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Sequence VIII Surveillance Panel Meeting Minutes
Wednesday May 3, 2023
Intertek, Port San Antonio Location
1:00 - 2:30 PM CDT

Minutes recorded by Patrick Lang
Direct any comments or corrections to: patrick.lang@swri.org

The attendance list can be found as Attachment #1.

One change was made to the membership list. Ben Maddock will replace Bob Campbell as the voting member for Afton.

Agenda:

The agenda can be found as Attachment #2.

Minutes Approval:

Pat Lang requested approval of the following Minutes:

a. November 15, 2022, in-person
b. March 1, 2023, Virtual
c. April 17, 2023, Virtual

A motion was made and approved to accept all three sets of minutes noted above. There were no objections or requested changes.

Sequence VIII Unavailable:

Pat advised that there is no change in the status of the Sequence VIII test. It is still unavailable at this time.

Updated Summary of Test Results:

Pat went through a summary of the testing that SwRI and IAR conducted in attempts to understand the severity issue (Attachment #3). The summary breaks the testing down into several items that have been known to influence test severity in the past. The major items that were investigated are as follows:

1) Test Fuel (KA24E Green Fuel is the test fuel)
    a. Tested Batch S-000156
    b. Tested Batch S-000309
    c. Tested with EEE (not a valid test fuel but a check to see if a different fuel would change results).

2) Reference Oil
    a. 1006-2
    b. 1006-2 retains from a point in time when reference tests were passing
    c. 704-1 on pooled retains from both labs
    d. 1009-1 tested at both labs

3) Crankshafts
    a. Multiple different crankshafts tested at both labs

4) Connecting Rods
    a. Multiple different connecting rod combinations
    b. A modified rod at SwRI (not "legal" for a valid test)

5) Bearing Batches
    a. Testing done on the current 06-16 bearing batch
    b. Testing done on the new bearing batch, 03-22

All of the testing on the various items outlined above are consistently yielding severe and failing results. In summary, results are consistently coming in two to four standard deviations severe based on the three oils that have been tested. Oil 1006-2 has a standard deviation of approximately 4 milligrams so this oil is more variable than 1009-1 and 704-1, which could help explain why it is the most severe.

After reviewing all of the testing that has been done with the panel, SwRI made the recommendation to consider a possible industry correction factor for addressing the problem. The following comments were made:

Mike Deegan advised that he is against the use of a correction factor. He stated that the test has been unavailable for a couple of months already and he would rather see the problem identified than use a correction factor to get it back online.

Robert Stockwell asked the question on how often we get bearings from the Central Parts Supplier (CPD) which is TEI in San Antonio. Both labs advised that they keep their own stock of bearings on hand that that it was unlikely that recent delivery of bearings was a common denominator between labs. Additionally, it was reiterated that testing was also done with the new bearing batch which are only about a year old so that would take the aging/degradation factor out of the equation. Both bearing batches are giving the same severe results.

Jeff Hsu asked about assembly lube. Adrian stated that EF-411 is used to assemble the engine as per the procedure. He also made the group aware that he did an experiment where he weighed bearings and soaked them in EF-411 for a period of time and reweighed them. This experiment did not show a bearing weight loss. Jeff further commented that you would really need the heat and blowby from a running engine to determine if the EF-411 was oxidizing to the point of causing a corrosive effect.

Bill Buscher reminded the group that reference oil 1006-2 was blended in 2001. Is it possible that the oil just reached the point where it degraded due to age? Rich Grundza informed the group that the other reference oil which is 704-1 is circa 1992.

Adrian advised that both labs compared the ICP (metals) analysis of 1006-2 on the testing that was done and there is no indication of a change. Rich Grundza also stated that he had checked the normal quality control metrics for the oil and did not observe any changes. Jeff Hsu cautioned that metals in the oil won't tell you anything about oil degradation.

Bob Campbell stated that we really don't know if it is an aging reference oil problem or has something changed with engine parts or engine operation. We need to determine this before we consider a correction factor.

Andy Ritchie stated that he believes that there is value in trying to bring oil 1009-1 into the system. Since the current oils are too old and we don't know if they are the problem, we have to get another oil in the system. The testing that was done by IAR and SwRI on the reblend of oil 1009, which is 1009-1, showed results at around the 18 mg weight loss which is right at the upper limit of the passing range for the original blend of 1009 when it was used in the Sequence VIII as a reference oil about 15 years ago.

Bob Campbell suggested we need to see where candidate data stands with this severity level. He asked where candidates were performing right before the recent shift. Adrian and Pat advised that candidates were typically in the single digit weight loss immediately prior to the failing references (very strong passes). Bob recommended that the two independent labs look at their data base and see if there are any candidate oils that are on the higher side but passing (around 20 mg). If so, contact the supplier and see if that oil would be available to test now and determine if the test has shifted.

Travis mentioned that we really need to see a candidate oil around the 26 mg point which is the pass limit for candidate tests. He would expect to see a 26 mg oil perform at around the 50 mg level if the problem is the test and not the oil. Pat advised that it is very unusual that any candidate tests perform at the 26 mg level.

The meeting ended due to time and the need to start the follow-up meeting. Pat Lang advised that he would call the panel together to further discuss the next steps that will be taken to solve the severity problem. The future focus would be to consider getting 1009-1 in the referencing system as a newer reference oil using the limited quantities of the original blend of 1009 for the tie-back. This could help us understand if we are dealing with a reference oil degradation problem.

Adjournment: The meeting was adjourned at 2:40 PM CDT.

Attachment #1

Attendance List

ASTM SEQUENCE VIII SURVEILLANCE PANEL
VOTING MEMBERSHIP ATTENDANCE RECORD

5/3/23

✓ = present

Name	Address	Attendance
Alfanso, Adrian	Intertek 5404 Bandera Road San Antonio, TX 78238 Phone:210-647-9429 adrian.alfonso@intertek.com	✓
Bowden, Jason	OH Technologies, Inc. P.O. Box 5039 Mentor, OH 44061-5039 Phone: 440-354-7007 dhbowden@ohtech.com	
Savant, Amol	Valvoline 21st and Front Streets Ashland, KY 41101 Phone: 606-585-8982 acsavant@valvolineglobal.com	
Campbell, Bob	Afton Chemical 500 Spring Street P.O. Box 2158 Richmond, VA 23218 Bob.Campbell@aftonchemical.com	✓
Grundza, Rich	ASTM/TMC Phone: 412-365-1031 reg@astmtmc.org	
Hsu, Jeff	Shell Projects and Technology-USA 3333 Hwy 6 Houston, TX 77082 Phone:281-544-8619 J.Hsu@shell.com	
Hairston, William	Haltermann Solutions 15600 W. Hardy Road Houston, TX 77060 Phone No: 832-647-9264 whhairston@haltermann.com	✓
Riou, Joseph	Southwest Research Institute 6220 Culebra Road P.O. Box 28510 San Antonio, TX 78228-0510 Phone: 210-522-6266 jriou@swri.org	

ASTM SEQUENCE VIII SURVEILLANCE PANEL
VOTING MEMBERSHIP ATTENDANCE RECORD

Name	Address	Attendance
Lanctot, Dan	Test Engineering Inc. 12718 Cimarron Path San Antonio, TX 78249-3423 Phone: 210-690-1958 dlanctot@tei-net.com	
Kowalski, Teri	Toyota Motor North America, Inc. 1555 Woodridge Ann Arbor, Mi 48105 Phone: 734-995-4032 Cell: 734-355-8082 teri.kowalski@tema.toyota.com	
Cosgrove, Bradley	GM Global Propulsion Systems Phone: 313-590-2186 Bradley.Cosgrove@gm.com	
Rubas, Paul	ExxonMobil Research and Engineering Company 600 Billingsport Rd. Paulsboro, NJ 08066 Email: paul.j.rubas@exxonmobil.com	
Tang, Haiying	Stellantis Phone: 248-512-0593 haiying.tang@stellantis.com	Via Teams
Stockwell, Robert	Chevron Oronite Company LLC 4502 Centerview Drive Suite 210 San Antonio, TX 78228 Phone: 210-232-3188 Robert.stockwell@chevron.com	
Marks, Brian	BP Lubricants USA 1500 Valley Rd Wayne, NJ 07470 Phone: Brian.Marks@BP.com	

ASTM SEQUENCE VIII SURVEILLANCE PANEL
VOTING MEMBERSHIP ATTENDANCE RECORD

Name	Address	Attendance
Deegan, Mike	Ford Motor Company 17228 Federal Drive Allen Park, MI 48101 Phone: 313-805-8942 mdeegan@ford.com	Via Teams
Ritchie, Andy	Infineum P.O. Box 735 1900 East Linden Ave. Linden, NJ 07036-0735 Phone: 908-474-2097 andrew.ritchie@infineum.com	✓
Szappanos, George	Lubrizol Corporation 29400 Lakeland Blvd. Wickliffe, OH 44092 Phone: 440-347-2631 George.szappanos@lubrizol.com	GS

ASTM SEQUENCE VIII SURVEILLANCE PANEL
NON- VOTING MEMBERSHIP and GUESTS ATTENDANCE RECORD

Name	Address	Phone/Fax/Email	Attendance
Todd Dvorak	1900 E Linden Ave Linden NJ.	todd.dvorak@infineum.com	✓
Adrian Alfonso	5404 Balcrest Rd. SA, TX, 78238	adrian.alfonso@intertek.com	✓
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Ricardo Affinito	3901 Briarpark Dr, Houston, TX 77042	affinito@chevron.com	✓
Travis Kostan	6220 Culebra Rd. San Antonio, TX 78238	travis.kostan@swri.org	✓
DAVE PASSMORE	6660 ROWOK DR CANTON, ME 04187	DPASSMORE@EMISCORP.COM	✓
MATTHEW BOWDEN	PO BOX 5039 MENTOR, OH 44061	MJBOWDEN@OHTECH.COM	✓
Tony Catanese		tony.catanese@lubrizol.com	✓
Andrew Stevens	29400 Lakeland Blvd Wickliffe, OH 44092	andrew.stevens@lubrizol.com	✓

Attachment #2

Agenda

1. Welcome

2. Attendance/Membership Changes

3. Approval of Minutes: The following minutes have been posted to TMC website and need approval:
    a. November 15, 2022, in-person
    b. March 1, 2023, Virtual
    c. April 17, 2023, Virtual

4. CPD Report from TEI (Dan Lanctot)

5. Fuel Report (Haltermann)
    a. Current fuel inventory level
    b. Advise on any potential issues or concerns with future supply

6. TMC Report (Rich Grundza)
    a. Current LTMS Status
    b. Reference oil inventory levels

7. Sequence VIII Test is unavailable and under provisional licensing
    a. Update on testing results to date (Pat Lang)
    b. Recommendation to get test back on-line (Travis Kostan)

8. Old Business
    a. Procure a more-current technology reference oil

9. Next Meeting will be at the call of the chairman

10. Adjournment

Attachment # 3

Summary of Testing Results

Sequence VIII Severity Issue Chronology

SOUTHWEST RESEARCH INSTITUTE®

5/3/2023

Metrics

- Fuel
- Oil
- Crankshaft
- Connecting Rod
- Bearing Batches

Fuel

- SWRI
  - Tried different fuel batches using 1006-2 reference oil
    - KA24E Green

      S-000156 (Sourced from Lubrizol)

      S-000309

Fuel Batch	Bearing Weight Loss Average
S-000309	34.9 (multiple tests see next slide)
S-000156 (Sourced from Lubrizol)	35.9 (one test)

Fuel

SwRI Fuel Results using oil 1006-2

Run #	Fuel Batch	BWL	Comment
52-S186-0-134	S-000309	37.3	S-000309
52-S186-0-134A	S-000309	42.8	
52-S186-0-134B	S-000309	36.5	
52-S186-0-134C	S-000309	27.9	
51-152A-0-573	S-000309	28.3	
51-152A-SWRI1	S-000309	33	
52-S186-0-134D	S-000309	32.5	
51-152A-0-574	S-000309	37.7	
52-S186-1-SWRI1	S-000309	36.2	
52-S186-0-134E	S-000309	36.7	
51-152A-0-573A	S-000156	35.9	S-000156 Sourced from Lubrizol

Note: Historical Average for 1006-2
BWL: 17.5 STDev: 4.23 Upper Passing Limit: 25.79

Fuel

- IAR
  - Tried different fuel batches using 1006-2 reference oil
    - KA24E Green

      S-000156

      S-000156 → S-000309

      S-000309

      EEE

Fuel Batch	Bearing Weight Loss Average
S-000156	32.2
S-000156 → S-000309	26.7
S-000309	31.1
EEE	36.9

Fuel

IAR Fuel Results using oil 1006-2

Run #	Fuel Batch	BWL	Comment
2-238-0-206	S-000156	27.6	Original S-000156
2-238-0-206A	S-000156/S-000309	26.7	Switched fuels mid test
2-238-0-206SHKDWN	S-000309	31.5	S-000309 batch
1-252-0-579SHKDWN	S-000309	29.2	
2-238-0-206BSHKDWN	S-000156	34.9	S-000156 batch
2-238-0-206CSHKDWN	S-000156	36.9	
1-252-0-579ASHKDWN	S-000156	29.5	
2-238-0-206DSHKDWN	EEE	36.9	Ran non-KA24E fuel
1-252-0-579BSHKDWN	S-000309	24.8	S-000309 batch
1-252-0-579CSHKDWN	S-000309	35.3	
2-238-0-206FSHKDWN	S-000309	34.9	

Note: Historical Average for 1006-2
BWL: 17.5 STDev: 4.23 Upper Passing Limit: 25.79

Oil

- SwRI
  - 1006-2
  - 1006-2 retains from last passed reference
  - 1009-1
- IAR
  - 1006-2
  - 704-1 retains
  - 1006-2 retains
  - 1009-1

Oil

- SwRI Results from Oil

Run #	Oil	BWL	Average
52-S186-0-134	1006-2	28.3	33.6
52-S186-0-134A	1006-2	42.8	
52-S186-0-134B	1006-2	36.5	
52-S186-0-134C	1006-2	27.9	
51-152A-0-573	1006-2	28.3	
52-S186-0-134D	1006-2	32.5	
52-S186-0-134E	1006-2	36.7	
51-152A-0-573A	1006-2	35.9	
51-152A-SWRI1	1006-2 retains from last passed reference	33	33
51-152A-0-RR3	1009-1	17.4	17.4

Note: 1009 Historical Average
BWL: 13.8 STDev: 2.14 Upper Passing Limit: 17.99

Oil

- IAR Results from Oil

Run #	Oil	BWL	Average
2-238-0-206	1006-2	27.6	
2-238-0-206A	1006-2	26.7	
2-238-0-206SHKDWN	1006-2	31.5	
1-252-0-579SHKDWN	1006-2	29.2	
2-238-0-206BSHKDWN	1006-2	34.9	
2-238-0-206CSHKDWN	1006-2	36.9	31.7
1-252-0-579ASHKDWN	1006-2	29.5	
2-238-0-206DSHKDWN	1006-2	36.9	
1-252-0-579BSHKDWN	1006-2	24.8	
1-252-0-579CSHKDWN	1006-2	35.3	
2-238-0-206FSHKDWN	1006-2	34.9	
2-238-0-206ASHKDWN	704-1	12.5	12.5
1-252-0-579ESHKDWN	1009-1	18.7	18.7

Note: 704-1 Historical Average
BWL: 8.3 STDev: 2.32 Upper Passing Limit: 12.85

Note: 1009 Historical Average
BWL: 13.8 STDev: 2.14 Upper Passing Limit: 17.99

Crankshaft

- SwRI
  - Tried several different crankshafts on one engine/stand combination

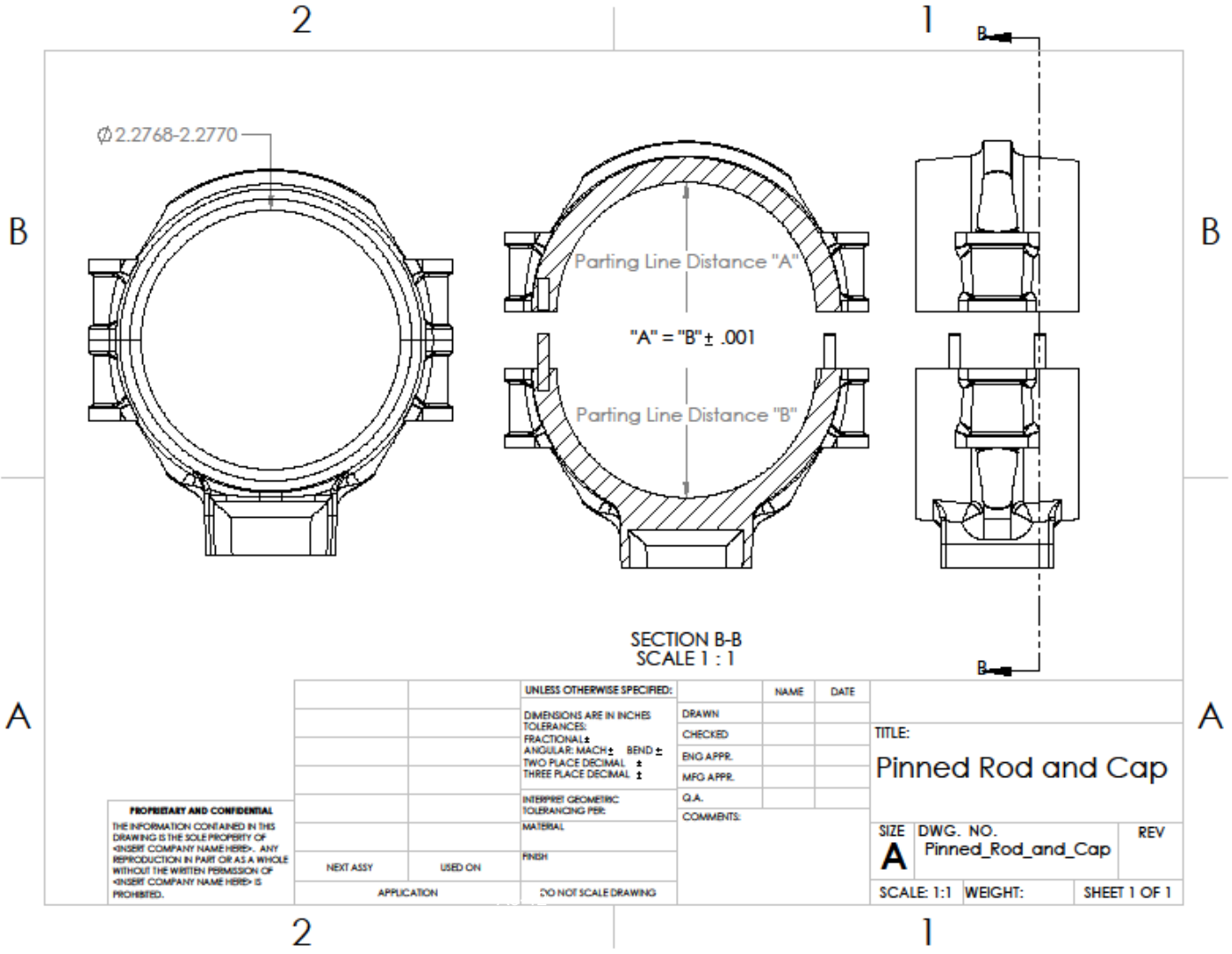
Run #	Crankshaft	BWL
52-S186-0-134	Original Crank (prior calibration success with this crankshaft)	28.3
52-S186-0-134A		42.8
52-S186-0-134B	New Crankshaft / Connecting rod	36.5
52-S186-0-134C	Same Crankshaft / New Connecting rod	27.9
52-S186-0-134D	Original Crankshaft / Connecting rod	32.5

Connecting Rods

- SwRI
  - Tried multiple different connecting rods including:
    - Existing rod used in last references
    - Older rods from storage
    - Modified rod, modified for better cap location (not a surveillance panel approved modification, for experiment only).

Modified Connecting Rod (SwRI)

- Rod pined for location, then was honed out to big end bore specification



Connecting Rods

- SwRI Connecting Rod Results
  - Using 1006-2, S-000309 for all

Run #	Connecting rod	BWL
52-S186-0-134	Original connecting rod	28.3
52-S186-0-134A		42.8
52-S186-0-134B	New connecting rod	36.5
52-S186-0-134C	Different, existing connecting rod	27.9
52-S186-0-134D	Original connecting rod	32.5
52-S186-0-134E	4th rod from existing inventory	36.7
52-S186-1-RR1	Modified rod using pins for location	15.3
52-S186-2-RR2		21.4

Bearing Batches

- Between both labs
  - Used 06-16 for most tests
  - Tried 03-22 to see if there was severity shift

Bearing Batches

- SwRI Bearing batch results
  - Using 1006-2, no modified rods

Run #	Bearing Batch	Fuel	BWL	Average
52-S186-0-134	06-16	S-000309	28.3	
52-S186-0-134A	06-16	S-000309	42.8	
52-S186-0-134B	06-16	S-000309	36.5	
52-S186-0-134C	06-16	S-000309	27.9	
51-152A-0-573	06-16	S-000309	28.3	33.5
51-152A-SWRI1	06-16	S-000309	33.0	
52-S186-0-134D	06-16	S-000309	32.5	
52-S186-0-134E	06-16	S-000309	36.7	
51-152A-0-573A	06-16	S-000156	35.9	
51-152A-0-574	03-22	S-000309	37.7	37.7

Bearing Batches

- IAR Bearing batch results
  - Using 1006-2

Run #	Bearing Batch	Fuel Batch	BWL	Average
2-238-0-206	06-16	S-000156	27.6	31.6
2-238-0-206A	06-16	S-000156/S-000309	26.7	
2-238-0-206SHKDWN	06-16	S-000309	31.5	
1-252-0-579SHKDWN	06-16	S-000309	29.2	
2-238-0-206BSHKDWN	06-16	S-000156	34.9	
2-238-0-206CSHKDWN	06-16	S-000156	36.9	
1-252-0-579ASHKDWN	06-16	S-000156	29.5	
2-238-0-206DSHKDWN	06-16	EEE	36.9	
1-252-0-579BSHKDWN	03-22	S-000309	24.8	31.7
1-252-0-579CSHKDWN	03-22	S-000309	35.3	
2-238-0-206FSHKDWN	03-22	S-000309	34.9	

Path Forward

- Much effort has been placed in finding an engineering fix, but it seems likely that a correction factor will be needed to return the test to traditional severity levels.

- Due to limited quantity of 704-1 remaining, a separate correction factor matrix and new bearing batch approval matrix will not be possible.

- Recommend to run additional testing all on new bearing batch to develop a correction factor which accounts for industry severity and any potential bearing batch severity, though the effects will not be separable.

Path Forward

A minimum of eight tests are recommended by SwRI to develop a correction factor. Based on the testing to date, it seems likely that a linear correction factor would be developed (larger correction at larger BWL).

Stand A-1	Stand A-2	Stand G-1	Stand G-2
704-1	1006-2	704-1	1006-2
1006-2	704-1	1006-2	704-1

Upon completion of the testing and correction factor development, these stands could be granted calibration status.

Correction Factor Possibility

- Average 1006-2 result around 32.5mg.
  - This is +15mg when compared to a target performance of 17.5mg
- One 704-1 result was 12.5.
  - This is +4.2mg when compared to a target performance of 8.3mg.
- Based on these results, one can calculate a linear correction factor.

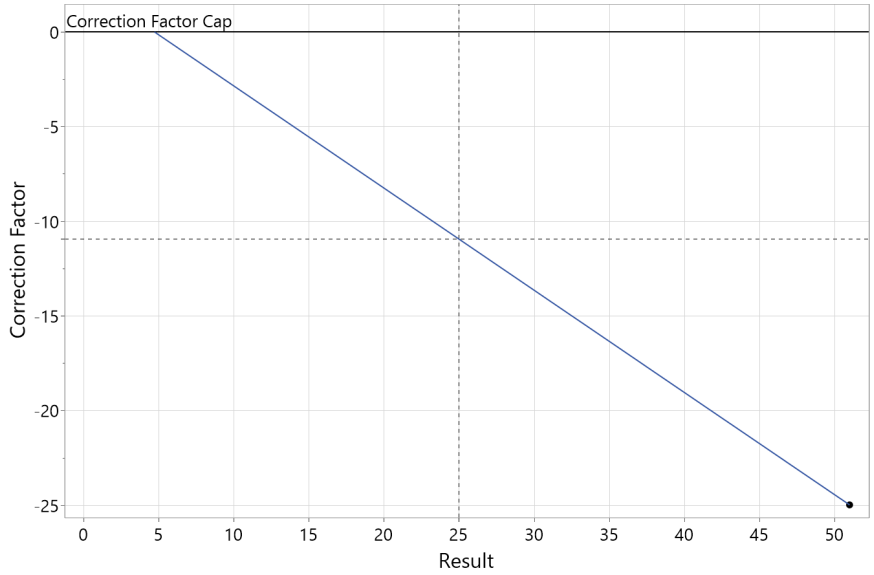
Avg. Result	CF Needed
12.5	-4.2
32.5	-15.0

Used to create a linear equation.

How a Linear Correction Might Work

CF_Needed = 2.55 – 0.54*Result.

- Will be zero or positive at a bearing weight loss results < 4.8 mg. and correction factor could be not applicable at those levels.



Based on this example equation, a hypothetical candidate result of 25 would receive a correction of -11, for an adjust result of 14mg prior to applying an severity adjustments.

- Based on this correction, a result with 51mg weight loss would be adjusted to the GF-6 pass limit of 26 mg.

Thank You