not a requirement for referencing a Sequence IIIG test stand. We do not feel it is correct to include this reference parameter in a Sequence IIIH stand as Apparent Viscosity is not a necessary parameter for passing a basic Sequence IIIH.

Negative

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Item Number: 001 Test Method For Evaluation of Automotive Engine Oils in the Sequence IIIH, Spark-Ignition Engine WK53774
(REFERENCE Z3520Z)
TECHNICAL CONTACT: Terence W Bates
BATESTERRYW@AOL.COM
441513421193

Member's Name: David B Gray

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723 Electronic Drive
Suite 100
HORSHAM PA 19044

Phone Nr: 2157065800 Fax Nr:

Email Address: David.Gray@Evonik.com

File Attachment:

Statement:

Section	**Statement**
	Test Method as written does not separate Method A and Method B

Negative

Ballot Number: D02.B0 (16-06) Close Date: NOVEMBER 6, 2016

Item Number: 001 Test Method For Evaluation of Automotive Engine Oils in the Sequence IIIH, Spark-Ignition Engine WK53774
(REFERENCE Z3520Z)
TECHNICAL CONTACT: Terence W Bates
BATESTERRYW@AOL.COM
441513421193

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723 Electronic Dr

HORSHAM PA 19044

Phone Nr: 2157065880 Fax Nr:

Email Address: joruetta.ellington@evonik.com

File Attachment:

Statement:

Section	Statement
D02.B0.01	The ASTM test procedure should align to match the IIIG test procedure with three separate procedures Sequence IIIH, Sequence IIIHA and Sequence IIIHB engine tests. These tests are recognized as separate and distinct tests in the ACC Code of Practice. The ASTM test procedure should align with the test registration procedure. Also, section 12.14.1 Phosphorus Retention has an error in the detergent metals that can be reported. The procedure lists barium, calcium or magnesium but should reflect sodium instead of barium.

Negative

Ballot Number: D02.B0 (16-06) Close Date: NOVEMBER 6, 2016

Item Number: 001 Test Method For Evaluation of Automotive Engine Oils in the Sequence IIIH, Spark-Ignition Engine WK53774
(REFERENCE Z3520Z)
TECHNICAL CONTACT: Terence W Bates
BATESTERRYW@AOL.COM
441513421193

Member's Name: Andrew J Ritchie

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PO Box 537
LINDEN NJ 07036

Phone Nr: 9084742097 Fax Nr: 9084743637

Email Address: andrew.ritchie@infineum.com

File Attachment:

Statement:

Section **Statement**

Infineum commends the test developers and the combined efforts of the Surveillance Panel group to bring the Sequence IIIH forward as a new ASTM test procedure. We do however believe that the Surveillance Panel should revise the proposed test procedure to include separate Appendices and Report Forms for the Sequence IIIHA and IIIHB procedures to mirror the format of the Sequence IIIG ASTM 7320 test. The Sequence III panel will review this subject at the November 15th meeting and it is hoped that a revised Sequence IIIH procedure which includes separate Appendices and Report Forms for the Sequence IIIHA and IIIHB procedures will be approved and reissued for ASTM ballot. With this revision approved Infineum will be pleased to vote Affirmative.

Lubrizol Negative for IIIH D02 ballot

1. Procedural issues: The version being balloted was not review nor approved by the Seq III surveillance panel prior to the issue of this ballot.
2. Section 12.14.1 refers to calculation of phosphorus retention using calcium, magnesium and BARIUM detergent metal levels. . Barium is Not a standard detergent metal and we believe that this is typo where Na (sodium) was confused with Ba (barium) because B next to N on the keyboard. We recommend that this section should be corrected by substituting "sodium" for "barium".
3. The Seq IIIH was developed as a replacement test for the Seq IIIG (D7320) however, this procedure is not written as such. Section 1.1 of D7320 (Seq IIIG procedure) states the scope of the Seq IIIG as "This test method covers an engine test procedure for evaluating automotive engine oils for certain high-temperature performance characteristics, including oil thickening, varnish deposition, oil consumption, as well as engine wear". The parts of the test known as the Seq IIIGA, Seq IIIGVS, & Seq IIIGB are stated in 1.1.1 as nonmanditory supplemental requirements which are outlined Appendices labeled as "nonmanditory information" (X1, X2, & X3 respectively). As separate tests, the ACC Code of practice requires separate registration for the IIIG, IIIGA, IIIGB, & IIIGVS. This proposed Seq IIIH procedure, however, is written so that the previously nonmanditory supplemental requirements are now mandatory – in essence deleting the IIIHA & IIIHB, instead rolling these parameters into the main test. This is counter to the way the industry has understood this test to be conducted. Currently, EMA, ACC, and API has funded testing to allow the IIIH to also replace the Seq IIIF in current active API categories. The Seq IIIF does not require IIIGA or IIIGB and will not need "IIIHA" or "IIIHB" requirements. Additionally, pending the outcome of this work, may be necessary to set up a IIIHVIS only parameter for the maintenance of the API HD categories. In light of this, we recommend that the IIIH procedure be re-written to match the structure of the IIIG procedure – maintaining the IIIHA, IIIHB as monmanditory supplemental requirements
4. Section 5 highlights the significance and use of the procedure. While the IIIG does not include the significance/use of the nonmanditory supplemental requirements in this section, this Seq IIIH draft attempts to include the significance and use of the "IIIHA", but neglects to include the "IIIHB". If the IIIHB and IIIHA are moved to an nonmanditory appendices, this is not an issue.
5. Section 5.3 also states "The Sequence IIIH engine oil test has been recommended as a replacement for the Sequence IIIG test and can be used in specifications and classifications of engine lubricating oils, such as the following: D4485; MIL-PRF-2104; SAE J183" While the first part of this statement is correct – the Seq IIIH has been recommended as a replacement for the IIIG, the IIIHA is not being recommended to replace the IIIGA. If the IIIHA and IIIHB are moved to a nonmanditory appendices, this does not present a confict. Additionally, as currently worded the second part of this statement implies that the use of the IIIH has been accepted by those specifications. We recommend that the second part be reworded to clarify that the test has not yet been adopted by those specifications as a replacement for the IIIG.

ATTACHMENT 10

ASTM SEQUENCE III SURVEILLANCE PANEL

SCOPE & OBJECTIVES

SCOPE

The Sequence III Surveillance Panel is responsible for the surveillance and continual improvement of the Sequence IIIF and IIIFHD tests documented in ASTM Standard D6984 as update by the Information Letter System, the Sequence IIIG, IIIGA and IIIGB tests documented in ASTM Standard D7320 as updated by the Information Letter System and the Sequence IIIH, IIIHA and IIIHB tests as documented in the most recent Draft Procedure. Data on test precision will be solicited and evaluated at least every six (6) months for Sequence III test procedures. The Surveillance Panel is to provide continual improvement of rating techniques, test operation, test monitoring and test validation through communication with the Test Sponsor, ASTM Test Monitoring Center, the Central Parts Distributor, Fuel Supplier, ASTM B0.01 Passenger Car Engine Oil Classification Panel, ASTM Committee B0.01, ACC Monitoring Agency and ASTM Deposit/Distress Workshop. Actions to improve the process will be recommended when appropriate based on input to the Surveillance Panel from one or more of the previously stated groups. This process will provide the best possible Sequence III Type Test Procedure for evaluating engine oil performance with respect to its ability to prevent oil thickening, varnish formation, oil consumption and engine wear.

OBJECTIVES	TARGET DATE
Monitor critical IIIF/IIIG/IIIH test hardware inventory	Ongoing
Endorse use of IIIH to replace tests for IIIF & IIIG	December 1, 2016
Review standard deviations of IIIH reference oils	May 1, 2017
Monitoring timely introduction of new critical hardware batches	Ongoing

David L. Glaenzer, Chairman **Updated 11/15/16**
Sequence III Surveillance Panel