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

Phone *610.832.9500*
Fax *610.832.9666*
Web *www.astm.org*

Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

May 30th, 2011

Reply to:
Galen Greene
The Lubrizol Corporation
29400 Lakeland Blvd.
Wickliffe, OH 44092
(440) 347-2394
(440) 347-2878 (FAX)
ggre@lubrizol.com

ASTM D02.B0.03 L-37 Surveillance Panel
Members and Guests:

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

- **May 11th, 2011 L-37 Surveillance Panel Meeting**

Please direct any corrections or comments to my attention.

Sincerely,

Digitally signed by Galen Greene
Date: 2011.05.30 07:44:50 -04'00'

Galen Greene, Chairman
L-37 Surveillance Panel

Report of Meeting
L-37 Surveillance Panel Meeting
BRTRC Facility – Warren, MI

May 11th, 2011

Attendees:

SwRI -	**Koehler**
Lubrizol -	**Greene**, Gropp, Venhoff
Afton -	**Koglin**, Bell, Higuchi, Kearney
Intertek -	**Smith**
TMC -	**Parke**
US Army -	**Comfort**, Dwornick
Meritor -	**McGlone,** Muransky
AAM -	**Dharte**
Chevron -	**Zakarian**
Dana -	**Guzikowski (TC)**
Eaton -	**Marougy**
General Motors -	Zreik

Voting Members in **BOLD**
TC = Teleconference

The meeting was called to order at 3:00 pm EDT.

1.0 Approval of Minutes:

- **February 9th, 2011 Surveillance Panel Meeting (Warrendale, PA)**

Motion # 1 → Mr. Zakarian / 2nd Mr. McGlone to approve the minutes as presented. Motion for approval was passed with a vote of 10-Yes, 0-No, and 0-Abstentions.

2.0 Summary of Meeting Discussions

2.1 Hardware Update

The group has conducted initial testing on the 12 pilot gear sets that were recently retrofitted. While some results looked promising, there were results on TMC152-1 that caused concern under the standard test conditions. One lab showed spalling and a second lab showed spalling and broken teeth. The group previously decided that they would like to see more results on TMC152-1 under standard test conditions and also chose to explore another contingency plan. This previously discussed contingency plan includes only Lubriting the ring gear. The current test plan as decided is shown below:

- Upcoming Testing:
  - Both ring on pinion Lubrited
    - SwRI – run 1 test on 152 at STD test conditions
    - Afton – run 1 test on 152 at STD test conditions
    - Intertek – run 1 test on 152 at STD test conditions (note: added at this meeting)
  - Ring only Lubrited:
    - Lubrizol – 1 test on 152 STD
    - Afton – 1 test on 134 STD
    - If results dictate, we will target 4 runs on 152 STD and 2 runs on 134 STD with 2 extra axles
      - One lab to run two 152 STDs, the other two labs to run 1 of each 152 and 134

The group has also decided to continue the manufacturing process on the full batch of hardware (~2000 gear sets). The reason for this was because the labs already have a significant investment in this hardware and it was decided that there is no other manufacturing processes that we can manipulate. The group has picked the ideal manufacturing parameters and will be deciding on how to proceed with Lubriting (the last step in gear set manufacture) over the coming weeks based on results from the pilot testing. The two options for Lubriting are ring and pinion both Lubrited or ring only Lubrited. There will also be a non-lubrited d batch that comes out of this hardware and the group is currently working with manufacturer to procure all the other components for this hardware (housing, bearings, etc.). Depending on the results of testing, it is expected that the full batch of hardware will be available towards the end of this year.

2.2 Next Generation L-37 Test

At the November 2010 meeting, the surveillance panel agreed to begin work on a next generation L-37 test and also agreed to several basic requirements of the new test. The most notable of these was that the new test will be electric motor powered. The chairman asked if any labs have been working on any proposals and if any labs had electric motored stands available.

Essentially, all four participating labs have, or soon will have, electric powered stands available. Two labs each made presentations on some initial test work looking at options for a new test. Afton had conducted work using the existing fired engine test stand. This work was with the current axle housing, but with custom ground ring and pinion gears. The lab had acquired several sets of ground gears from Gleason and built them into existing axle housings. The lab stated that they have taken an initial look using some good and poor oils and seen some success at discrimination. They had run about 12 tests on the current L-37 test conditions and had 20 more gear sets on order. The lab stated their next step was to explore the testing on an electric powered stand. The presentation is in attachment 2.

Lubrizol had conducted work on an electric powered stand using a production American Axle Zeta 218mm RDM (Rear Drive Module, from a vehicle with an independent rear suspension). The hardware was batch built so all testing was conducted on the same batch. The lab created a matrix to look at different operational parameters including test loading, test speed, conditioning, and test length. The matrix led the lab to a probable set of conditions. The lab shared results on good and poor oils and showed good separation between the two. The data shown was the output of about 40 tests of development. All of the testing conducted was on an electric powered stand. This labs presentation is in attachment 3.

ACTION ITEM: The chairman is to form a task force group to work on the development of a new test. An email will be sent to the panel to ask for members for the task force.

Motion # 2 → Mr. Zakarian / 2nd Mr. Smith – Motion to allow the task force and participating labs to use reference oils for the next generation test development. The TMC is to monitor reference oil usage. The motion passed with a vote of Yes-10, No-0, Abstensions-0.

2.3 Broken Teeth Definition

At the last meeting, a broken tooth definition was proposed and the TMC was to review this definition with the rating group to get comments. Mr. Parke commented that the rating group had some discussions and recommended a slight modification to the definition. The modified definition is as follows:

Broken Tooth - Distinct from and more extensive than "chipping" (which is defined elsewhere), a broken gear tooth is a gear tooth where some portion of the face of the tooth is missing and the missing portion includes some part of the top land, toe, heel, or coast side of the tooth.

Additional information on this definition is located in attachment 4.

Motion # 3 → Mr. Zakarian / 2nd Mr. McGlone – Motion to accept the update definition as stated above and implement this definition into the procedure. The motion passed with a vote of Yes-8, No-0, Abstensions-1.

2.4 LTMS Ring Targets

The TMC informed the panel that we had specifically addressed the pinion targets when the method for calculating reference acceptance bands was changed in 2010. However, the ring targets were not addressed. The TMC asked the group whether or not these targets needed to be calculated since they were not used for reference acceptance. One point of discrepancy was on the RGL form used at LRI. The TMC explained that some labs reported ring targets and others didn't. It was decided to move the discussion to the LRI L-37 reviewers, the chairman, and the TMC to find a solution to this problem. If the targets are not needed on the RGL form, it was decided that the TMC would not need to calculate this data. The pinion targets are in attachment 5.

2.5 Calculation of Targets when Standard Deviation is Zero

When the new method for calculating reference acceptance bands was adopted, the situation where the standard deviation equals zero was not addressed. When this occurs, the acceptance band is effectively just one number which is undesirable when the n size is low. Therefore the following motion was proposed:

Motion # 4 → Mr. Zakarian / 2nd Mr. Smith – Motion to use the minimum standard deviation across all previous approved hardware batches for a particular parameter when the standard deviation is equal to zero. The motion passed with a vote of Yes-9, No-0, Abstensions-0.

2.6 Electronic Report Submittal to the TMC

The TMC reported that it is shifting to a paperless system and it would like to forgo the requirement to submit a paper report for L-37 tests. The following motion was proposed:

Motion # 5 → Mr. Smith / 2nd Mr. Greene – Motion to accept the proposed changes to 13.3 and 13.5 as outlined in attachment 6. From this point forward, no paper report will need to be mailed to the TMC; it will only need to be submitted electronically. The motion passed with a vote of Yes-9, No-0, Abstensions-0.

3.0 Adjournment

Motion to Adjourn by Mr. Smith, 2nd Mr. Dharte. Meeting Adjourned at 5:15 pm EDT

Respectfully submitted,

Digitally signed by Galen Greene
Date: 2011.05.30 07:45:14 -04'00'

Galen Greene
L-37 Surveillance Panel Chairman

1

ASTM L-37 Surveillance Panel Membership/Mailing List

Meeting Date: May 11th, 2011

Initials*	Name	Voting Status	Company Name & Address	Phone/Email Info
DB	Bell, Don	Non Voting	Afton Chemical 500 Spring Street Richmond, VA 23219	Phone: 804-788-6332 Fax: 804-788-6243 E-Mail: don.bell@aftonchemical.com
	Bryson, Tom	Voting	Mack Trucks 13302 Pennsylvania Avenue Hagerstown, Maryland 21740	Phone: 301-790-6744 Fax: 301-790-5605 E-Mail: thomas.bryson@volvo.com
	Clark, Jeff	Non Voting	ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, Pennsylvania 15206	Phone: 412-365-1032 Fax: 412-365-1047 E-Mail: jac@astmtmc.cmu.edu
A.C.	Comfort, Allen	Voting	US Army RDECOM/TARDEC 6501 East 11 Mile road Warren, MI 48397-5000	Phone: 586-282-4225 Fax: 586-282-4244 E-Mail: allen.s.comfort@us.army.mil
	Dharte, John	Voting	American Axle & Manufacturing 1 Dauch Drive Detroit, MI 48211	Phone: 313-758-4687 Fax: 313-758-4237 E-Mail: Dhartej@aam.com
BD	Dwornick, Bridget	Non-Voting	US Army RDECOM/TARDEC 6501 East 11 Mile road Warren, MI 48397-5000	Phone: 586-282-4221 Fax: 586-282-4244 E-Mail: bridget.dwornick@us.army.mil
	Eliot, Stephen	Non Voting	ExxonMobil Lubricants & Specialties 18486 Lanier Island Sq. Leesburg, Virgina 20176	Phone: 703-669-9916 Fax: 703-669-9917 E-Mail: stephen.w.eliot@exxonmobil.com
	Farber, Frank	Non Voting	ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, Pennsylvania 15206	Phone: 412-365-1030 Fax: 412-365-1047 E-Mail: fmf@astmtmc.cmu.edu
	Foeking, Brian	Non Voting	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-347-2130 Fax: 440-347-9011 E-Mail: brian.foeking@lubrizol.com
	Gao, Hong	Non-Voting	Conoco Phillips 100 s Pine St. Ponca City, OK 74602	Phone: 580-767-2126 Fax: 580-767-4534 E-Mail: hong.gao@conocophillips.com
	Graziano, Rick	Non-Voting	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-347-2058 Fax: 440-347-2878 E-Mail: rick.graziano@lubrizol.com

Attachment 1

* Initial to indicate attendance at subject meeting

ASTM L-37 Surveillance Panel Membership/Mailing List

Meeting Date: May 11th, 2011

Initials*	Name	Voting Status	Company Name & Address	Phone/Email Info
	Greene, Galen	Voting/Chair	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-347-2394 Fax: 440-347-2878 E-Mail: galen.greene@lubrizol.com
JLG	Gropp, Jerry	Non Voting	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-347-1223 Fax: 440-347-1555 E-Mail: jerrold.gropp@lubrizol.com
T/C	Guzikowski, Joe	Voting	Dana Corporation Maumee, IN	Phone: Fax: E-Mail: joe.guzikowski@dana.com
SJH	Higuchi, Sam	Non Voting	Afton Chemical 500 Spring Street Richmond, VA 23218	Phone: 804-788-5375 Fax: 804-788-6358 E-Mail: samuel.higuchi@aftonchemical.com
	Huron, John	Non Voting	Chevron Oronite Company LLC Suite 210 San Antonio, Texas 78228-1374	Phone: 210-731-5609 Fax: 210 731 5699 E-Mail: huro@chevrontexaco.com
	Jackson, Matt	Non Voting	Southwest Research Institute PO Drawer 28510 San Antonio, Texas 78228-0510	Phone: 210-522-6981 Fax: 210-522-6858 E-Mail: matt.jackson@swri.org
	Kanga, Percy	Non Voting	ExxonMobil Research & Engineering 600 Billingsport Road Paulsboro, New Jersey 08066	Phone: 856-224-2094 Fax: 856-224-3613 E-Mail: percy.r.kanga@exxonmobil.com
WAK	Kearney, Bill	Non Voting	Afton Chemical Southfield, MI	Phone: Fax: E-Mail:
C.L	Koehler, Brian	Voting	Southwest Research Institute PO Drawer 28510 San Antonio, Texas 78228-0510	Phone: 210-522-3588 Fax: 210-684-7523 E-Mail: bkoehler@swri.org
	Koglin, Cory	Voting	Afton Chemical 500 Spring Street Richmond, VA 23219	Phone: 804-788-5305 Fax: 804-788-6358 E-Mail: CoryKoglin@aftonchemical.com
	Lind, Don	Non Voing	ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, Pennsylvania 15206	Phone: 412-365-1034 Fax: 412-365-1047 E-Mail: dml@astmtmc.cmu.edu

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Meeting Date: May 11th, 2011

Initials*	Name	Voting Status	Company Name & Address	Phone/Email Info
	Lochte, Michael	Non Voting	Southwest Research Institute PO Drawer 28510 San Antonio, Texas 78228-0510	Phone: 210-522-5430 Fax: 210-684-7523 E-Mail: Mlochte@swri.org
	Marougy, Thelma	Voting	Eaton Corporation 26201 Northwestern Highway Southfield, MI 48034	Phone: 248-226-6985 Fax: 248-226-2739 E-Mail: thelmaemarougy@eaton.com
	Martin, Dan	Non Voting	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-347-4723 Fax: 440-347-2878 E-Mail: dan.martin@lubrizol.com
	McGlone, Bruce	Voting	Meritor Automotive 2135 West Maple Troy, Michigan 48084	Phone: 248-435-9929 Fax: 248-435-1411 E-Mail: Bruce.McGlone@Meritor.com
	Pappademos, Lou	Non Voting	Dana Corporation Fort Wayne, IN	Phone: Fax: E-Mail: lou.pappademos@dana.com
	Parke, Scott	Voting	ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, Pennsylvania 15206	Phone: 412-365-1036 Fax: E-Mail: sdp@astmtmc.cmu.edu
	Radonich, Peter	Non Voting	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-347-2184 Fax: 440-347-9011 E-Mail: peter.radonich@lubrizol.com
	Sanchez, Art	Non Voting	Southwest Research Institute PO Drawer 28510 San Antonio, Texas 78228-0510	Phone: 210-522-3445 Fax: 210-680-1777 E-Mail: asanchez@swri.org
	Smith, Dale	Voting	Intertek San Antonio, Texas	Phone: ~~412-423-1120 , ext 403~~ 412-855-6854 Fax: ~~412-826-5443~~ E-Mail: Dale.Smith@intertek.com
	Song, HaiQing	Non Voting	Research Institue of Petroleum Processing No. 18, XueYan Road, PO Box 914-19 Beijing 10083 P.R. China	Phone: 011-86-10-8236-8182 Fax: 011-86-10-6231-1290 E-Mail: songhq@ripp-sinopec.com
	Sullivan, Bill	Non Voting	William T. Sullivan, Inc. 5 Scheiber Drive Brick, NJ 08723	Phone: 908-930-3512 Fax: 267-220-7750 E-Mail: wtsullivan@comcast.net

Attachment 1

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Initials*	Name	Voting Status	Company Name & Address	Phone/Email Info
WV	Venhoff, Wes	Non Voting	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-347-4879 Fax: 440-347-2878 E-Mail: wve@lubrizol.com
	Xie, JingChun	Non Voting	Lanzhou Lube Oil R&D Institute No. 369 Yumen Streat, XiGu District Lanshou 730060, GanSu Province P.R. China	Phone: 011-86-931-793-3713 Fax: 011-86-139-9319-2560 E-Mail: xiejingchun_rhy@petrochina.com.cn
JAZ	Zakarian, Jack	Voting	Chevron Products 100 Chevron Way Richmond, CA 94802	Phone: 510-242-3595 Fax: 510-242-3758 E-Mail: jaza@chevron.com
K.Z	Zreik, Khaled	Non Voting	General Motors 823 Joslyn Ave Pontiac, MI 48340-2925	Phone: 248-977-9214 Fax: 248-857-2550 E-Mail: khaled.zreik@gm.com
TM.	Murnsky, Troy	NV	Member 2135 W. Maple Rd. Troy, MI 48084	Phone: 248 435 1409 Fax: 248 435 6602 E-Mail: troy.murnsky@Mentor.com
				Phone: Fax: E-Mail:
				Phone: Fax: E-Mail:
				Phone: Fax: E-Mail:

Attachment 1

* Initial to indicate attendance at subject meeting

Attachment 2

L37-1 Next Generation development

5-11-2011

Passion for Solutions™

Attachment 2

Development ring and pinion selected

- **Parts made by Gleason Works**
- **Same ratio as current axle 5.86**
- **Similar contact stress**
- **Steel is 8620**
- **Ground gear set**
  - Consistency part-to-part
- **Can be installed into current Model 60 housing**
- **Run on referenced test stand**
- **Run under current specification**
  - Break-in load, speed, and temperature
  - Testing load, speed and temperature
  - Using fired engine

Attachment 2

Test parts

Ring and Pinion made by The Gleason Works

- Main business is making manufacturing machines, software, and measuring systems for hypoid industry
- Specialty gear services group manufactures hardware for niche markets including Nascar and also larger runs for OEMs
- Production capability of >1000pcs
- No issues with loss of production model or platform
  - Parts are available for the long haul
- ASTM requests is a normal operation to Gleason

Attachment 2

Current results

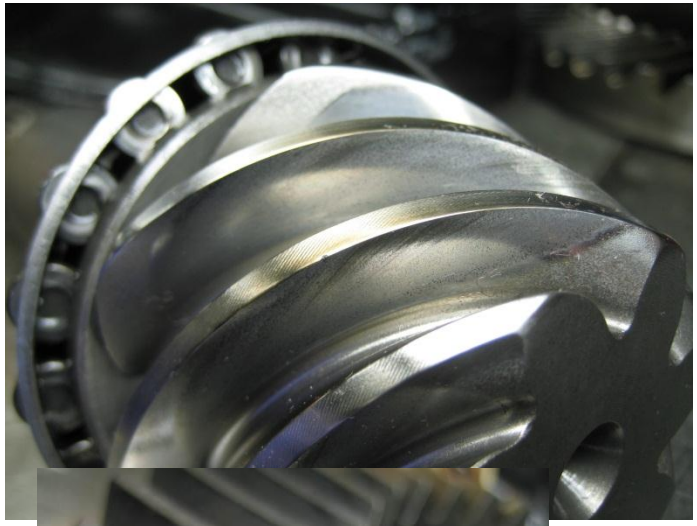
Limited data on 12 test pieces

- both lubrited and non-lubrited results

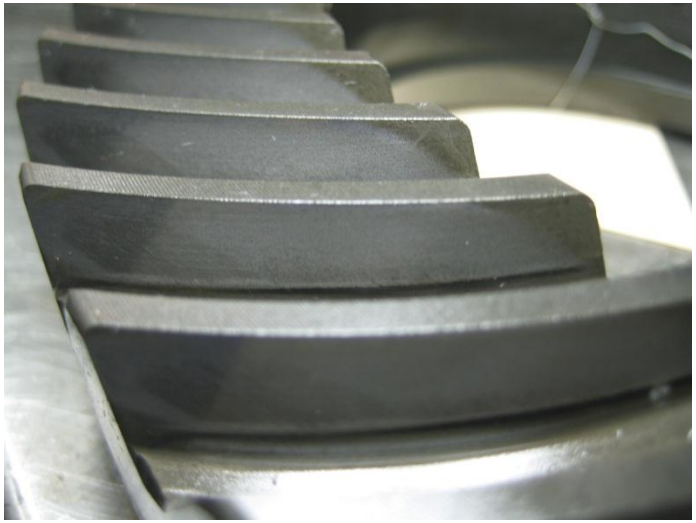
Oil	Lubrited/ non-lubrited	Pass/Fail	Pinion Wear	Pinion Rippling	Pinion Ridging	Pinion Spitting	Gear Wear	Gear Rippling	Gear Ridging	Gear Spitting
J2360	Non-lub	Pass	7	10	8	9.9	7	10	8	10
J2360	Non-lub	Pass	7	10	8	9.9	7	10	9	10
J2360	lubrited	Pass	7	10	8	9.9	7	10	9	10
J2360	lubrited	Pass	7	9	8	9.9	7	10	9	10
TMC134	Non-lub	Fail	7	6	4	9.8	7	7	4	10
TMC134	Non-lub	Fail	5	6	5	9.5	6	9	6	9.9

Attachment 2

Non-lubrited



Lubrited

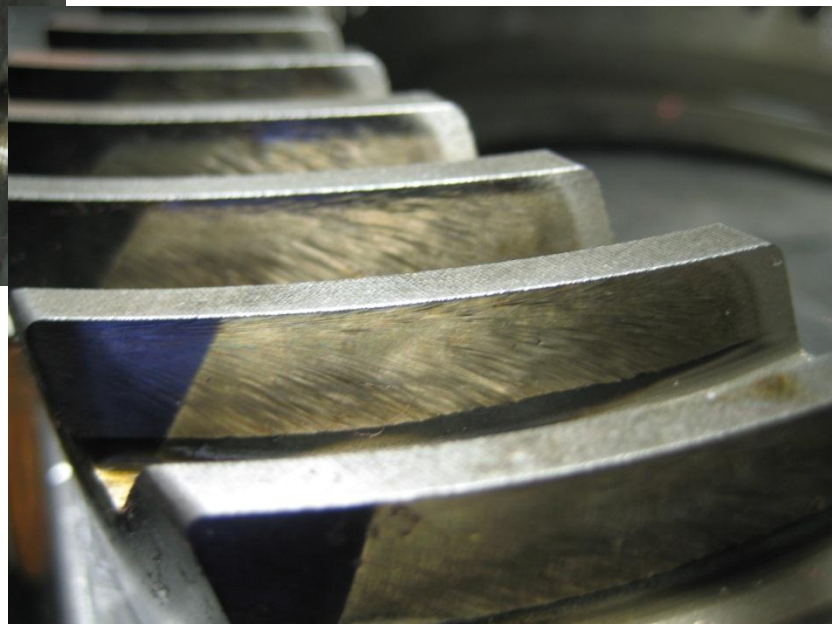


Afton CHEMICAL

Passion for Solutions™

Attachment 2

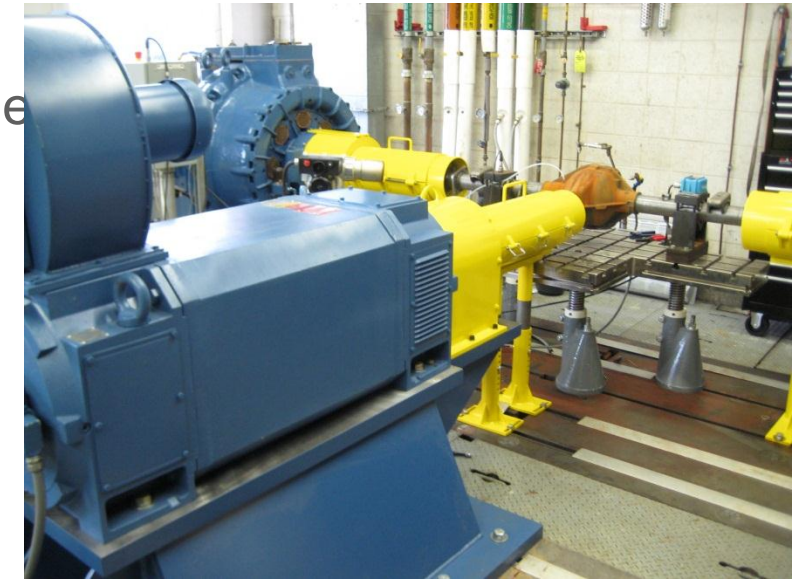
Fail oil



Attachment 2

Next steps

- **Good correlation with current hardware, but more testing needed**
- **Additional 20 pcs ordered and will be tested**
- **Run on both fired engine and electric motor stand**
- **Ask ASTM panel to use passing ref. oils**
- **Future L37-1 concept**
  - Parts can be adapted into re-usable ‘test housings’ spec’d by each lab
    - Install just rings/pinions
    - No large storage of axles housings
    - Less scrap
- **Questions?**



Afton CHEMICAL

Passion for Solutions™

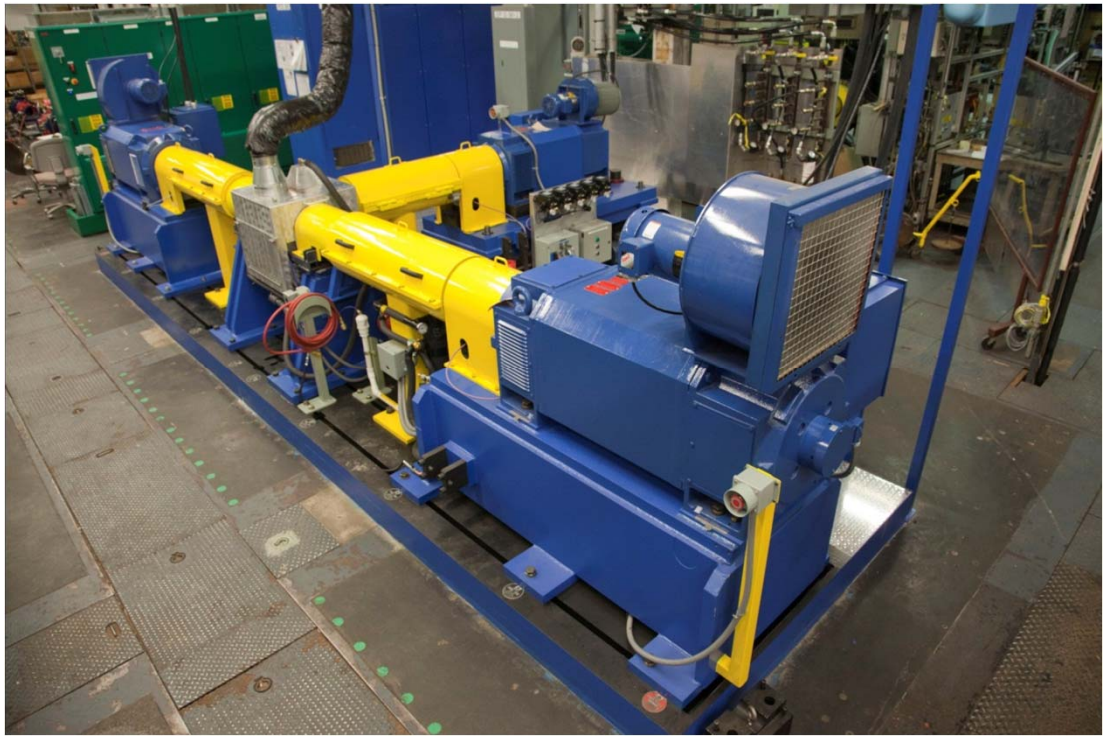
Attachment 3

Next Generation L-37 Test Investigation

5/11/2011

Overview

- Lubrizol has conducted some initial test work on an electric motored test stand
- T-type axle test stand



Lubrizol

Test axle

- American Axle Zeta platform (218mm, 3.45 ratio RDM)
  - A pilot batch of hardware was acquired, all testing was run on same batch
- The goal was to relate the Zeta 218mm axle to the current L-37 test
  - This was done by matching PV values for each application
  - This takes sliding speed and contact pressure into account

Lubrizol

Test development

- A test development matrix was defined
- The matrix included the following phases:
  - Determine ideal test time (explored 12 to 30 hours)
  - Determine ideal test phase loading (explored 1200 to 1650 ft. lbs. wheel load)
  - Determine the effects of conditioning
  - Determine ideal wheel speed (explored 80 to 160 rpm)
- We considered both Lubrited and non-Lubrited hardware
- Oil temperature was kept the same as the current L-37
  - Test: 275 °F Conditioning: 297 °F
- At this point, we have narrowed the test conditions to a likely option

Lubrizol

Results from Lubrited hardware

Oil Description	Pass/Fail	PINION GEAR WEAR MERIT	PINION GEAR RIPPLING MERIT	PINION GEAR RIDGING MERIT	PINION GEAR SURFACE FATIGUE PITT/SPALL MERIT	RING GEAR WEAR MERIT	RING GEAR RIPPLING MERIT	RING GEAR RIDGING MERIT	RING GEAR SURFACE FATIGUE PITT/SPALL MERIT
Pass Oil	PASS	7	10	9	9.5	8	10	10	9.9
Pass Oil	PASS	7	10	9	9.9	8	10	10	9.9
Fail Oil	FAIL	6	9	4	9.9	7	9	5	9.9
Fail Oil	FAIL	7	7	5	9.9	7	7	6	9.9

Pass Oil - Lubrited

Pinion

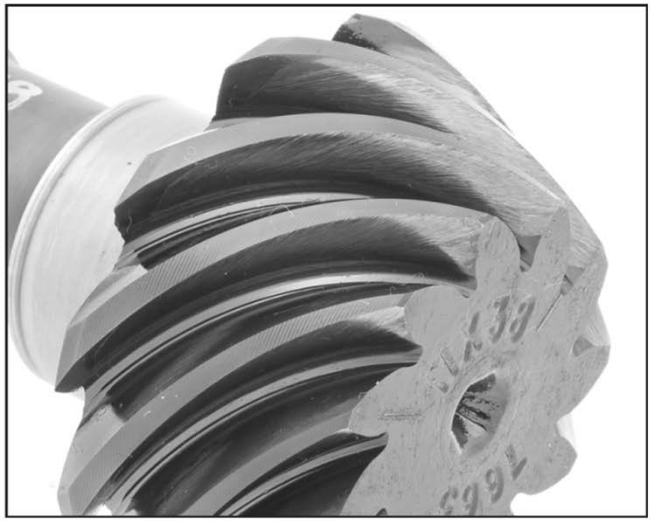
Ring

Pinion

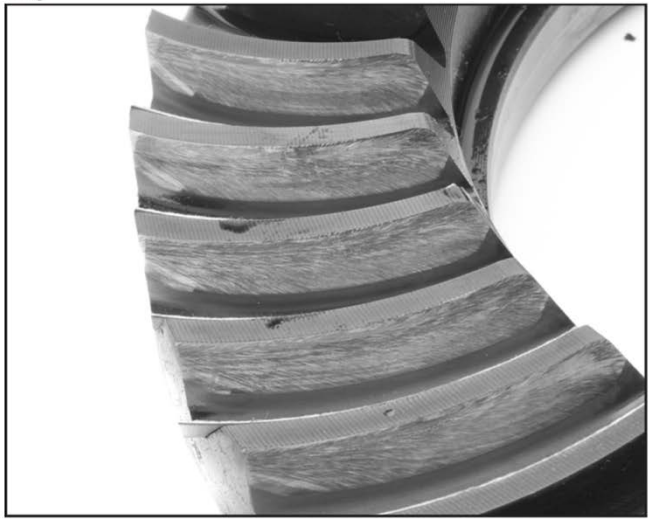
Ring

Fail Oil - Lubrited

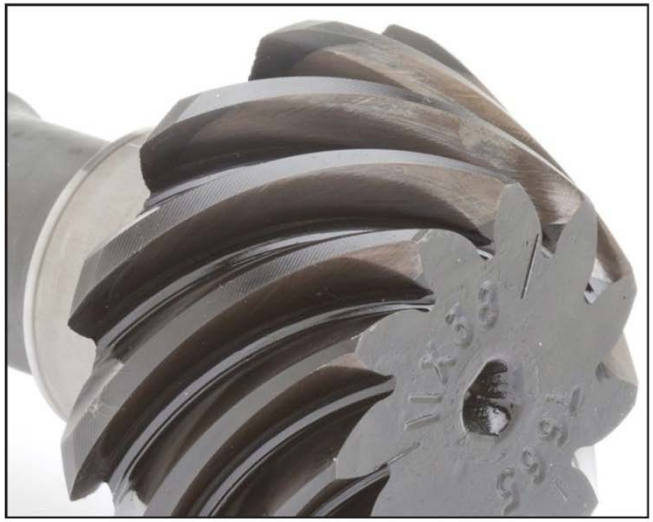
Pinion



Ring



Pinion



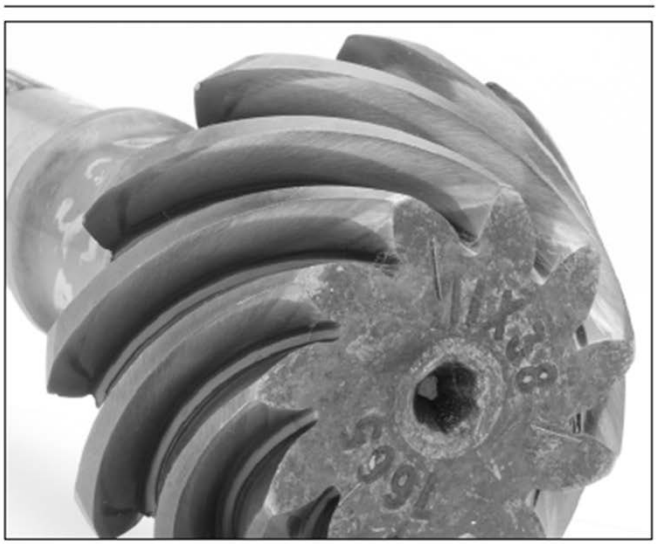
Ring

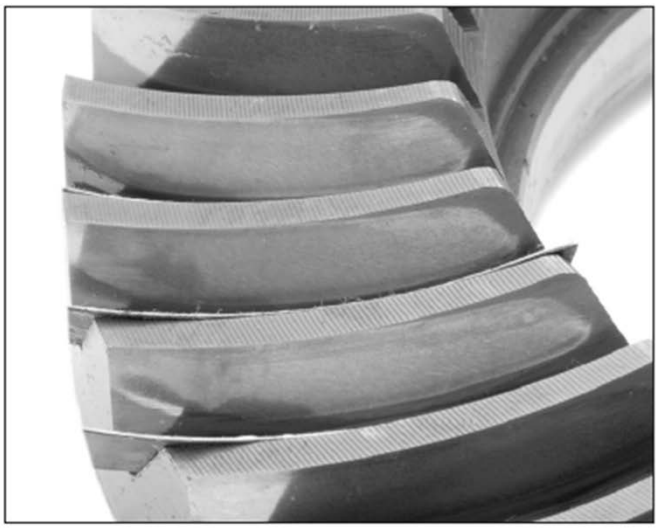
Lubrizol

Results from non-Lubrited hardware

Oil Description	Pass/Fail	PINION GEAR WEAR MERIT	PINION GEAR RIPPLING MERIT	PINION GEAR RIDGING MERIT	PINION GEAR SURFACE FATIGUE PITT/SPALL MERIT	RING GEAR WEAR MERIT	RING GEAR RIPPLING MERIT	RING GEAR RIDGING MERIT	RING GEAR SURFACE FATIGUE PITT/SPALL MERIT
Pass Oil	PASS	7	10	9	9.9	7	10	10	9.9
Pass Oil	PASS	7	10	9	9.9	8	10	10	9.9
Fail Oil	FAIL	7	6	4	9.9	7	7	7	9.9
Fail Oil	FAIL	7	9	5	9.9	7	10	5	9.9

Pass Oil – non-Lubrited





Pinion

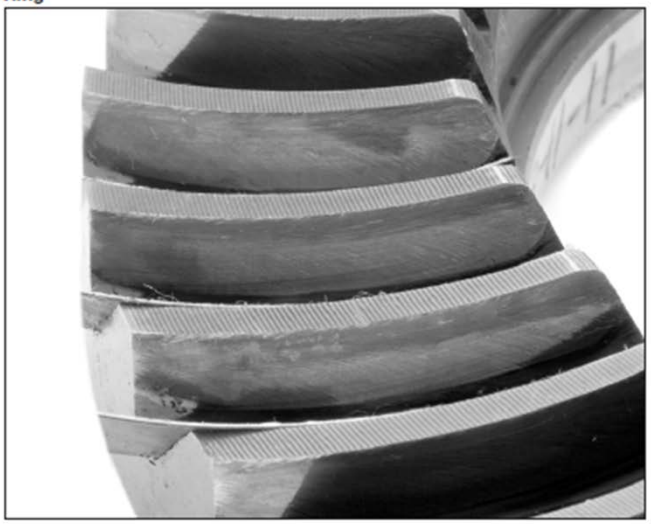
Ring

Lubrizol

Fail Oil – non-Lubrited

Pinion

Ring



Pinion

Ring

Lubrizol

Summary

- We built a matrix to investigate some possible test conditions
- Identified a set of conditions that looked promising
- The early stages of this investigation are showing encouraging results
  - Good correlation with results on current L-37 test

Attachment 4

“Broken Tooth” History

Problem brought to July 2010 rating workshop indicated need for definition for “broken tooth”

Starting point definition:

> Mechanical failure that results in the creation of two (or more) distinct pieces that can be fitted back together into the original configuration. One (or more) of the pieces may be destroyed by other processes after the initial breakage. Breakage is characterized by sharp, distinct edges.

After input from LZ raters:

> Mechanical failure that results in the creation of two (or more) distinct pieces that can be fitted back together into the original configuration. One (or more) of the pieces may be destroyed by other processes after the initial breakage. Visually, breakage is characterized by sharp, distinct edges. When used in describing gear tooth failure, breakage generally implies that a substantial portion of the tooth is missing or damaged.

Rater-derived definition from January 2011 workshop:

> Distinct from chipping (defined elsewhere), **tooth breakage** is characterized by distinct sharp edges or pieces broken from or displaced from any single gear tooth in any one location larger than 1 mm^2 on the drive side, coast side, or top land.
>
> A **broken tooth** is characterized by removal of or displacement of the gear tooth due to stress sufficient to push the gear beyond its yield point causing failure of material in excess of one third of the rated contact area.
>
> **Breakage:** > $1mm^2$ and < 1/3 of the entire tooth.
>
> **Broken tooth:** > 1/3 of the rated contact area.

Surveillance Panel-derived definition:

> **Broken Tooth** - Removal of metal including and beyond the drive side onto the top land, toe, heel, or coast side of a tooth. This is a condition more extensive than chipping.

Rater feedback:

"I do not believe the definition is accurate for describing a broken tooth. The definition proposed by the surveillance panel sounds a lot like the definition for wear. I do not believe this definition would help me to determine if I have a broken tooth on a ring or pinion gear. I would still be confused using this definition." (Pete Radonich)

> **Wear** – The removal of metal, without evidence of surface fatigue or scoring, resulting in partial or complete elimination of tool or grinding marks and or development of a discernible shoulder ridge at the bottom of the contact area near the root or at the toe or heel end of the pinion tooth contact area. (Manual 21)

"I agree with Pete, this sounds like the definition for wear & spalling. I can't work with this definition. I think that we should not rush into taking just any definition, lets get our thoughts together for the next workshop [or once] we get a definition that we all agree with, then we can try it out by looking at the broken tooth photos again. Then we can make the decision to accept [or] not." (Tony Barrera)

> **Spalling** – The breaking-out of flakes or irregular area of the tooth surface, 1 square millimeter or larger; a condition more extensive than pitting. (Manual 21)

"I have to agree with Pete and Tony." (Chris Lonsway)

"I think the this definition could work by making a few changes to the wording. What I understand from the Surveillance panel definition is to try to keep it simple to avoid confusion.

> Removal of a small to large tooth section including and beyond the drive side onto the top land, toe, heel, or coast side of a tooth. This is a condition more extensive than chipping.

Let's try to make changes to the definition we can work with." (Art Sanchez)

"I've thought about this and came up with this. I'm fine with what the panel came up with. This is getting out of hand." (Marty Rose)

> 3.1.4 ***chipping***, *n—on ring and pinion gears*, a condition caused in the manufacturing process in which a small irregular cavity is present only at the face/crown edge interface. The edge-chipping phenomenon occurs when sufficient fatigue cycles accumulate after tooth surface wear relieves the compressive residual stress on the tooth profile side of the profile-to-topland interface. Chipping within 1 mm of the face/crown edge interface is to be called chipping, not pitting/ spalling. (3.1.4 of D6121 ***not in Manual 21, BTW***)

Attachment 4

Edit of surveillance panel definition after talking with raters about their comments:

> Distinct from and more extensive than “chipping” (which is defined elsewhere), a broken gear tooth is a gear tooth where some portion of the face of the tooth is missing and the missing portion includes some part of the top land, toe, heel, or coast side of the tooth.

Original surveillance panel definition (for comparison):

> Broken Tooth - Removal of metal including and beyond the drive side onto the top land, toe, heel, or coast side of a tooth. This is a condition more extensive than chipping.

Attachment 5

Untransformed L37 Targets

				Ridging			Rippling			Spitting			Wear		
			n	x	s	Bands	x	s	Bands	x	s	Bands	x	s	Bands
LUBRITED	C1L308	128	15	6.53	1.407	4 - 9	7.63	1.420	5 - 10	8.83	1.754	6 - 10	5.60	1.298	3 - 8
		128-1	7	7.00	0.000	7 - 7	8.00	0.577	7 - 9	8.84	1.723	6 - 10	5.57	0.535	5 - 7
		129	5	9.00	0.000	9 - 9	8.40	0.894	7 - 10	9.56	0.089	9.4 - 9.7	6.80	1.483	4 - 9
	C1L426	128	7	7.57	0.976	6 - 9	8.29	1.380	6 - 10	6.83	2.357	3 - 10	5.71	0.488	5 - 7
		128-1	7	7.71	1.113	6 - 10	7.86	0.690	7 - 9	7.57	3.187	2 - 10	6.00	0.577	5 - 7
		129	2	9.00	0.000	9 - 9	9.50	0.707	8 - 10	9.60	0.141	9.3 - 9.9	7.50	0.707	6 - 9
	L247	128-1	10	7.40	0.516	6 - 8	7.60	1.075	6 - 10	9.02	0.892	7 - 10	5.80	0.422	5 - 7
		151-3	10	8.80	0.422	8 - 10	8.60	0.516	8 - 10	9.49	0.586	8 - 10	6.00	0.000	6 - 6
		155	1	9.00	0.000	9 - 9	8.00	0.000	8 - 8	9.30	0.000	9.3 - 9.3	6.00	0.000	6 - 6
	V1L303	128	1	7.00	0.000	7 - 7	7.00	0.000	7 - 7	8.00	0.000	8 - 8	6.00	0.000	6 - 6
		128-1	30	7.30	1.264	5 - 10	6.97	1.497	4 - 10	5.26	3.144	0 - 10	5.67	0.959	4 - 7
		129	9	8.11	0.601	7 - 9	8.56	0.527	8 - 10	9.61	0.366	9 - 10	6.56	0.527	6 - 8
	V1L686	128-1	20	6.35	0.813	5 - 8	7.20	1.473	5 - 10	9.77	0.421	9.0 - 10	6.40	0.598	5 - 7
		151-3	21	6.43	1.207	4 - 9	8.71	0.463	8 - 10	9.68	0.632	9 - 10	6.57	0.598	5 - 8
		152	4	5.25	0.500	4 - 6	8.25	0.500	7 - 9	9.53	0.359	9 - 10	6.25	0.500	5 - 7
		153	2	5.00	0.000	5 - 5	8.00	0.000	8 - 8	9.30	0.424	9 - 10	5.50	0.707	4 - 7
		155	1	7.00	0.000	7 - 7	9.00	0.000	9 - 9	9.90	0.000	9.9 - 9.9	7.00	0.000	7 - 7
NONLUBRITED	C1L308	127	17	6.41	2.033	3 - 10	6.06	1.784	3 - 9	9.54	0.450	9 - 10	6.82	2.038	3 - 10
		128	30	7.93	0.980	6 - 10	5.90	2.426	2 - 10	9.71	0.306	9.2 - 10	6.37	0.718	5 - 8
		128-1	8	8.38	0.744	7 - 10	5.75	1.982	2 - 9	9.43	0.883	8 - 10	6.50	0.535	6 - 7
		128-2	1	8.00	0.000	8 - 8	6.00	0.000	6 - 6	8.00	0.000	8 - 8	6.00	0.000	6 - 6
		129	19	9.26	0.933	8 - 10	9.89	0.315	9 - 10	9.89	0.091	9.7 - 10	8.11	0.875	7 - 10
	C1L426	127	10	7.25	1.752	4 - 10	8.30	1.767	5 - 10	9.40	1.039	8 - 10	6.50	0.972	5 - 8
		128	10	7.90	0.738	7 - 9	8.20	0.789	7 - 10	9.21	0.998	7 - 10	5.80	0.422	5 - 7
		128-1	11	8.36	0.674	7 - 10	8.00	1.095	6 - 10	9.54	0.785	8 - 10	5.73	0.467	5 - 7
		128-2	2	8.00	0.000	8 - 8	7.50	0.707	6 - 9	9.90	0.000	9.9 - 9.9	6.00	0.000	6 - 6
		129	8	9.50	0.535	9 - 10	9.75	0.463	9 - 10	9.96	0.052	9.9 - 10	7.00	1.195	5 - 9
	V1L176	127	2	7.00	2.828	2 - 10	8.00	0.000	8 - 8	6.45	4.879	0 - 10	6.00	1.414	3 - 9
		128-1	12	8.25	0.754	7 - 10	7.17	2.038	4 - 10	9.72	0.208	9.3 - 10	6.08	0.289	6 - 7
		128-2	1	7.00	0.000	7 - 7	9.00	0.000	9 - 9	9.90	0.000	9.9 - 9.9	6.00	0.000	6 - 6
		151-3	14	9.14	0.363	8 - 10	8.86	0.363	8 - 10	9.56	1.314	7 - 10	6.64	0.633	6 - 8
	V1L303	127	3	6.67	1.155	5 - 9	6.67	2.082	3 - 10	9.80	0.173	9.5 - 10	6.00	0.000	6 - 6
		128-1	13	8.08	0.494	7 - 9	6.92	1.656	4 - 10	8.07	2.451	4 - 10	5.85	0.376	5 - 7
		129	4	9.50	0.577	8 - 10	9.00	0.816	8 - 10	9.93	0.050	9.8 - 10	6.75	0.957	5 - 8
	V1L351	151-3	5	9.20	1.304	7 - 10	9.20	0.447	8 - 10	9.92	0.045	9.8 - 10	7.00	1.000	5 - 9
		152	5	9.40	0.548	8 - 10	8.80	0.447	8 - 10	9.88	0.045	9.8 - 10	7.20	0.837	6 - 9
		153	9	7.22	0.972	5 - 9	7.22	0.972	5 - 9	9.62	0.618	9 - 10	6.44	0.726	5 - 8
		155	3	9.33	0.577	8 - 10	8.67	0.577	8 - 10	9.90	0.000	9.9 - 9.9	7.00	1.000	5 - 9
	V1L417	151-3	23	9.39	0.499	8 - 10	9.35	0.487	8 - 10	9.65	1.232	7 - 10	8.04	0.475	7 - 9
		152	6	9.17	0.408	8 - 10	9.17	0.408	8 - 10	9.90	0.000	9.9 - 9.9	8.00	0.632	7 - 9
		152-1	15	9.47	0.640	8 - 10	9.40	0.507	8 - 10	9.44	1.782	6 - 10	8.00	0.378	7 - 9
		153	4	9.00	0.816	8 - 10	8.25	0.500	7 - 9	9.88	0.050	9.8 - 10	7.50	0.577	6 - 9
		153-1	20	8.80	0.616	8 - 10	8.90	0.447	8 - 10	9.89	0.049	9.8 - 10	7.55	0.605	6 - 9
		155	10	9.50	0.527	9 - 10	9.60	0.516	9 - 10	9.90	0.000	9.9 - 9.9	8.00	0.000	8 - 8
	V1L500	152-1	6	9.00	0.894	7 - 10	9.67	0.516	9 - 10	9.90	0.000	9.9 - 9.9	7.50	0.548	7 - 8
		155	8	9.38	0.518	8 - 10	9.50	0.535	9 - 10	9.84	0.141	9.6 - 10	7.38	0.518	6 - 8
	V1L686	127	9	7.00	2.000	3 - 10	7.56	1.236	5 - 10	9.71	0.643	9 - 10	6.67	0.500	6 - 8
		128-1	8	7.50	0.926	6 - 9	5.63	1.188	3 - 8	9.93	0.046	9.8 - 10	6.88	0.641	6 - 8
		129	2	9.50	0.707	8 - 10	10.00	0.000	10 - 10	10.00	0.000	10 - 10	8.00	1.414	5 - 10
		151-2	11	9.09	0.701	8 - 10	8.73	0.647	8 - 10	9.92	0.040	9.8 - 10	7.55	0.688	6 - 9
		151-3	1	9.00	0.000	9 - 9	8.00	0.000	8 - 8	9.90	0.000	9.9 - 9.9	7.00	0.000	7 - 7

Current hardware/oils are shaded

Attachment 5

Untransformed Targets for Current Hardware/Oils

				Ridging					Rippling					Spitting					Wear				
						shewhart					shewhart					shewhart					shewhart			
			n	x	s	min	max	band	x	s	min	max	band	x	s	min	max	band	x	s	min	max	band
NONLUBRITED	V1L417	151-3	30	9.47	0.507	9	10	9-10	9.33	0.606	8	10	8-10	9.71	1.080	7.769	11.657	8-10	8.00	0.587	7	9	7-9
		152-1	15	9.47	0.640	8	11	8-10	9.40	0.507	8	10	8-10	9.44	1.782	6.232	12.648	6-10	8.00	0.378	7	9	7-9
		153-1	20	8.80	0.616	8	10	8-10	8.90	0.447	8	10	8-10	9.89	0.049	9.797	9.973	9.8-10	7.55	0.605	6	9	6-9
		155	10	9.50	0.527	9	10	9-10	9.60	0.516	9	11	9-10	9.90	**0.000**	9.900	9.900	**9.8-10***	8.00	**0.000**	8	8	**7-9***
	V1L500	152-1	13	8.85	0.689	8	10	8-10	9.39	0.506	8	10	8-10	9.89	0.028	9.842	9.942	9.8-9.9	7.46	0.519	7	8	7-8
		155	15	9.07	0.594	8	10	8-10	9.33	0.488	8	10	8-10	9.84	0.124	9.617	10.063	9.6-10	7.47	0.516	7	8	7-8
minimum std for targets generated for all non-current batches:															0.040					0.289			

*bands for these s=0 parameters were computed using the minimum std.
data included: chart = Y or val = AG up to 30 tests

Attachment 6

Current L-37-1 Procedure	Proposed Change
13. Report 13.1 For reference oil tests, the standardized report form set and data dictionary for reporting the test results and for summarizing the operational data are required. The report forms and data dictionary are available on the ASTM Test Monitoring Center web page at http://www.astmtmc.cmu.edu/, or they can be obtained in hardcopy format from the TMC. 13.2 Attach the temperature recording trace for the test as part of the report. 13.3 When reporting reference oil test results to the TMC, transmit by facsimile the complete report form package (see Annex A7) within five days of test completion. Within 30 days of test completion, mail a copy of the final test report to the ASTM Test Monitoring Center.[2] Electronic transfer of test results (see 13.5) is also permitted for approved laboratories. 13.4 *Deviations from Test Operational Limits*—Report all deviations from specified test operational limits on Form 4 (Annex A7) under Other Comments. 13.5 *Electronic Transmission of Test Results*—Electronic transfer of reference and non-reference oil test report data can be done utilizing the Flat File Transmission Format contained in Section 2 of the ASTM Data Communications Committee Test Report Transmission Model, available from the ASTM TMC.	**13. Report** 13.1 For reference oil tests, the standardized report form set and data dictionary for reporting the test results and for summarizing the operational data are required. The report forms and data dictionary are available on the ASTM Test Monitoring Center web page at http://www.astmtmc.cmu.edu/, or they can be obtained in hardcopy format from the TMC. 13.2 Attach the temperature recording trace for the test as part of the report. 13.3 Report reference oil test results to the TMC within five days of test completion. Use the report form package shown in Annex A7. 13.4 *Deviations from Test Operational Limits*—Report all deviations from specified test operational limits on Form 4 (Annex A7) under Other Comments. 13.5 *Electronic Transmission of Test Results*—For electronic transfer of test results, use the ASTM Data Communications Committee Test Report Transmission Model (see Section 2 - Flat File Transmission Format) available from the ASTM TMC.