



**INTERNATIONAL**  
Standards Worldwide

**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](http://www.astm.org)

---

**Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS**

**Chairman:** KENNETH O. HENDERSON, Cannon Instrument Co., 2139 High Tech Road, State College, PA 16803, (814) 353-8000, Fax: (814) 353-8007, e-mail: [kenohenderson@worldnet.att.net](mailto:kenohenderson@worldnet.att.net)  
**First Vice-Chairman:** BEN R. BONAZZA, 3457 WOODVALLEY DRIVE, LAPEER, MI 48446 (810) 664-6769 e-mail: [bbonazza@charter.net](mailto:bbonazza@charter.net)  
**Second Vice-Chairman:** JANET L. LANE, ExxonMobil Research & Engrg., 600 Billingsport Rd, Paulsboro, NJ 08066-0480 (856) 224-3302, Fax: (856) 224-3616, e-mail: [janet.l.lane@exxonmobil.com](mailto:janet.l.lane@exxonmobil.com)  
**First Secretary:** RALPH A. CHERRILLO, Shell Global Solutions (US) Inc., Westhollow Tech Ctr., 3333 Highway 6 South, Houston, TX 77082 (281) 544-8789, Fax: (281) 544-8150, e-mail: [ralph.cherrillo@shell.com](mailto:ralph.cherrillo@shell.com)  
**Second Secretary:** MICHAEL A. COLLIER, Petroleum Analyzer Co. LP, PO Box 206, Wilmington, IL 60481, (815) 458-0216, Fax: (815) 458-0217, e-mail: [Michael.collier@pacip.com](mailto:Michael.collier@pacip.com)  
**Staff Manager:** DAVID R. BRADLEY, (610) 832-9681, Fax: (610) 832-9668, e-mail: [dbradley@astm.org](mailto:dbradley@astm.org)

October 22, 2007

Reply to:

Donald T. Bartlett

The Lubrizol Corporation

29400 Lakeland Blvd.

Wickliffe, OH 44092

(440) 347-2388

(440) 347-2878 (FAX)

ASTM D02.B0.03 L-37 Surveillance Panel

Members and Guests:

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

- o **October 18, 2007 L-37 Surveillance Panel Teleconference Meeting**

Please direct any corrections or comments to my attention.

Sincerely,

Donald T. Bartlett, Chairman

L-37 Surveillance Panel

Attachments

**Report of Meeting**  
**L-37 Surveillance Panel Teleconference**  
October 18, 2007, 10:30 a.m. EDT

**I. Attendees:**

ASTM TMC:	Don Lind	Afton Corp:	Cory Koglin
Lubrizol Corp:	Don Bartlett	Lubrizol Corp:	Jerry Gropp
Dana Corp:	Greg Fett	SwRI:	Brian Koehler
PARC:	Dale Smith	Dana Corp:	Joe Guzikowski
Dana Corp:	Don Kreinbring	Dana Corp:	Steve Bird
SwRI:	Steve Marty	Dana Corp:	Mark Kelly
Dana Corp:	Kenny Miller		

**II. Agenda and Summary of Panel Discussion, Consensus Actions, and Motions:**

- 1) **Minutes of the September 19, 2007 meeting:** Motion # 1: Mr. Koehler, second by Mr. Smith moved to approve the minutes as written with no corrections. The vote was unanimous, 6-0-0.
  
- 2) **2007 Lubrited Gear Batch B6L566/P4L816 Review**
  - ✓ Recommendation to Panel by HTF 10/11/2007
    - Chairman Bartlett quickly reviewed the attachments to today's meeting announcement that detailed decisions since the September 19 panel teleconference meeting. There was no further discussion.
    - Motion # 2: Moved by Mr. Bartlett, second by Mr. Koglin, "That the lubrited gear batch B6L566 be totally rejected for any L-37 approval testing. No further modified procedure testing will be conducted. The motion carried, 3-0-3. *As a side note, the chairman informed the panel that he received an email from Mr. Rea, Infineum, indicating a vote "in absentia" that should the same motion come forward that he would votes Yes to this motion. That would have technically been a vote of 4-0-3.*
  
  - ✓ Discussion, comments, action items from much discussion:
    - **Bird** – Marko Ojanen was not able to make this meeting. There have been several internal meetings with in Dana last week and we need to get the people from Ft. Wane involved. Is it coming down to warrantee, vs. price on a new order. There is an option for a Dana lab in Maumee to rebuild the axle with new ring and pinions.  
**Gropp** - While he commended the Task Force and Dana for working very hard to find a way to make this batch of hardware useable, he indicated that with the rejection of this batch, we must now move quickly to find a different way to make hardware available to the industry. He reminded everyone of the importance of the SAE J2360 Standard as a worldwide performance standard for gear lubricants, and stressed the need to insure that test sponsors have hardware available to develop/approve lubricants under this specification.

- **Kelly** – it was at this point that Mark Kelly introduced himself to the panel as the Dana Lugoff facility Plant manager. He indicated that Dana is in full discussion with sales and the technical side to replace or remake and apologized that Dana did not have the necessary information as promised at this time.
  - **Bartlett** – asked and was confirmed by Mr. Kelly that Mr. Kelly would have the answers to these questions for next Thursdays meeting:
    - Define what compensation would be available for what has been spent by the labs to date on the rejected batch.
    - Cost of brand new axles complete axle assemblies and timing.
    - With respect to retrofitting the rejected axles with new hardware i.e., total price (out the door) to the labs and full details (new parts, shipping to and from, and labor).
  - **Marty & Koehler** – are in favor of retro fitting the axles with new ring and pinion and felt that the 8-test alternate lubrited matrix was a successful example of the type of shop rebuild coming out of the Maumee facility.
  - **Miller** – wanted to confirm how many axles there were to be built, what the timing needs would be, and what type of distribution process would be followed.
  - **Fett** – indicated that he would hope the Maumee facility could complete the process in less than 6 months. He indicated that Dana needs to map out the all aspects under its control.
  - **Bartlett** – reiterated, for those newly engaged in this discussion, that the initial axle order was placed in May 2006. This was to be a two-year axle order. Today, it is now 17 months later, 1.2 million spent to purchase the axles and 62 donated tests costing four labs ~ \$ 350,000. The labs are now out 10 percent of the axle count ordered. No matter what we do today, i.e. make new axles or retro fit the old axles, we will still need a 44-test matrix at another cost to the four labs of ~ \$ 260,000.
- Gropp** – Indicated that he understands that everyone is attempting to be responsible in how they are using their company’s resources, but questioned if our efforts to save money might be influencing our decisions on how to proceed and possibly reducing our chances of success. He again reminded everyone of the importance of the SAE J2360 Standard, and said that we must not take any action which would place this specification in jeopardy.
- **Bartlett** - Indicated that the next teleconference would again be an L-37 Surveillance Panel teleconference. He also indicated if we can’t come to resolution quickly, it would probably be prudent to travel to Dana for the next teleconference.
  - **L-37 SP Teleconference call information:**

Call in number: 608-250-0194, code 324160  
 Date: Thursday, October 25, 2007  
 Time: 10:00 EDT

### 3) Next Lubrited and Non-Lubrited hardware order status – Initial orders posted

- Approximately 600 non-lubrited?
- Approximately 854 lubrited?
- Labs need to look at their initial orders and determine a final count required. More discussion after the Dana report at next weeks panel teleconference.

#### 4) Resolution of Email Ballot on changes to Section 8.2.3 – Backlash

- ✓ **Current D 6121:** Section 8.2.3 - Backlash Measurements -- Remove the cover plate. Record backlash at four equally spaced locations. The average of the four readings shall be from 0.004 to 0.009 in (0.102 to 0.229 mm).
- ✓ **Proposed Change to D 6121 (as in current L-42): Section 8.2.3** Record the backlash reported from the manufacturer. The readings shall be between .004 and .012 in. (0.102 to 0.305 mm). **Section 8.2.3.1.** Measure and record backlash at four equally spaced locations. Report the average and the four readings.
- ✓ Official email ballot (closed 10/15/2007) vote was unanimous - 12-0-0
- There are some of the older axles batches approved for testing that do not have the Dana Mfg information. We would not be appropriate to render the older but approved axles unacceptable for use. Mr. Lind and Bartlett will work on some wording and form proposals.

#### 5) Pinion and Ring Gear Tooth Chipping Action Item Proposal – Fett comments

- ✓ The anomaly at the top of the L37 gear teeth is chipping as a result of the wear on the tooth face and the compressive residual stress from the shot peening operation.
- ✓ The shot peening operation puts a considerable amount of compressive residual stress in the corner of the tooth tip which tends to make it want to crack or pop off.
- ✓ When there is wear on the tooth face the stress is relieved on one side only which tends to cause these cracks.
- ✓ These are not normal pitting which is associated with localized high contact stresses or poor lubricant performance.
  - Mr. Lind and Mr. Bartlett offered to work on a 'strawman' document proposal with pictures and the panel can decide at a later date what verbiage to put into the standard.

6) **Attachments # 1 and # 2** are included for documentation and represent the minutes from the L-37 Hardware TF teleconference meetings held on October 4 and October 11.

7) Adjournment at 11:41.

Respectfully submitted:



Donald T. Bartlett  
L-37 Surveillance Panel Chairman

## L-37 HTF Teleconference Call Minutes, 10/04/2007

### Attendees;

Dana - Kreinbring, Miller, Guzikowski, Bird, Fett, Pappademos, Basset  
Intertek-Parc – Smith  
SwRI – Koehler  
TMC – Lind  
Lubrizol – Bartlett, Gropp  
Afton - Koglin

It was unanimously confirmed that the next L-37 HTF teleconference is scheduled for Thursday, October 11, 2007 at 10:00 a.m., EDT. **Call in number will be 608-250-0194, participation code is 324160.**

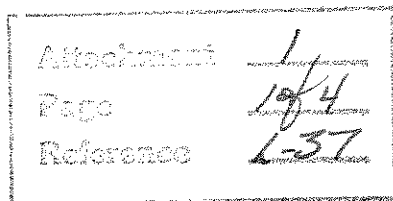
### 1. P4L792/V1L417 Hardware gear batch alternate lubrited testing update - Attach # 1

- Dana Analysis of Afton goers - results not yet completed
- Intertek EOT gears shipped on Monday 10/1.
- Lind asked - What is the difference between the V1L417 non-lubrited gears that were lubriting versus the lubriting from the B6L566 batch? Fett answered, with respect to the B6L566 gear batch, the total acid parameter was not where it was suppose to be.
- Both alternate lubrited parts look and seem to be giving good and acceptable test results.
- Fett - L-37 lubrited gears have never performed as good as the non-lubrited lubrited gears in this test.

### 2. P4L792/V1L417 Hardware gear batch alternate lubrited testing update - Attach # 2

Procedure modification proposed by Ken Miller for the 3-part BI: The new break in procedure for the L37 axle is now in three parts, but same 100-minute total. This scheme is an attempt to address the initial trace scoring and the one pinion heel spill encountered. If need be, we could probably move things around a bit to better accommodate.

	<u>Speed (RPM out)</u>	<u>Torque (ft-lbs / axle)</u>	<u>Duration (mins)</u>	<u>Temp (°F)</u>
1)	190	395	40	250
2)	80	1,000	40	250
3)	80	1,200	20	250



- **SwRI Update** - Mr. Koehler -He was very encouraged during the three-borescope inspections of the 3-step break in. The stand ran very well. The ring looked very good after break-in. Pinion might have shown a possible score on the heel end. About 1.5 hours from EOT, the vibration sensor was indicating that something was possibly going on. SwRI sent some photos from the EOT ring and pinion. Many spalls central tooth, some had spalls down in the heel. Photos are included as **attachment # 3**. Pinion bearings looked fine.
- **Miller** - Appears to be indicative of cone eccentricity (wobbling cone). Composite pitch of cone is not concentric to the mounting. He had higher expectations, possibly an outlier?
- **Koehler** will send the ring and pinion to Mr. Miller.
- **Koehler** indicated that SwRI is willing to run one more test, trying to find a way to salvage this batch. Wants to make sure it is not just a lubrifying issue and we discover the impact before we order the next order.
- **Gropp** - He re-iterated that the mid stream core issues encountered last winter during the gears during production at Ft. Wayne appears to have caused questions & concerns to many i.e., core issues - remake of the ring, steel used, hardening, contact patterns let along the lubrifying issue. It is a combination of that plus the lubrifying etch that concerns many of us.
- **Lind** - asked is there any other B6L566 hardware left that we could use the alternate lubrified process on and further determine if it is only just the lubrifying process causing the issue or something from production as well. Miller commented that Ft. Wayne indicated that there are two or three sets left but they were not ring and pinion matches with respect to lapping. Dead end here.
- **Koehler** - all changes relate to the ring and pinion. His questioned, do we go back to replacing the ring and pinions and rebuild the lot? Lots of what ifs discussed.
- **Smith** - Wants to rebuild and salvage the batch.
- **Miller** - Indicated that discussion with Mr. Okamuro were that he strongly urges and recommends that a Line build if the key for consistencies and reduced variation vs. Bench build from an outside source. Getting outside the normal mode, you are asking for trouble.

Attachment	1
Page	2 of 4
Reference	6-37

- **Bartlett** - He commented that, from the chairman's point of view (insure that there is adequate hardware available to meet industry needs) and protecting his companies position, he now believes it is time that we all recognize that the B6L566 batch outcome is what it is, not very good! It will take more \$\$\$ than we realize (already has) and expects that the continued work and cost will exceed 50% of a total full replacement of this batch. We have a 2-year order for green and lubrited moving forward now. Dana and the labs must meet and put down on paper the 'what went right, what went wrong, concerns, improvements, drawing documentation and expectations before this next batch enters production. He recommends that we put our time and effort into a new full replacement batch vs. pouring more time, energy, and \$\$\$ into saving this batch. This will be one that the results will always be questioned, require more tests to achieve a pass, and not good for future new formulation verifications. The industry needs hardware to meet our needs.
- **Motion # 1** - Bartlett motioned, second Koglin - That the lubrited gear batch B6L566 be totally rejected for any L-37 approval testing. Much discussion! The vote for the motion was defeated 1-3-2.
- It was then decided that we would complete running the three-step break-in at three labs and report the data by Wednesday, October 10 for review and discussion at the next teleconference meeting which is scheduled for Thursday, October 11, 2007 at 10:00 am. Use the same call in teleconference number.
- Afton to run TMC153, 3-pt break-in.
- Parc to run TMC 153, 3-pt break- in.
- SwRI - to run TMC 153, 3-pt break-in. Lubrizol agreed to fund this test.
- All agreed that we would use L2FO contact patterns and that the need to borescope the 3-step break-in was not necessary.
- **Gropp** expressed his concern that we should run all tests in one lab versus going across multiple labs. No support.
- **Bird** - was asked/agreed to contact Mr. Ojanen to work on the following action item:
- **ACTION ITEM:** The question to be answered at next weeks teleconference call is: "If the industry walks away/fully rejects the B6L566 gear batch of hardware and orders another batch of hardware, what compensation is Dana going to provide to the industry"?

3. Action Item from September 27 meeting - Transmission Information/ Gear Ratios in Use at the Labs.

- All labs email to the TMC their respective transmission information with ratios.
- **Koehler** - Transmissions may provide a little torque surging effect, same torques and speeds, just different engine speed. Bottom line, the procedure requires that the wheel speeds and torques are maintained, the engine RPM will just vary accordingly. Not an issue.

Attachment	1
Page	34/4
Reference	L-37

4. **Next hardware order status** - The chairman asked if all labs had placed an order per the SP direction. The labs made the following comments:

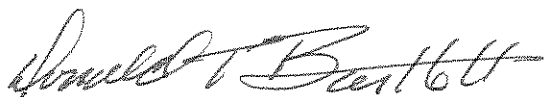
- PO Status -

- o Afton - via voice mail - ordered both hardware types.
- o SwRI - via email - ordered both hardware types.
- o LZ - via voice and email, ordered both hardware types.
- o Parc - via voice mail, ordered no non-lubrited and no lubrited.
- o Dana is working on an update quote. Timing?

- Ordering some hardware of the parallel cut (toe and heel, face hobing) that cuts all the slots simultaneously. - Not Discussed

Being no other business, the meeting was adjourned at 11:04 am.

Respectfully submitted,



Donald T. Bartlett  
L-37 SP Chairman

Attachment	<u>1</u>
Page	<u>4 of 4</u>
Reference	<u>L-37</u>



## L-37 HTF Teleconference Call Minutes, 10/11/2007

### Attendees;

Dana - Kreinbring, Miller, Bird, Ojanen, Guzikowski, Basset, Fett  
Intertek-Parc – Smith  
SwRI – Koehler  
TMC – Lind  
Lubrizol – Bartlett, Gropp  
Afton - Koglin

### 1. P4L792/V1L417 Hardware gear batch alternate lubrited testing update - Attachment # 1

- Dana analysis of Afton gears - completed, data reported and TMC to enter into the website spreadsheet.
- Intertek EOT gears were received at Dana and scheduled for analysis.
- No other action planned.

### 2. B6L566 Lubrited Hardware Modified Hardware - Attachment # 2

3-part BI Procedure modification proposed by Ken Miller: The new break in procedure for the L37 axle is now in three parts, but same 100-minute total. This scheme is an attempt to address the initial trace scoring and the one pinion heel spall encountered. If need be, we could probably move things around a bit to better accommodate.

	<u>Speed (RPM out)</u>	<u>Torque (ft-lbs / axle)</u>	<u>Duration (mins)</u>	<u>Temp (°F)</u>
1)	190	395	40	250
2)	80	1,000	40	250
3)	80	1,200	20	250

- Three more tests were run and reported from 3 labs. One at SwRI (Lubrizol donated funds); One at Afton; and one at Intertek-Parc; As agreed, all tests were conducted using the 3-part BI, TMC 153, and L2FO contact patterns were used.
  - **3 out of 4 tests were clear failures.** It appears that, while somewhat better (no broken teeth this time) there is still a common and repeatable phenomenon that is not good. Where do we go from here is the question asked?
  - **SwRI** asked Miller if he had received the ring and pinion from the previous 3—PT-BI that had the initial ring with a broken tooth.
  - **Miller** indicated that he looked at it and stated that void of any other information, the general consensus was that it appeared to be a wear phenomena followed by sub case fatigue and spall. Miller will send it off to Guzikowski for further analyses. The phenomenon occurring appears to be stress conditions that are initial and altered by wear. Contact stress originals are elevated based on the MET workup

Attachment 2

Page 1 of 7

Reference L-375A

- **Gropp** - Looking at all the options, what could we predict that we would we get if we ran more tests. It is interesting vs. are we further ahead or have a different position then where we are today. Which oils do we run, TMC 151, 152, or 127? The good oils (TMC 152, 151/155) would be interesting, but would this solve our dilemma? If we run TMC 127, we know it should fail, but how much worse than the TMC 153. Up to this point, we have not had the ability to discriminate? Interesting, but does not solve our dilemma.
- **Smith** - The TMC 127 response vs. the TMC 153, we appear to be getting directionally worse. Are we not getting too far into broken teeth phenomena? How do we get directionally worse without catastrophic failure?
- **Koglin**, after further review of the data, if Miller were to consider making another proposed change to the BI procedure, what would it be?
- **Miller** indicated he would run a longer BI, slow down initial speed, leave parts 2 and 3 the same and lengthen each phase somewhat.
- **Bartlett** - commented that he has seen the industry labs donate the following work:
  - **44 test industry matrix** with varied results with all reference oils (TMC 155, 152, 153, and 127). Far too many tests exhibiting broken teeth, ridging, spalling and failing results with oils that should customarily pass.
  - **3 tests** at Lubrizol (2 reducing the speed & load 10 % on TMC 152 and 127 and one (TMC 152) with a test length shorted to 20 hours; two of the tests exhibited failing distress on one or more distress parameter (one with a spall) with no broken teeth.
  - **3 tests** on a two-part Break In from two labs using TMC 153. In each case, all tests failed one or more distress parameter, one with a spall, and no broken teeth.
  - **4 tests** on a three-part Break In from three labs using TMC 153. Three tests failed one or more distress parameter, one test had a spall and a broken tooth, and one test passed.
  - **8 tests** on two alternate lubrifying process (TMC 153) using the 2005 P4L792/V1L417 non-lubrited gear batch (approved by the industry in 2006). In this experiment, all tests passed the distress parameters, no spalling and no broken teeth.
  - This represents a total of **62 tests donated tests** across 4 labs for an additional cost of approximately \$ 350,000 to \$ 375,000 dollars. We have tried the additional matrix plus 5 other options in our attempts to approve or find an option to make the B6L566 hardware work. Unfortunately, none of the modifications evaluated have proven effective and consistent in addressing the problems we are seeing with this batch of hardware (specifically, unable to produce acceptable levels of Ridging, Rippling, and Pitting/Spalling on our "good" reference oils).

Attachment	<u>2</u>
Page	<u>2 of 7</u>
Reference	<u>L-375P</u>

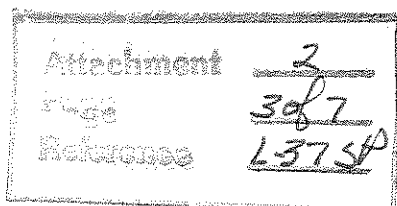
- **Bartlett** - Recognizing that these efforts could continue on indefinitely with no guarantee of success, he recommended that the industry abandon any further efforts to "salvage" this batch of hardware. The chairman further added that he and the panel has the responsibility to ensure that there is adequate hardware available to meet industry needs and again believes it is time that we all recognize that the B6L566 batch outcome is what it is, not very good! He commended the labs and Dana for their efforts to this point and again recommended that we put our time and effort into a new full replacement batch vs. pouring more time, energy, and \$\$\$ into saving this batch.
- **Recommendation to the SP:** Motion # 1 - Bartlett motioned, second Koglin; that the lubrited gear batch B6L566 be totally rejected for any L-37 approval testing. No further modified procedure testing will be conducted. The motion passed, 3 for, 0 opposed, and 3 abstentions.

**It was unanimously confirmed that the next L-37 HTF teleconference would be an L-37 Surveillance Panel Teleconference scheduled for Thursday, October 18, 2007 at 10:30 a.m., EDT. Call in number will be 608-250-0194, participation code is 324160.**

- **Pending ACTION ITEM to Dana:** "If the industry walks away/fully rejects the B6L566 gear batch of hardware and orders another batch of hardware, what compensation is Dana going to provide to the industry"?
  - Marko Ojanen reported that he is working within Dana to get an answer and asked how many axles is a part of the warrantee recall.
  - Afton - 250
  - Lubrizol - 250
  - Intertek - 204
  - SwRI - 249
  - Grand Total - 953

**3. Action Item from September 27 meeting - Transmission Information/ Gear Ratios in Use at the Labs. See Attachment # 3**

- The TMC compiled the spreadsheet of industry used transmissions by lab.



4. **Next hardware order status** - Depending the outcome of the SP teleconference call on Thursday, October 18, the labs are advised to revisit their order information they provided Dana for the next green and lubrited hardware. Dana is hoping to have the full official quote in the next week or 10 days.
- **Ordering some hardware of the parallel cut (toe and heel, 3-axis face hobing) that cuts all the slots simultaneously.** Based on today's discussions points, it appears that since there is no tooling for the 5:86 gear ratio, the panel will want to look at this option as a future action item. That may be the time to move the L-37 to the L-37-1. We have our hands full of details to get this next dual batch through in a timely and consistent manner and to not spread our selves and efforts to thin.

Being no other business, the meeting was adjourned at 11:04 am.

Respectfully submitted,



Donald T. Bartlett  
L-37 SP Chairman

Attachment	2
Page	4 of 7
Reference	L-37SP

ALTERNATE SUBSTITUTION MATRIX

key	Lab	STD	Oil	VAL	PinBat	RingBat	DTCOMP	Pwear	Pidg	Pripp	Pspit	Rwear	Rridg	Rripp	Rspit	BKAVG	fpcrat	fpcrat	COM1	COM2	Match #	Pinion Pitting			Ring Pitting		
																						10.30 microns	>30 microns	>30 microns	10.30 microns	>30 microns	>30 microns
364	A	4	153	NN	V1L417	P4L792	20070808	7	8	8	9.9	8	9	9	9.9	0.008	0	2	Ft Wayne	Process	5V	16	0	3	0		
347	B	191	153	NN	V1L417	P4L792	20070814	8	8	9	9.9	7	9	10	9.9	0.005	0	2	Ft Wayne	Process	5H	14	0	5	0		
352	D	3A	153	LN	V1L417	P4L792	20070908	7	9	9	9.9	8	10	9	9.9	0.011	0	3	Ft Wayne	Process	7J	15	0	4	0		
314	E	1	153	XN	V1L417	P4L792	20070922	8	9	8	9.9	7	9	9	9.9	0.008	0	2	Ft Wayne	Process	0P						
285	A	4	153-1	LN	V1L417	P4L792	20070809	8	9	8	9.9	8	10	10	9.9	0.01	0	2	Alternate	Process	1X	1	0	0	0		
846	B	191	153	LN	V1L417	P4L792	20070812	7	8	9	9.9	7	8	10	9.7	0.01	0	2	Alternate	Process	1V	0	0	1	0		
289	D	3A	153	LN	V1L417	P4L792	20070830	7	9	9	9.9	8	10	10	9.9	0.012	0	2	Alternate	Process	7X	0	0	0	0		
356	E	1	153	NN	V1L417	P4L792	20070926	7	9	9	9.9	7	10	10	9.9	0.008	0	2	Alternate	Process	2J						

Attachment 1  
 Page 1081  
 Reference L37HF

Attachment 2  
 Page 5 of 7  
 Reference L-375A

*MODIFIED PROCEDURE WORK*

Askey Lab	STD	Oil	VAL	PinBat	RingBat	DTCOMP	Pwear	Priddg	Prripp	Pspit	Rwear	Rriddg	Rripp	Rspit	BKAVG	Ipcrat	Ipcrat	Modified Procedure	Match #	Comments	Pinion Pitting		Ring Pitting	
																					10-30 microns	>30 microns	10-30 microns	>30 microns
1845	B	191	152-1 LN	B6L566	P4L816	20070615	6	8	9	5	8	7	9	10	0.004	0	2	A	2L					
3265	B	191	152-1 NN	B6L566	P4L816	20070619	7	10	8	9.9	8	9	9	9.9	0.006	0	2	B	7H					
9292	B	191	127 LN	B6L566	P4L816	20070623	6	9	7	9.9	7	10	7	9.9	0.009	0	2	B	7HA					
3286	A	4	153-1 NN	B6L566	P4L816	20070905	6	7	7	9.9	6	6	9	9.9	0.005	0	2	C	5A					
3287	A	4	153-1 NN	B6L566	P4L816	20070914	6	8	7	8	8	9	10	9.9	0.009	0	2	C	0J					
3263	D	3A	153-1 NN	B6L566	P4L816	20070914	7	7	9	9.9	8	9	10	10	0.006	0	2	C	2C					
4177	A	4	153-1 MN	B6L566	P4L816	20071002	6	6	7	2	6	7	9	8	0.007	0	2	D	1V					
3264	D	3A	153-1 NN	B6L566	P4L816	20071010	7	7	9	7	8	9	10	9.9	0.006	0	2	D	7C					
4178	A	4	153-1 NN	B6L566	P4L816	20071010	7	7	7	9.5	7	9	9	9.9	0.004	0	2	D	IJ					
3278	E	1	153-1	B6L566	P4L816		7	9	9	9.9	7	9	9	9.9				D		Broken Tooth				

Short length test. Test phase of the test was stopped after 20 hours

Test phase of the test was run at reduced speed and torque (1588 rpm / 73 lb-ft)

Test was run with a Modified break-in procedure.  
 1st break-in period; 50 minutes, run at standard L-37 speed and torque conditions, oil temperature 250°F  
 2nd break-in period; 50 minutes, run at 80 rpm and 1000 lb-ft, oil temperature 250°F.  
 3rd break-in period; 50 minutes, run at 80 rpm and 1000 lb-ft, oil temperature 250°F.

Test was run with a Modified break-in procedure.  
 1st break-in period; 40 minutes, run at 190 rpm and 395 lb-ft, oil temperature 250°F  
 2nd break-in period; 40 minutes, run at 80 rpm and 1000 lb-ft, oil temperature 250°F  
 3rd break-in period; 20 minutes, run at 80 rpm and 1200 lb-ft, oil temperature 250°F  
 4th break-in period; 20 minutes, run at 80 rpm and 1200 lb-ft, oil temperature 250°F.

Attachment 2  
 Page 6 of 7  
 Reference L-37HT

Attachment 2  
 Page 6 of 7  
 Reference L-37HT

## L-37 TRANSMISSIONS

Lab	Transmission	Gear Ratio				
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>
A	SM-465 4-speed	6.55 : 1	3.58 : 1	1.57 : 1	1.0 : 1	
B	NV4500 5-speed	5.61 : 1	3.06 : 1	1.67 : 1	1.0 : 1	0.75 : 1
D	NV4500 4-speed	6.57 : 1	3.04 : 1	1.67 : 1	1.0 : 1	
E	117 mm 4-speed	6.55 : 1	3.85 : 1	1.70 : 1	1.0 : 1	

Attachment	<u>3</u>
Page	<u>1 of 1</u>
Reference	<u>L-37 HTF</u>

Attachment	<u>2</u>
Page	<u>7 of 7</u>
Reference	<u>L-37SP</u>