



January 17, 2007

Reply to:

Donald T. Bartlett

The Lubrizol Corporation

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ASTM D02.B0.03 L-37 Surveillance Panel

Members and Guests:

Attached for your review and comment are the unconfirmed minutes of the:

- o **November 15, 2006 L-37 Surveillance Panel Meeting conducted at the PRI Headquarters, Apollo Room, Warrendale, PA.**

Please direct any corrections or comments to my attention.

Sincerely,

A handwritten signature in black ink that reads "Donald T. Bartlett".

Donald T. Bartlett, Chairman

L-37 Surveillance Panel

Attachments

The Lubrizol Corporation

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Report of Meeting
L-37 Surveillance Panel
Warrendale, PA
PRI Apollo Room
November 15, 2006

Sign-in/Review of Membership: The meeting was called to order at 8:35 pm. The sign-in sheet is Attachment 1.

The chairman opened the meeting with a review of the membership list which is current with no proposed changes at this time. See Attachment 2. He questioned the membership status of Mr. Sullivan who recently retired from ExxonMobil and waiting guidance as to who will replace him as their voting member. The chairman also recommended that all panel chairmen add the gear rating task force members to their respective mailing lists to aid communication between the respective groups.

Meeting Agenda Review:

The agenda is included as Attachment 3. A review of the agenda was performed with one additional business items added to the agenda.

The minutes of the June 21, 2006 Surveillance Panel Meeting and the November 1, 2006 Hardware Task Force Teleconference Meeting were presented for review and approval.

Motion 1 ⇒ Mr. Smith, Second ⇒ Mr. Rea) - The panel approves both sets of minutes as presented with no corrections or additions. The motion to approve was unanimous (6, 0, 0).

Summary of Meeting Discussions

Action Items:

- The chairman is to contact Dana for further clarification of what the 'A' in 8620A steel means for the ring? Mr. Kreinbring will check and report back.
- TMC to work with the group to gather and implement more pinions for the RCMS system with wear distress down in the 4 or 5 range.
- The Lubrizol Corporation is to contact Astro Model to make wear and ridging distress molds and agreed to front the initial expense of approximately \$ 4400. At a determined time in the near future, the four labs agreed to share the costs (approximately \$ 1100 each lab) and reimburse Lubrizol accordingly.
- The Laboratory Hardware TF, during their visits to the Dana Ft. Wayne and Lugoff facilities for the Dana 44 and 60 model axle build outs, is to ask that Dana report both of their backlash measurements on the housing.

Motions:

- **Motion 1** ⇒ Mr. Smith, **Second** ⇒ Mr. Rea) - The panel approves both sets of minutes as presented with no corrections or additions.
- **Motion 2** ⇒ **Mr. Gropp, Second** ⇒ **Mr. Rea**: The Surveillance Panel supports the request of the GORTF group and directs them to work with the chairman to procure ridging and wear molds and determine if their use will improve precision and reduce variability.
- **Motion 3** ⇒ **Mr. Koglin, Second** ⇒ **Mr. Dharte**: With respect to L-37 RCMS, the TMC was directed to mark an additional tooth for wear rating distress when there is a spall present in the wear step. This will affect only pinion # 15, 17, 21, and 33. The motion passed unanimously (7, 0, 0)
- **Motion 4** ⇒ **Mr. Lind, Second** ⇒ **Mr. Koehler**: Both of the L-37 backlash measurements by Dana be recorded on the axles and will be between and including .004" and .009".

Summary of Meeting Discussions

2006 Lubrited Hardware Order Status:

A summary from the November 1, 2006 HTF teleconference call is included as Attachment 4. The chairman reviewed the visitation plan which includes the L-42 & L-37 gear batch order. The chairman provided the following status:

- 1175 rings which were made of the 8620 steel that have been blanked. The steel on the drawing is 8620A but this is made of 8620.
- 1600 Pinion forgings have been blanked and cutting has begun.

Mr. Kreinbring from Dana Corp was brought into the meeting via teleconference to discuss the status of the hardware order and confirm a time for the SP to visit Dana Ft. Wayne.

Action Item: The chairman was asked to inquire what the 'A' designation in 8620A steel means. Mr. Kreinbring was not sure by but would check and report back.

Dana has received the forgings, turned the blanks down; cutting has or will begin very soon. Dana will stop short of the lubriting process for the purpose of the Laboratory HTF visitation.

Heat-treating hardness should be setup similar to the 792/417 non-lubrited batch in which Mr. Okamuro identified the need to keep the levels of retained austenite in the pinion below 10%. The chairman reminded the panel that the levels were near 20% on some batches in the past. Ft. Wayne is targeting the 10% level but couldn't guarantee to meet it. They believe they'll be close but might make 11 or 12% depending on how the heat-treating goes.

ASTM concerns expressed to Dana based on former learning from Ken Okamuro:

- Prior to running, recharge with fresh initiator
- Want relatively low etching and fine grain sizing
- Expressed a concern about hardware not being run immediately after a tank shut down. If there is a shutdown, after the bath has been brought back up to temperature, run several "other" pieces through first.
- We desire no lubriting change, need consistency from front to rear of the batch.

The HTF meeting trip date to Ft. Wayne is scheduled for 8 am on November 29th. December 15th is the target ship date for the L-37 hardware.

Mr. Rea asked whether we have a good handle on how different manufacturing process changes affect L-37 test severity. Mr. Bartlett explained the work Mr. Okamuro & panel previously addressed but these outcomes have always been based on historical data (reviewing test parts from old gear batches). An experimental design has never been conducted due to expense.

RCMS Pinion Target Updates - TMC

Attachment 5 is the motion from the June SP meeting. Mr. Lind did perform a t-test for all distresses. For wear distress only, a significant difference was observed between the updated targets for wear based on the current definition. See Attachment 6. Mr. Lind commented that there is no shift with the two most 'consistent L37 RCMS raters. There appears to be a shift or variation introduced by just certain raters in the 6, 7, and 8 rating range.

Mr. Lind stated he felt more investigation was needed and he compared the most "consistent" raters (taken from the L-37 RCMS) in the system (called A and B) and compared their original numbers, See Attachment 7. No shift was observed between raters A and B when compared against their original ratings prior to the definition change. When comparing raters A and B to the aggregate after the wear rating definition change, the t-test also shows there to be no significant difference. He notes that other raters are starting to rate wear more consistently with respect to raters A and B.

Mr. Gropp commented that he looked at the data based on severity shifting. For all of the raters, he observed 16 of the 18 data points were more severe based on the updated targets of all raters. Mr. Lind pointed to the center table called 'Rater A & B vs. Updated Targets of All Raters'. The results from this table show that there is no shift in the mean from before and after the rating definition change. Out of the 18 pinions, 9 were more severe and 9 were milder. Without even considering the magnitude, this emphasizes no shift in performance. Mr. Lind commented that he believes the shift was only with certain raters and only within a certain area.

Mr. Lind also wanted to check whether there was a statistically significant shift close to the pass/fail line. The data shows that the shift was at the 6, 7, and 8 rating by certain raters. He doesn't agree with implementing a linear offset correction because the shift didn't occur at the pass/fail line. It is slightly above the pass/fail line.

Action Item: TMC to work with the labs to procure more pinions for the RCMS system down in the 4 or 5 range.

Gear Rating Task Force Summary and Requests:

Attachment 8 is included as a 'summary' and is included for background information and documentation. It represents an L-37 only summary from the ASTM Gear Rating Task Force that last met in Cleveland, Ohio on July 25-27, 2006. The attachment details all work and requests from the rating TF group to the Panel and captures the details of their specific requests. The chairman walked the panel through the details with the following outcomes:

With respect to rating molds:

Motion 2 ⇒ Mr. Gropp, Second ⇒ Mr. Rea: The Surveillance Panel supports the request of the GORTF group and directs them to work with the chairman to procure ridging and wear molds and determine if their use will improve precision and reduce variability. Further discussion and agreement: To simplify the process, the Lubrizol Corporation agreed to front the initial expenses of approximately \$ 4400. At a determined time in the near future, the four labs agreed to share the costs (approximately \$ 1100 each lab) and reimburse Lubrizol accordingly. The motion passed unanimously (5, 0, 2).

With respect to the 5-ripple CRC photo:

The Gear Rating Task Force believes the 5-ripple photo could be improved to gain better rater precision. Afton has agreed to co-ordinate the photo enhancement through the GRTF.

With respect to rating RCMS Pinion wear distress with Spalling present in the Wear Step area:

This effort stems from wear being hard to rate when a spall is present on the marked gear tooth. The TMC presented the data; See Attachment 9, from a small experiment involving 4 high volume raters at the last workshop. The TMC had marked a newly identified tooth on 4 pinions. The data is attached which shows no significant change in the ratings on the new teeth. However the results were shared at the workshop with all of the raters. The remaining raters said while the experiment didn't show an improvement they felt that marking the new teeth would help them in the future. Mr. Gropp reminded the group that marking the teeth is not a real world occurrence. The procedure says to evaluate all of the occurrences.

Motion 3 ⇒ Mr. Koglin, Second ⇒ Mr. Dharte: With respect to L-37 RCMS, the TMC was directed to mark an additional tooth for wear rating distress when there is a spall present in the wear step. This will affect only pinion # 15, 17, 21, and 33. The motion passed unanimously (7, 0, 0)

Agenda Item Addition for L-37 Pinion Backlash Discussions:

The chairman was asked by the Laboratory Hardware TF group (they met the day before) to add this topic to the L-37 agenda as the issue with backlash measurements and reporting should be consistent with both the Dana 60 and 44 model hardware and will also be discussed later in the day at the L-42 Surveillance panel.

Currently, Dana, at time of assembly, only makes 2 backlash measurements. They record the maximum and minimum (as they have been doing so for many years) and record just the minimum value for backlash on the axle housing. The D6121 standard currently requires the labs to make and report 4 equally spaced backlash measurements before and after test along with the averages. The minimum and maximum backlash acceptable for testing is a backlash between 0.004" & 0.009". Based on all the finite elemental analysis work performed by Mr. Okamuro and approved by the respective panels, Dana is now targeting a contact pattern length of L2 or L3 and flank values of -1, 0, and +1. Labs are now seeing backlash measurements from Dana as 0.009" (the maximum allowed specification in D6121). When the labs take their four measurements, the average can, and has been, higher than 0.009". At that point, the labs have to reject the axle or make appropriate adjustments to show the backlash is within specification. The labs are proposing that we continue to take the 4 measurements but also capture the Dana minimum backlash number.

There was much discussion on the appropriate action to take. Jack Zakarian said there are 2 issues. "One is that we need to address the differences between how Dana measures backlash and how the L-37 procedure specifies. The second issue is why Dana has provided some hardware outside of their current specification. The panel should request that Dana conduct the same 4 measurements and ask why they have deviated from the specifications".

Action Item: The Laboratory Hardware TF, during their visits to the Dana Ft. Wayne and Lugoff facilities for the Dana 44 and 60 model axle build outs, ask for further clarification and ask that Dana report both of their measurements. The following motion was offered.

Motion 4 ⇒ Mr. Lind, Second ⇒ Mr. Koehler: Both of the L-37 backlash measurements by Dana be recorded on the axles and will be between and including .004" and .009". The motion passed unanimously, 7-0-0). (*Secretary's follow up note: The chairman contacted Mr. Ottley (Lugoff facility) to request this action on December 14th. Mr. Ottley agreed to incorporate the request into the axle assembly process and to capture the information in the spreadsheet and provided as well).*

Being not further business to conduct, the meeting was adjourned at 11:15 am. Motion was made by Mr. Koglin and seconded by Mr. Schenkenberger.

Respectfully submitted,



Donald T. Bartlett
L-37 Surveillance Panel Chairman

ASTM L-37 Surveillance Panel Membership/Mailing List

Meeting Date: November 15, 2006

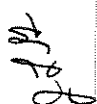


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* Initial to indicate attendance at subject meeting

Attachment
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 Reference L37 M/S/Job

ASTM L-37 Surveillance Panel Membership/Mailing List

Meeting Date: November 15, 2006

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* Initial to indicate attendance at subject meeting

ASTM L-37 Surveillance Panel Membership/Mailing List

Meeting Date: November 15, 2006

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ASTM L-37 Surveillance Panel Membership/Mailing List

Meeting Date: November 15, 2006

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* Initial to indicate attendance at subject meeting

ASTM L-37 Surveillance Panel Membership/Mailing List

Meeting Date: November 15, 2006

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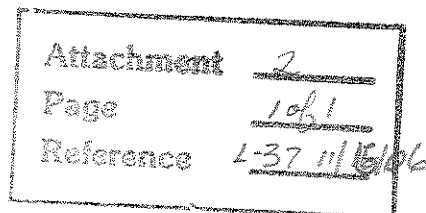
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L-37 Surveillance Panel Voting Members

Donald Bartlett	The Lubrizol Corporation (Chairman)
Tom Bryson	Volvo Powertrain Corporation
Juan Buitrago	Chevron Oronite Company
Allen Comfort	AMSTA-TR-D/210 US Army Tacom-Tardec
John Dharte	American Axle & Manufacturing
Brian Koehler	Southwest Research Institute
Cory Koglin	Afton Chemical Company
Don Kreinbring	Dana Corporation
Don Lind	ASTM Test Monitoring Center
Jim Linden	GMR Research and Development
Thelma Marougy	Eaton Corporation
Bruce McGlone	ArvinMeritor Materials Engineering
Salvatore Rea	Infineum
Dale Smith	PARC Technical Services
William Sullivan	ExxonMobil Chemical Company
Paula Vettel	D.A. Stuart Company

Total 16 Voting Members



**L-37 Surveillance Panel
PRI/ Headquarters, Apollo Room - Warrendale, PA
November 15, 2006**

AGENDA

- I. Call to Order & Membership Review
- II. Review Agenda
- III. Approval of Minutes:
 - o June 21, 2006 SP Meeting
 - o November 1, 2006 HTF Teleconference Meeting
- IV. 2006 Lubrited Hardware Order Status
- V. L37RCMS Statistical Differences Request of TMC
- VI. Gear Rating TF Requests
- VII. New Business
- VIII. Adjournment

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✓ **2006 Lubrified Hardware Order**

<input type="checkbox"/> Afton	275
<input type="checkbox"/> Parc	220
<input type="checkbox"/> SwRI	275
<input type="checkbox"/> Lubrizol	300
Total	1070

- Binding PO's Presented May 31, 2006.
- Panel requests HTF to visit Ft. Wayne at time of production. Yes
- Panel requests HTF to visit Lugoff at time of assembly. Yes
- Don Kreinbring, Dana ASTM representative to keep Panel, HTF and Dana Facility representatives informed as the hardware progresses.

Status as of 11/13/2006 – Lab TF Teleconference Call

○ **Status of ring:**

- 1175 rings were received. Made of 8620 steel (8620A is spec on drawing), cut and quarantined to go through furnace for extra heat-treating. Shot peening, surface grinding, and lapping to follow. The drawing version is revision C.

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- **Status of pinion:**
 - Approximately 1600 Pinion forgings (some for another job) are due to ship/arrive on Friday, 11/3/06. Made of 8625 steel. Will immediately be annealed, blanked and proceed up to cutting, lapping, etc. The drawing version is revision C.
 - 200 piece cutting tool change out.
 - Cutting to be performed around November 9th.
- **Heat Treating** hardness should be set up as the last non-lubrited batch and case depth (heaver than normal production). Appropriate drawings from P4L792/V1L417 batch with quality alerts confirmed. Expressed a concern with retained austenite (pinion only) being less than 10 % percent. This is something they will target, but no guarantee it will be achieved.
- **Lapping process** comes after heat-treating and shot peening and set up properly using lapping compound, 280-grit.
- **Lubriting process** – The question was...have there been any changes to the lubriting process at Ft. Wayne since 1999?
 - ASTM requirement is different than normal Ft. Wayne productions. They normal lubrited the ring only, we require both ring and pinion to be lubrited. Ft. Wayne must make a special tool to hang the pinion.
 - Special cleaning process before luberizing? Yes, continuous line rinsed, initiated, runs through tank, rinsed, oiled. (Alkaline cleaner and oiling chemicals are different than previous lubrited runs).
 - This is a manganese phosphate process, has temperature specification, certain soak times. Acid is continuously added.

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- ASTM concerns expressed and Dana to confirm:
 - Prior to running, recharge with fresh initiator (fixidyne can lead to fine crystals, which is what we want).
 - Want relatively low etching and fine grain sizing.
 - Expressed a concern about hardware not being run immediately after run after a tank shut down. If there is a shutdown, after the bath has been brought back up to temperature, run several "other" pieces through first (say for 1 day).
 - We desire no lubriting change, need consistency from front to rear of the batch run.
- Lab TF visit to Ft. Wayne at lubriting time is November 29th, 8:00 a.m.
- Don Kreinbring to confirm status of parts batch lot and build status for L-37 hardware.
- Lab TF Trip to Lugoff facility at assembly time is tentatively scheduled for December time frame (dependent on L-42 build out). There is a hardware line move to another building scheduled at Lugoff as well.

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✓ L37RCMS Statistical Differences Request of TMC

From the June 21, 2006 SP meeting:

Motion 4 ⇒ Mr. Gropp, Second ⇒ Mr Sullivan): For all distress categories, the panel requests the TMC to use this data to determine the magnitude of offset between the current and new targets and if the differences in means are statistically significant.

TMC Presentation 1:

Mr. Lind reports that with respect to Ridging, Rippling, and Pitting/spalling distresses, there were no statistically significant differences between the current and new target means.

TMC Presentation 2:

Consistency ratings of consistent rater A and B comparison

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ALL Pinions			
Pinion #	Original	Updated	Delta
1	5.9	5.8	-0.1
2	6.6	5.9	-0.7
3	6.6	5.9	-0.7
6	6.6	5.8	-0.8
7	7.8	6.7	-1.1
8	7.7	7.0	-0.7
10	5.7	5.6	-0.1
11	6.9	6.1	-0.8
13	8.2	7.5	-0.7
14	6.7	5.9	-0.8
15	5.4	5.7	0.3
17	6.0	5.7	-0.3
18	5.7	5.0	-0.7
19	7.0	5.9	-1.1
21	6.0	5.6	-0.4
22	7.3	6.4	-0.9
25	6.7	6.0	-0.7
26	8.8	8.5	-0.3
27	5.7	5.6	-0.1
29	7.0	6.5	-0.5
30	7.0	6.1	-0.9
31	6.8	7.2	0.4
32	7.0	7.4	0.4
33	6.3	6.1	-0.2
34	6.3	6.4	0.1
35	6.5	6.6	0.1
36	6.2	6.1	-0.1
37	6.7	7.4	0.7
38	6.7	6.4	-0.3
39	6.8	6.8	0.0
40	6.3	6.2	-0.1
41	6.8	7.4	0.6
42	6.0	6.0	0.0
43	6.5	7.3	0.8
45	6.3	6.5	0.2
46	6.8	6.4	-0.4
47	6.0	6.1	0.1
48	6.5	6.4	-0.1
50	6.8	6.6	-0.2
51	7.2	7.1	-0.1
52	5.7	6.1	0.4
53	6.8	6.8	0.0
54	6.5	6.4	-0.1
55	7.0	7.1	0.1
56	7.3	7.1	-0.2
N		Mean	-0.22
45		S.D.	0.473
T = -3.1494			
T Table Value 2.045			

Pinions With Merit Ratings 6.5 to 8.8			
Pinion #	Original	Updated	Delta
2	6.6	5.9	-0.7
3	6.6	5.9	-0.7
6	6.6	5.8	-0.8
7	7.8	6.7	-1.1
8	7.7	7.0	-0.7
11	6.9	6.1	-0.8
13	8.2	7.5	-0.7
14	6.7	5.9	-0.8
19	7.0	5.9	-1.1
22	7.3	6.4	-0.9
25	6.7	6.0	-0.7
26	8.8	8.5	-0.3
29	7.0	6.5	-0.5
30	7.0	6.1	-0.9
31	6.8	7.2	0.4
32	7.0	7.4	0.4
35	6.5	6.6	0.1
37	6.7	7.4	0.7
38	6.7	6.4	-0.3
39	6.8	6.8	0.0
41	6.8	7.4	0.6
43	6.5	7.3	0.8
46	6.8	6.4	-0.4
48	6.5	6.4	-0.1
50	6.8	6.6	-0.2
51	7.2	7.1	-0.1
53	6.8	6.8	0.0
54	6.5	6.4	-0.1
55	7.0	7.1	0.1
56	7.3	7.1	-0.2
N		Mean	-0.30
30		S.D.	0.533
T = -3.0826			
T Table Value 2.045			

Pinions With Merit Ratings 5.4 to 6.3			
Pinion #	Original	Updated	Delta
1	5.9	5.8	-0.1
10	5.7	5.6	-0.1
15	5.4	5.7	0.3
17	6.0	5.7	-0.3
18	5.7	5.0	-0.7
21	6.0	5.6	-0.4
27	5.7	5.6	-0.1
33	6.3	6.1	-0.2
34	6.3	6.4	0.1
36	6.2	6.1	-0.1
40	6.3	6.2	-0.1
42	6.0	6.0	0.0
45	6.3	6.5	0.2
47	6.0	6.1	0.1
52	5.7	6.1	0.4
N		Mean	-0.07
15		S.D.	0.277
T = -0.9325			
T Table Value 2.145			

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Updated Targets of All Raters			
Pinion #	Original	Updated	Delta
2	6.6	5.9	-0.7
3	6.6	5.9	-0.7
6	6.2	5.8	-0.4
10	5.7	5.6	-0.1
11	6.9	6.1	-0.8
14	6.7	5.9	-0.8
21	6.0	5.6	-0.4
22	7.3	6.4	-0.9
29	7.0	6.5	-0.5
30	7.0	6.1	-0.9
32	7.0	7.4	0.4
36	6.2	6.1	-0.1
38	6.7	6.4	-0.3
40	6.3	6.2	-0.1
46	6.8	6.4	-0.4
50	6.8	6.6	-0.2
51	7.2	7.1	-0.1
52	5.7	6.1	0.4
N		Mean	-0.37
18		STD	0.397
T = -3.9180			
T Table Value = 2.11			

Rater A & B VS Updated Targets of All Raters			
Pinion #	Original	Updated	Delta
2	6.5	5.9	-0.6
3	6.5	5.9	-0.6
6	6.0	5.8	-0.2
10	5.5	5.6	0.1
11	6.0	6.1	0.1
14	6.5	5.9	-0.6
21	6.0	5.6	-0.4
22	6.5	6.4	-0.1
29	6.5	6.5	0.0
30	6.5	6.1	-0.4
32	7.0	7.4	0.4
36	6.0	6.1	0.1
38	6.5	6.4	-0.1
40	6.0	6.2	0.2
46	6.5	6.4	-0.1
50	7.0	6.6	-0.4
51	7.0	7.1	0.1
52	5.5	6.1	0.6
N		Mean	-0.11
18		STD	0.346
T = -1.2961			
T Table Value = 2.11			

Rater A & B VS Updated Targets of Rater A & B			
Pinion #	Original	Updated	Delta
2	6.5	6.0	-0.5
3	6.5	6.0	-0.5
6	6.0	5.8	-0.2
10	5.5	6.0	0.5
11	6.0	6.0	0.0
14	6.5	6.0	-0.5
21	6.0	6.0	0.0
22	6.5	6.0	-0.5
29	6.5	6.3	-0.2
30	6.5	6.0	-0.5
32	7.0	7.0	0.0
36	6.0	6.0	0.0
38	6.5	6.0	-0.5
40	6.0	6.0	0.0
46	6.5	6.3	-0.2
50	7.0	6.8	-0.2
51	7.0	7.0	0.0
52	5.5	6.0	0.5
N		Mean	-0.16
18		STD	0.318
T = -2.0722			
T Table Value = 2.11			

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 Reference LS7 11/15/06

✓ Gear Rating TF Requests

SP Request January, 2006:

- Looking to the Gear Oil Rating TF for rating improvements requested by SP:
 - For rating pinions and rings – The difference between the vast population of raters is that a rating for any distress should not be more than 1
 - The reproducibility of the number across the industry should be no worse than what it is where a lab has more than one rater

The July 2006 ASTM Gear Rating Task Force Meeting in Cleveland was attended by Don Lind, Frank Lopez, Garland Tschirhart, Wes Stocks, Marty Rose, Robert Burrow, Ralph Kozlowski, Mark Sweeney, Paul Yanchar, Brian Foecking, and Pete Radonich.

L-37 Rating Aids - Molds

At the January 2006, The ASTM Gear Workshop, Lubrizol and SwRI were assigned the task of investigating a rating aid to use in the feeling process for wear. Also, in January of 2006, it was decided to re-open the issue of having molds produced as a rating aid for wear and ridging.

Pete Radonich met with the original manufacturer of the molds, Astro Model. The provided the following information:

1. The original castings manufactured in 2000 have been discarded.
2. The mold process has improved over the last six years.
3. Astro Model would remake molds of the original gears that were used for the photo rating aids for wear and ridging.
4. The white boards, with seven individual teeth representing wear and ridging, would then be remolded producing a white mold background with black molded teeth.
5. Each molded board would be serialized.
6. The cost for ridging would be \$2,200 (all tooling included, pieces would be \$78 each).
7. The cost for wear would be \$2,200 (all tooling included, pieces would be \$78 each).

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The original wear and ridging metal gears that were used for the CRC photo rating scale were then reviewed by all in attendance to determine if the gears matched the photos and new definitions that were adopted with the Rater Calibration Monitoring System.

The raters agreed that all gears on the original wear and ridging metal board matched the photos and new definitions.

The original moldboards for wear and ridging that were manufactured in 2000 were then compared to the original metal boards, photos, and new definitions.

The original molds for ridging matched the original metal board, photos, and new definitions. Some raters felt the color black made it a challenge to see the ridges for trace and trace to light, but all were in agreement that with use this would become less of a concern.

All original molds for wear were also a match with the original metal board, photos, and new definitions. There was some concern that the light or 7 mold contained a wear step, which could be felt. Not all raters felt or saw a wear step. A discussion was held concerning the 7 mold. It was determined that if a definition change was needed to address the slight wear step, this could be accomplished after the mold rating aids were produced and evaluated.

After further review, it was decided to vote on molds for use as a rating aid. The vote for the ridging mold had Afton, Lubrizol, Intertek, and SwRI all in agreement. The vote for the wear mold was the same.

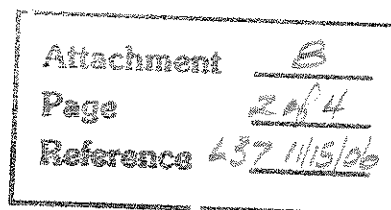
L-37 Photos

A discussion and review of the original gear metal boards for wear, ridging, and ripple took place to determine if any photos from the CRC Rating Photo Aids did or did not match or correctly represent the respective distresses.

It was determined that the 5 ripple photo could be improved to better represent the original gear and improve what the raters were actually rating as medium ripple. Afton volunteered to provide a new digital photo and present it for review to the Rating Task Force in January 2007.

L-37 Definitions

These were tabled until mold rating aids are approved or disapproved by Surveillance Panels.



Rating of L-37 RCMS Pinions With Spans Covering the Wear Step for Wear

Only

Garland, Marty, Ralph, Paul, and Pete were instructed to rate four RCMS pinions for wear due to the fact that a spall was present in the original area rated for wear. The ratings were then reviewed. Although the ratings were not different than the original ratings, it still makes it easier to determine and rate wear if a spall is not present in the area where wear is being rated. The TMC will review the data with the L-3 SP and the RTF.

Rate L-37 Pinions provided by Don Lind for Introduction into the RCMS System

Garland, Marty, Ralph, Paul, and Pete rated three gears for introduction into RCMS. The ratings were reviewed, and all looked acceptable.

L-37 Rings

Garland, Marty, Ralph, Paul, and Pete were instructed to rate four RCMS pinions for wear due to All of the ratings which had a difference of 2 numbers or greater were re-examined and discussed in detail.

L-37 Pinions

All ratings with a difference of 2 numbers or greater were reexamined and discussed in detail.

Some raters were using pins to feel wear. TMC commented that the raters had agreed that the word "tactile" in the definition for wear does not disqualify the use of pins. Therefore, some gear sets, for example #5, could rate from a 6 to an 8 on wear.

Pinion Set #7 produced a spitting rating from a 9.4 to a 10. The raters could not reach consensus on this rating due to connectivity of pits in the heel area. Some raters believed the pits were connected while others saw the pits as being separate. The rater with a 10 rating was new and needed instruction on how to rate pitting.

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Pinion Set #12 produced a wear rating from a 7 to a 9. The raters could not agree if tool marks were present or not present. This may be a case where a rating aid could be useful.

Closing Minutes Meeting

Afton proposed a photo rating aid to be developed for rating ring gears similar to the aids available for pinions.

The Rating Task Force's response was to support Afton if it would like to develop the rating aid. Furthermore, the Rating Task Force would be open to review of the photos. The consensus from the raters and TMC was that ring gear data is improving by using the pinion photos.

The next workshop is scheduled for January 2007 and is to be hosted by SwRI.

✓ New Business:

- ✓ Section 8.2.3 currently states: Remove the cover plate. Record backlash at four equally space locations. The average of the four readings shall be from 0.004 to 0.009 in. (0.102 to 0.229 mm).
- Modify through information letter Section 8.2.3 wording to the D6121 standard to state the following.
- 8.2.3: Record the as received backlash from the Manufacture (written on the back of the axle housing at time of assembly). The reading shall be between 0.004 to 0.009 in. (0.102 to 0.229 mm).
- 8.2.3.1: Remove the cover plate. Record backlash at four equally spaced locations and report the average and the four observed readings.

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ASTM Gear Calibration Workshop
Cleveland, OH July 25, 26, & 27, 2006

L-37 PINION GEARS (Wear/Spalling Issue)

SET #	DISTRESS	RATER										Pinion Mean
		A	B	C	D	E	MAX	MIN	AVG	Std Dev		
15	Wear	5.0	5.0	5.0	6.0	6.0	6.0	5.0	5.40	0.548		5.40
17	Wear	6.0	6.0	6.0	6.0	7.0	7.0	6.0	6.20	0.447		6.00
21	Wear	6.0	5.0	6.0	6.0	6.0	6.0	5.0	5.80	0.447		6.00
33	Wear	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.00	0.000		6.30

Attachment 9
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Reference 37-115106