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### **Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS**

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April 13<sup>th</sup>, 2010

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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:

- **April 8<sup>th</sup>, 2010 L-37 Surveillance Panel Meeting**

Please direct any corrections or comments to my attention.

Sincerely,

Galen Greene, Chairman  
L-37 Surveillance Panel

**Report of Meeting**  
**L-37 Surveillance Panel Teleconference**

*April 8<sup>th</sup>, 2010*

Attendees:

Dana -	<b>Miller</b> , Guzikowski, Pappademos
SwRI -	<b>Koehler</b>
Lubrizol -	<b>Greene</b> , Gropp
Afton -	<b>Koglin</b>
Intertek-Parc -	<b>Smith</b>
TMC -	Parke
Chevron -	<b>Haire</b>
Arvin Meritor	<b>McGlone</b>

Voting Members in **BOLD**

The meeting was called to order at 10:30 am EST.

**1.0 Summary of Meeting Discussions**

**1.1 Action Item Review**

- ACTION ITEM 1 (Mr. Greene):** The Chairman is to create a survey for the industry which asks how lubrifying is used at axle manufacturers. Specifically the panel is looking to find out whether the ring only, pinion only, or both are commonly lubrified throughout the industry.  
**COMPLETE - Survey sent on 4/6/2010, reply by 4/16/2010**
- ACTION ITEM 2 (Mr. Guzikowski/Mr. Smith/Mr. Koglin):** Mr. Smith is to provide Mr. Guzikowski with a new and used 2005 V1L417/P4L792 gear set. Mr. Koglin is to provide Mr. Guzikowski with a new 2008 V1L500/P4T813 gear set. Shipping should be expedited (overnight) to ensure fast arrival. Mr. Guzikowski is to review these two different gear batches and comment on the differences. From this point, the panel will discuss whether any actions should be pursued.  
**OPEN - Mr. Guzikowski has received parts from Mr. Smith, awaiting arrival of parts from Mr. Koglin. On the parts from Mr. Smith, Mr. Guzikowski commented that he didn't see any problems with shot peening, nothing looked strange.**
- ACTION ITEM 3 (Mr. Miller):** Explore changes in micro geometry and make recommendation on the likelihood of this improving the gear performance. The panel will review and make a decision at the next meeting.  
**COMPLETE – See attachment 1 and section 1.2.**
- ACTION ITEM 4 (Mr. Greene):** Create a task force focusing on developing a new generation of the current test  
**OPEN**

**1.2 Discussion of how to Proceed with the Manufacture of a New Pilot Batch of Lubrified Hardware**

Mr. Miller commented that he was able to design a theoretical micro geometry with a significant reduction in peak contact stress (see attachment 1). This reduced contact stress would have the net effect of reducing torque. This geometry has essentially spread out the stress across the entire tooth so stress near the heel and toe are slightly higher than the 2005 master.

Mr. Haire asked if this gear was representative of current parts. Mr. Miller stated that in some respects the answer is yes, but in others no. Most gears today are 3 axis face hobbing whereas the L-37 gear set is face milling. Mr. Gropp asked if the ratio (5.86:1) was relevant to the field today. Mr. Miller commented that it was not really popular in field applications. The ratio used is the so-called drag racer ratio. The reason the steep ratio is used in this test is to obtain high stress without having to have an extremely high pinion load.

Mr. Greene proposed that we proceed with the manufacture of a pilot batch at Fort Wayne using the new lower peak stress model that Mr. Miller created. We could then decide how to proceed with lubrified and shot peening/lapping at the next meeting. Mr. Koglin asked if we should produce this batch using a face hobbing method now. Mr. Miller commented that face milling is better for bending and for this application face milling was the best way to go.

**The group discussed and came to the following consensus:**

- **Dana is to immediately proceed with the manufacture of 24 gear sets using the reduced peak stress model Mr. Miller has created.**
- **The panel will await the results of the survey and hold a meeting in the near future to discuss whether to lubrite ring+pinion or ring only.**
- **The panel will also discuss possible changes to shot peening based on Mr. Guzikowski's analysis of the 2005 and 2008 gears.**
- **The panel will give direction to Dana on these items at the next meeting**

### **1.3 Dana Maumee Facility**

There was a discussion regarding the pieces of hardware at the Dana Maumee facility. The hardware task force will work with Dana to assure that there is little chance of a mix up in hardware. Dana is to hold onto the 2008 lubrified ring and pinions for the short term. If these become an issue as the pilot hardware arrives, Dana will work with the hardware task force to resolve. Dana is to discard any leftover pieces from the several pilot batches of hardware that were attempted in the 2<sup>nd</sup> half of 2009. Any plain axles still remaining at Maumee are to be shipped back to Lubrizol. Dana is to work with the laboratories to reconcile all axles that have gone in and out of Maumee.

### **2.0 Adjournment**

Meeting Adjourned at 12:00 pm EST

Respectfully submitted,

Galen Greene  
L-37 Surveillance Panel Chairman

# ASTM L37 summary of FEA study

4/5/2010

Ref: V1L528-P4T883A heat codes (2009)

	Stress <sub>B</sub>	Stress <sub>C</sub>	Stress <sub>C</sub> (pitchline)
<b>Average:</b>	<b>167,279</b>	<b>294,223</b>	<b>287,264</b>
<b>Percent of 2005:</b>	<b>101.40%</b>	<b>97.38%</b>	<b>98.10%</b>

Above is from 16 samples, reverse-measured gearsets. These gearsets are the 2nd iteration 2009 pilot lot which targeted matching the 2005 "platinum" lot, ref. heat code V1L417-P4L792. The FEA-derived stress values are from these measured gearsets and the values represent the averages.. Gearset MN 7L5 represents average stress from this group.

Ref: V1L417-P4L792 heat codes (2005 baseline)

M/N	Original FEA Date	Stress <sub>B</sub>	Stress <sub>C</sub>	Stress <sub>C</sub> (pitchline)
7J	2005	164,971	302,143	292,827

Note: Above stress data is from reverse-measured baseline 2005 "platinum" lot, FWP lapped master, ref. heat code V1L417-P4L792.

Ref: NEW proposed micro-tooth design for reduced stress (theory)

	Original FEA Date	Stress <sub>B</sub>	Stress <sub>C</sub>	Stress <sub>C</sub> (pitchline)
	4/4/2010	151,699	279,380	263,659
<b>Percent vs. 2009 average:</b>		<b>90.69%</b>	<b>94.96%</b>	<b>91.78%</b>
<b>Percent vs. 2005 average:</b>		<b>91.96%</b>	<b>92.47%</b>	<b>90.04%</b>

INPUT FILE: REVERSE-7Jdrive  
OUTPUT FILE: REVERSE-7Jdriveout  
GEAR TORQUE: 3480.000 lb-ft  
04\06\2010 VERSION 8.19 time:11:12am  
V= 0.0000 in E= -.01295 in  
H= 0.0000 in P= 0.00907 in  
G= 0.0000 in G= 0.00392 in  
cmf= 1.0000 A= 0.00272 ra  
Separation factor= 0.00025

### GEAR CONTACT STRESS



INPUT FILE: REVERSE-7L5  
OUTPUT FILE: REVERSE-7L5out  
GEAR TORQUE: 3480.000 lb-ft  
04\06\2010 VERSION 8.19 time:11:11am  
V= 0.0000 in  
H= 0.0000 in  
G= 0.0000 in  
cmf= 1.0000  
Separation factor= 0.00025  
E= -.01295 in  
P= 0.00907 in  
G= 0.00392 in  
A= 0.00272 ra

### GEAR CONTACT STRESS



INPUT FILE: S060586-6drive  
OUTPUT FILE: S060586-6driveout  
GEAR TORQUE: 3480.000 lb-ft  
04\06\2010 VERSION 8.19 time:11:12am  
V= 0.0000 in E= -.01295 in  
H= 0.0000 in P= 0.00907 in  
G= 0.0000 in G= 0.00392 in  
cmf= 1.0000 A= 0.00272 ra  
Separation factor= 0.00025

### GEAR CONTACT STRESS

