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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

February 18th, 2011

Reply to:
Galen Greene
The Lubrizol Corporation
29400 Lakeland Blvd.
Wickliffe, OH 44092
(440) 347-2394
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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:

- **February 9th, 2011 L-37 Surveillance Panel Meeting**

Please direct any corrections or comments to my attention.

Sincerely,

Digitally signed by Galen Greene
Date: 2011.02.25 07:19:56 -05'00'

Galen Greene, Chairman
L-37 Surveillance Panel

Report of Meeting
L-37 Surveillance Panel Meeting
PRI Headquarters – Warrendale, PA

February 9th, 2011

Attendees:

SwRI -	**Koehler**
Lubrizol -	**Greene**, Gropp, Venhoff, Graziano
Afton -	**Koglin (TC)**, Bell
Intertek-Parc -	**Smith**
TMC -	**Parke,** Clark
US Army -	**Comfort**, Dwornick
Arvin Meritor -	**McGlone**
AAM -	**Dharte**
ExxonMobil -	Eliot, Kanga
Chevron -	**Zakarian**

Voting Members in **BOLD**
TC = Teleconference

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

1.0 Approval of Minutes:

- **November 3rd, 2010 Surveillance Panel Meeting (Warren, MI)**

Motion # 1 → Mr. Smith / 2nd Mr. Zakarian to approve the minutes as presented. Motion for approval was passed with a vote of 8-Yes, 0-No, and 0-Abstentions.

2.0 Summary of Meeting Discussions

2.1 Hardware Update

The pilot gear sets have been manufactured and 12 sets were in the process of being Lubrited. Once complete these gear sets are going to be shipped to Maumee for retrofit into the existing 2006 housings. No representative from Dana was present so a further update was not provided.

The labs reviewed the agreed upon matrix and selected labs to run each test. The oils will be run as follows:

Oil	Conditions	Both ring and pinion Lubrited	Lab
152	STD	3	SwRI
			Afton
			Lubrizol
	CAN	3	Intertek
			SwRI
			Afton
155	STD	3	Lubrizol
			Intertek
			SwRI
134	STD	2	Afton
			Lubrizol

Since only 11 tests were originally scheduled, Intertek will receive an extra axle which will likely be run at a later date. After these 12 tests are complete, the labs will review the data and decide on next steps.

2.2 Broken Teeth Definition

At the recent rating calibration workshop, the group discussed how to interpret broken teeth on L-37 gears. The group did a survey on several photos of gears. The results showed that there was quite a difference in interpretation. The surveillance panel discussed the issue.

One area that the panel felt needed clarification was section 12.7. There was some confusion on the use of the word "breakage" versus "broken." While the difference was strictly grammatical, the following motion was made to make the interpretation of 12.7 easier:

Motion # 2 → Mr. Koglin / 2nd Mr. Smith – Motion to change 12.7 to read (changes in red): "Consider as non-interpretable any reference or non-reference oil test that has one or more broken pinion or ring gear teeth. Note any broken teeth in the comment section of the rating form." The motion passed with a vote of Yes-8, No-0, Abstensions-1.

The group also discussed a definition of the term "broken teeth." After discussion the following motion was proposed:

Motion # 3 → Mr. Greene / 2nd Mr. Zakarian – Motion to have the TMC discuss the following broken tooth definition with the rating group:
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.
The TMC is to try to report back to the surveillance panel at the May 2011 meeting. The motion passed with a vote of Yes-9, No-0, Abstensions-0.

2.3 L37RC Targets

The TMC presented the updated L37RC targets for approval. The panel reviewed and the following motion was made.

Motion # 4 → Mr. Smith / 2nd Mr. Koehler – Motion to approve the L37RC targets as presented. The motion passed with a vote of Yes-9, No-0, Abstensions-0.

3.0 Adjournment

Motion to Adjourn, Meeting Adjourned at 5:00 pm EST

Respectfully submitted,

Digitally signed by Galen Greene
Date: 2011.02.25 07:20:11 -05'00'

Galen Greene
L-37 Surveillance Panel Chairman

ASTM L-37 Surveillance Panel Membership/Mailing List

Meeting Date: ~~November 3rd 2010~~ 2/9/2011

Initials*	Name	Voting Status	Company Name & Address	Phone/Email Info
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	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
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JCA	Clark, Jeff ~~Farber, Frank~~	Non Voting	ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, Pennsylvania 15206	Phone: 412-365-~~1030~~ 1032 Fax: 412-365-1047 E-Mail: ~~jmf~~ jac@astmtmc.cmu.edu
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* Initial to indicate attendance at subject meeting

ASTM L-37 Surveillance Panel Membership/Mailing List

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retired	Haire, Mike	~~Voting~~	Chevron Global Lubricants ~~100 Chevron Way, Rm 71-7302~~ Richmond, California 94802	Phone: 510-242-2740 ~~Fax: 510-242-3758~~ E-Mail: mhaire@chevron.com
	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
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PRK	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
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	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

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WV	VENHOFF, WES	NON	LZ	Phone: 440 347 4879 Fax: E-Mail: WVEE LUBRIZOL.COM
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Updated L37RC Targets

		Current Tartget			New Targets		
Pinion #	Distress	MEAN	Std Dev	N Size	MEAN	Std Dev	N Size
1	Wear	5.90	1.000	9	5.80	0.420	33
	Rippling	7.80	0.890		7.50	0.800	
	Ridging	5.40	0.670		5.80	0.670	
	Spitting	9.91	0.100		9.90	0.024	
2	Wear	5.90	1.010	19	5.90	0.280	36
	Rippling	8.00	1.120		7.90	0.720	
	Ridging	8.60	0.670		8.50	0.510	
	Spitting	9.60	0.224		9.59	0.185	
3	Wear	5.90	1.010	23	6.00	0.170	34
	Rippling	6.80	0.890		6.90	0.600	
	Ridging	8.40	0.670		8.30	0.590	
	Spitting	9.88	0.089		9.88	0.041	
6	Wear	5.80	0.890	18	5.80	0.360	33
	Rippling	7.20	0.890		7.20	0.570	
	Ridging	6.30	0.780		6.40	0.490	
	Spitting	9.91	0.101		9.91	0.024	
7	Wear	7.80	0.890	9	6.40	0.600	36
	Rippling	8.60	0.670		8.80	0.620	
	Ridging	9.20	0.890		9.00	0.240	
	Spitting	9.87	0.078		9.89	0.023	
8	Wear	7.00	0.600	27	6.90	0.350	33
	Rippling	7.80	0.890		7.80	0.710	
	Ridging	7.70	0.780		7.70	0.630	
	Spitting	9.90	0.090		9.90	0.017	
10	Wear	5.60	0.670	18	5.60	0.500	34
	Rippling	6.20	0.890		6.40	0.650	
	Ridging	8.40	0.670		8.40	0.600	
	Spitting	9.86	0.067		9.87	0.670	
11	Wear	6.10	1.010	15	6.20	0.440	37
	Rippling	6.40	0.670		6.50	0.610	
	Ridging	8.50	0.560		8.60	0.490	
	Spitting	9.60	0.112		9.59	0.172	
13	Wear	7.50	0.600	20	7.50	0.640	40
	Rippling	9.60	0.670		9.70	0.460	
	Ridging	9.50	0.560		9.50	0.500	
	Spitting	9.92	0.089		9.91	0.033	
14	Wear	5.90	1.010	28	6.00	0.290	37
	Rippling	8.50	0.560		8.50	0.560	
	Ridging	6.50	0.560		6.40	0.870	
	Spitting	9.88	0.089		9.88	0.042	

		Current Tartget			New Targets		
Pinion #	Distress	MEAN	Std Dev	N Size	MEAN	Std Dev	N Size
15	Wear	5.40	0.670	9	5.60	0.500	40
	Rippling	8.60	0.670		8.60	0.680	
	Ridging	5.60	0.670		5.60	0.700	
	Spitting	7.56	0.622		7.63	0.490	
17	Wear	5.70	0.780	23	5.90	0.520	39
	Rippling	9.00	1.110		8.90	0.500	
	Ridging	8.10	1.000		8.00	0.610	
	Spitting	6.10	1.000		6.10	0.394	
18	Wear	5.60	0.670	28	5.60	0.490	34
	Rippling	9.10	1.000		9.10	0.650	
	Ridging	4.90	1.000		4.90	0.640	
	Spitting	9.87	0.078		9.87	0.046	
19	Wear	6.10	0.560	20	6.10	0.340	34
	Rippling	9.30	0.780		9.20	0.430	
	Ridging	7.50	0.560		7.40	0.500	
	Spitting	9.90	0.056		9.90	0.017	
21	Wear	5.60	0.670	22	5.60	0.500	35
	Rippling	8.80	0.890		8.80	0.410	
	Ridging	8.40	0.670		8.30	0.530	
	Spitting	8.10	1.010		8.10	0.280	
22	Wear	6.40	0.670	17	6.40	0.500	34
	Rippling	8.90	1.010		9.20	0.590	
	Ridging	9.10	1.010		9.10	0.420	
	Spitting	9.88	0.089		9.88	0.039	
25	Wear	6.70	0.780	9	6.00	0.280	38
	Rippling	7.60	0.670		7.10	0.610	
	Ridging	8.10	1.000		7.60	0.550	
	Spitting	9.90	0.111		9.88	0.047	
26	Wear	8.80	0.890	9	8.30	0.500	38
	Rippling	9.30	0.780		9.40	0.540	
	Ridging	9.80	0.890		9.60	0.500	
	Spitting	9.98	0.089		9.92	0.039	
27	Wear	5.60	0.670	21	5.60	0.550	38
	Rippling	8.40	0.670		8.70	0.660	
	Ridging	5.30	0.780		5.60	0.650	
	Spitting	9.66	0.200		9.76	0.141	
29	Wear	6.50	0.560	22	6.50	0.670	33
	Rippling	9.50	0.560		9.70	0.480	
	Ridging	9.60	0.670		9.60	0.500	
	Spitting	9.91	0.101		9.91	0.042	
30	Wear	6.10	1.010	22	6.00	0.240	35
	Rippling	4.60	0.670		4.50	0.610	
	Ridging	9.10	1.010		9.20	0.380	
	Spitting	9.89	0.101		9.89	0.028	

		Current Tartget			New Targets		
Pinion #	Distress	MEAN	Std Dev	N Size	MEAN	Std Dev	N Size
31	Wear	6.80	0.890	6	7.20	0.620	35
	Rippling	9.20	0.890		9.30	0.440	
	Ridging	9.50	0.560		9.20	0.490	
	Spitting	9.91	0.100		9.90	0.045	
32	Wear	7.40	0.670	22	7.40	0.550	35
	Rippling	8.90	1.010		8.90	0.340	
	Ridging	9.50	0.560		9.50	0.510	
	Spitting	9.89	0.101		9.90	0.017	
33	Wear	6.30	0.780	6	6.00	0.420	40
	Rippling	9.20	0.890		9.10	0.390	
	Ridging	9.00	1.100		9.10	0.390	
	Spitting	2.33	0.744		2.30	0.550	
34	Wear	6.40	0.670	22	6.40	0.500	39
	Rippling	6.70	0.780		6.80	0.660	
	Ridging	7.50	0.560		7.50	0.760	
	Spitting	9.90	0.056		9.90	0.016	
35	Wear	6.70	0.780	23	6.60	0.550	36
	Rippling	4.80	0.890		4.80	0.690	
	Ridging	7.70	0.780		7.60	0.730	
	Spitting	9.90	0.056		9.90	0.017	
36	Wear	6.10	1.010	6	6.20	0.450	35
	Rippling	9.40	0.670		9.40	0.490	
	Ridging	9.10	1.010		9.10	0.280	
	Spitting	9.91	0.101		9.91	0.032	
37	Wear	7.70	0.780	20	7.70	0.580	37
	Rippling	9.20	0.890		9.10	0.430	
	Ridging	9.40	0.670		9.20	0.530	
	Spitting	9.91	0.056		9.91	0.023	
38	Wear	6.40	0.670	15	6.40	0.500	35
	Rippling	9.10	1.010		9.10	0.420	
	Ridging	7.10	1.010		7.20	0.620	
	Spitting	9.91	0.101		9.91	0.024	
39	Wear	6.80	0.890	6	6.40	0.500	38
	Rippling	8.50	0.820		9.00	0.370	
	Ridging	8.70	0.780		8.70	0.460	
	Spitting	9.92	0.089		9.90	0.010	
40	Wear	6.20	0.890	28	6.20	0.430	35
	Rippling	8.90	1.010		8.90	0.420	
	Ridging	5.80	0.890		5.70	0.680	
	Spitting	9.89	0.101		9.89	0.028	
41	Wear	6.80	0.890	6	7.20	0.580	36
	Rippling	9.30	0.780		9.30	0.530	
	Ridging	9.30	0.780		9.20	0.450	
	Spitting	9.92	0.089		9.91	0.033	

		Current Tartget			New Targets		
Pinion #	Distress	MEAN	Std Dev	N Size	MEAN	Std Dev	N Size
42	Wear	6.00	1.100	6	6.00	0.150	45
	Rippling	6.80	0.890		7.40	0.710	
	Ridging	8.80	0.890		8.60	0.500	
	Spitting	9.80	0.222		9.81	0.106	
43	Wear	6.80	0.890	22	6.80	0.600	35
	Rippling	9.30	0.780		9.40	0.500	
	Ridging	9.00	0.560		9.00	0.170	
	Spitting	9.90	0.056		9.90	0.010	
44	Wear	5.80	0.890	6	6.20	0.430	35
	Rippling	9.30	0.780		8.80	0.660	
	Ridging	4.80	0.890		5.30	0.700	
	Spitting	9.90	0.111		9.89	0.047	
45	Wear	6.30	0.780	6	6.40	0.500	30
	Rippling	8.50	0.560		8.30	0.660	
	Ridging	5.50	0.560		5.90	0.870	
	Spitting	9.92	0.137		9.88	0.079	
46	Wear	6.40	0.670	27	6.50	0.510	37
	Rippling	4.80	0.890		4.80	0.730	
	Ridging	9.10	1.010		9.10	0.420	
	Spitting	9.92	0.089		9.92	0.044	
47	Wear	6.20	0.890	20	6.10	0.320	35
	Rippling	8.70	0.780		8.80	0.510	
	Ridging	5.00	1.120		5.10	0.730	
	Spitting	9.88	0.089		9.89	0.036	
48	Wear	6.50	0.560	6	6.50	0.610	35
	Rippling	9.20	0.890		9.10	0.450	
	Ridging	9.70	0.780		9.30	0.520	
	Spitting	9.88	0.089		9.89	0.024	
50	Wear	6.60	0.670	21	6.50	0.510	33
	Rippling	9.60	0.670		9.50	0.510	
	Ridging	8.40	0.670		8.20	0.830	
	Spitting	9.91	0.101		9.91	0.024	
51	Wear	7.10	1.010	22	7.10	0.350	32
	Rippling	8.70	0.780		8.60	0.500	
	Ridging	9.70	0.780		9.70	0.480	
	Spitting	9.90	0.110		9.90	0.018	
52	Wear	6.10	1.010	20	6.20	0.370	32
	Rippling	8.80	0.890		8.70	0.460	
	Ridging	5.40	0.670		5.30	0.750	
	Spitting	9.90	0.110		9.90	0.010	
53	Wear	6.80	0.920	6	6.90	0.610	30
	Rippling	8.30	1.050		8.80	0.460	
	Ridging	9.20	0.920		9.20	0.480	
	Spitting	9.90	0.111		9.90	0.018	

		Current Tartget			New Targets		
Pinion #	Distress	MEAN	Std Dev	N Size	MEAN	Std Dev	N Size
54	Wear	6.80	0.890	24	6.70	0.680	33
	Rippling	9.20	0.890		9.20	0.460	
	Ridging	8.80	0.890		8.70	0.590	
	Spitting	9.90	0.056		9.90	0.170	
55	Wear	7.00	1.000	6	6.90	0.470	32
	Rippling	9.20	0.920		9.10	0.470	
	Ridging	8.70	0.740		8.80	0.540	
	Spitting	9.90	0.111		9.90	0.031	
56	Wear	7.20	0.890	20	7.30	0.670	34
	Rippling	8.90	1.000		9.00	0.580	
	Ridging	8.60	0.670		8.50	0.560	
	Spitting	9.88	0.056		9.89	0.069	
57	Wear	5.90	0.320	10	5.90	0.300	32
	Rippling	8.20	0.890		8.60	0.620	
	Ridging	8.80	0.890		8.90	0.340	
	Spitting	9.61	0.100		9.60	0.106	
59	Wear	NEW	NEW		5.70	0.450	40
	Rippling	NEW	NEW		5.70	0.750	
	Ridging	NEW	NEW		8.20	0.610	
	Spitting	NEW	NEW		8.66	0.525	
60	Wear	NEW	NEW		7.80	0.420	33
	Rippling	NEW	NEW		8.90	0.520	
	Ridging	NEW	NEW		9.10	0.350	
	Spitting	NEW	NEW		9.90	0.017	

L37 Broken Gear Survey

Rater:_____

Gear Number	Broken	Not Broken	Not Sure
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
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16			
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25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			

L37 Broken Gear Survey

Gear Number	Broken		Not Broken		Not Sure	
1	●●●●	4	●●●	3	●	1
2	●●●●●●●	7	●	1		
3	●●●●●●	6	●●	2		
4	●●●●●●●	7	●	1		
5	●●●●●●	6	●●	2		
6	●	1	●●●●●●●	7		
7	●●●	3	●●●●	4	●	1
8	●●●●	4	●●●●	4		
9	●●●●	4	●●●	3	●	1
10	●	1	●●●●●●	6	●	1
11	●●	2	●●●●●●	6		
12			●●●●●●●●	8		
13	●	1	●●●●●●●	7		
14	●●	2	●●●●●●	6		
15	●●●●●	5	●●	2	●	1
16	●●	2	●●●●●	5	●	1
17	●●	2	●●●●●●	6		
18	●●●●●●	6	●●	2		
19	●●	2	●●●●●●	6		
20	●●●●●	5	●●	2	●	1
21	●●●●●	5	●●	2	●	1
22	●●●●●●●●	8				
23	●●●●●●●	7	●	1		
24	●●●●	4	●●	2	●●	2
25	●●●	3	●●●●	4	●	1
26	●●●●●	5	●●●	3		
27	●●●●	4	●●●	3	●	1
28	●●	2	●●●●●●	6		
29	●●●●	4	●●●●	4		
30	●●●●●	5	●●	2	●	1
31	●●●●	4	●●●●	4		
32	●●●●●●●	7	●	1		
33	●●	2	●●●●●	5	●	1
34	●●●	3	●●●●	4	●	1
35	●●●●●●●●	8				
36	●●●	3	●●●●	4	●	1
37	●●●●●	5	●●●	3		

L37 Broken Gear Survey

Gear Number	Broken		Not Broken		Not Sure	
22	●●●●●●●●	8				
35	●●●●●●●●	8				
2	●●●●●●●	7	●	1		
4	●●●●●●●	7	●	1		
23	●●●●●●●	7	●	1		
32	●●●●●●●	7	●	1		
3	●●●●●●	6	●●	2		
5	●●●●●●	6	●●	2		
18	●●●●●●	6	●●	2		
15	●●●●●	5	●●	2	●	1
20	●●●●●	5	●●	2	●	1
21	●●●●●	5	●●	2	●	1
30	●●●●●	5	●●	2	●	1
26	●●●●●	5	●●●	3		
37	●●●●●	5	●●●	3		
24	●●●●	4	●●	2	●●	2
1	●●●●	4	●●●	3	●	1
9	●●●●	4	●●●	3	●	1
27	●●●●	4	●●●	3	●	1
8	●●●●	4	●●●●	4		
29	●●●●	4	●●●●	4		
31	●●●●	4	●●●●	4		
7	●●●	3	●●●●	4	●	1
25	●●●	3	●●●●	4	●	1
34	●●●	3	●●●●	4	●	1
36	●●●	3	●●●●	4	●	1
16	●●	2	●●●●●	5	●	1
33	●●	2	●●●●●	5	●	1
11	●●	2	●●●●●●	6		
14	●●	2	●●●●●●	6		
17	●●	2	●●●●●●	6		
19	●●	2	●●●●●●	6		
28	●●	2	●●●●●●	6		
10	●	1	●●●●●●	6	●	1
6	●	1	●●●●●●●	7		
13	●	1	●●●●●●●	7		
12			●●●●●●●●	8		

L37 Broken Gear Survey

Gear Number	Broken		Not Broken		Not Sure	
22	●●●●●●●●	8				
35	●●●●●●●●	8				
2	●●●●●●●	7	●	1		
4	●●●●●●●	7	●	1		
23	●●●●●●●	7	●	1		
32	●●●●●●●	7	●	1		
3	●●●●●●	6	●●	2		
5	●●●●●●	6	●●	2		
18	●●●●●●	6	●●	2		
15	●●●●●	5	●●	2	●	1
20	●●●●●	5	●●	2	●	1
21	●●●●●	5	●●	2	●	1
30	●●●●●	5	●●	2	●	1
26	●●●●●	5	●●●	3		
37	●●●●●	5	●●●	3		
24	●●●●	4	●●	2	●●	2
1	●●●●	4	●●●	3	●	1
9	●●●●	4	●●●	3	●	1
27	●●●●	4	●●●	3	●	1
8	●●●●	4	●●●●	4		
29	●●●●	4	●●●●	4		
31	●●●●	4	●●●●	4		
7	●●●	3	●●●●	4	●	1
25	●●●	3	●●●●	4	●	1
34	●●●	3	●●●●	4	●	1
36	●●●	3	●●●●	4	●	1
16	●●	2	●●●●●	5	●	1
33	●●	2	●●●●●	5	●	1
11	●●	2	●●●●●●	6		
14	●●	2	●●●●●●	6		
17	●●	2	●●●●●●	6		
19	●●	2	●●●●●●	6		
28	●●	2	●●●●●●	6		
10	●	1	●●●●●●	6	●	1
6	●	1	●●●●●●●	7		
13	●	1	●●●●●●●	7		
12			●●●●●●●●	8		

Definition Developed by raters at last rating 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.

12.7 Consider as non-interpretable any reference or non-reference oil test that has one or more broken pinions or ring gear teeth. Note any tooth breakage in the comment section of the test report.

12.8 Rate only the corrosion on the contact surface of the drive side of any pinion or ring gear tooth. Enter the corrosion rating in the rating section of the rating form. Note any corrosion on the pinion and ring in a non-contact surface area in the comment section of the rating form.

12.9 Round test results according to Practice E29.

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.

14. Precision and Bias

14.1 *Precision*—Test precision is established on the basis of reference oil test results (for operationally valid tests) monitored by the ASTM TMC. The data are reviewed semiannually by the L-37 Surveillance Panel. Contact the ASTM TMC for current industry data. Table 1 summarizes reference oil precision of the test as of March 29, 2005.

14.1.1 *Intermediate Precision Conditions*—Conditions where test results are obtained with the same test method by the same laboratory, with the same gear batch using the same test oil, with changing conditions such as operators, measuring equipment, test stands, test engines, and time.

NOTE 6—"Intermediate precision" is the appropriate term for this test method, instead of "repeatability," which defines more rigorous within-laboratory conditions.

14.1.1.1 *Intermediate Precision Limit (i.p.)*—The difference between two results obtained under intermediate precision conditions that would, in the long run, in the normal and correct conduct of the test method, exceed the values shown in Table 1 in only one case in twenty. When only a single test result is available, the Intermediate Precision Limit can be used to calculate a range (test result ± Intermediate Precision Limit) outside of which a second test result would be expected to fall about one time in twenty.

14.1.2 *Reproducibility Conditions*—Conditions where test results are obtained with the same test method using the same gear batch on the same test oil in different laboratories with different operators using different equipment.

14.1.2.1 *Reproducibility Limit (R)*—The difference between two results obtained under reproducibility conditions that would, in the long run, in the normal and correct conduct of the test method, exceed the values shown in Table 1 in only one case in twenty. When only a single test result is available, the Reproducibility Limit can be used to calculate a range (test result ± Reproducibility Limit) outside of which a second test result would be expected to fall about one time in twenty.

14.2 *Bias*—No estimate of bias for this test method is possible because the performance results for an oil are determined only under specific conditions of the test and no absolute standards exist.

TABLE 1 Reference Oil Test Precision Data—Transformed Units

NOTE—These statistics are based on the L-37 Standard version test results obtained on Test Monitoring Center Reference Oils 151–2, 151–3, 152, and 153 as of March 29, 2005. There are no statistics for the Canadian version test at this time.

Legend:
$S_{i.p.}$ = intermediate precision standard deviation,
i.p. = intermediate precision,
S_R = reproducibility standard deviation, and
R = reproducibility.

Hardware Type	Variable	$S_{i.p.}$	i.p.[A]	S_R	R[A]
Lubrited	Pinion ridging,[B] -ln(10.5-merit)	0.2612	0.7314	0.2719	0.7613
	Pinion rippling,[B] -ln(10.5-merit)	0.2341	0.6555	0.2341	0.6555
	Pinion wear, merit	0.548	1.534	0.589	1.649
	Pinion pitting/spalling,[B] -ln(10.5-merit)	0.4038	1.1306	0.4095	1.1466
Non-lubrited	Pinion ridging,[B] -ln(10.5-merit)	0.5323	1.4904	0.5323	1.4904
	Pinion rippling,[B] -ln(10.5-merit)	0.3480	0.9744	0.3480	0.9744
	Pinion wear, merit	0.694	1.943	0.694	1.943
	Pinion pitting/spalling,[B] -ln(10.5-merit)	0.4603	1.2888	0.4603	1.2888

[A] This value is obtained by multiplying the standard deviation by 2.8.
[B] This parameter is transformed using a natural log. When comparing two test results on this parameter, first apply this transformation to each test result. Compare the absolute difference between the transformed results with the appropriate (intermediate precision or reproducibility) precision limit.

This section contains photographs representing classic cases of the different types of gear tooth distress. These photographs can be used as a guide to rate gear tooth condition.

In addition to using the rating terminology in this Manual for gear tooth condition, the terms used to indicate the severity level of deposits and/or distress are defined as:

None – Absence of distress.
Trace – Barely discernible, magnification (10x maximum) recommended.
Light – Discernible without magnification.
Medium – Easily discernible, midway between light and heavy.
Heavy – Intense or severe.
Catastrophic – Not ratable.

Scoring should be further classified by assigning a numerical percentage of the tooth area covered by the scored surface.

These definitions, along with their severity levels, will allow an individual to determine gear tooth condition using a common terminology.

Numerical Distress Rating Scales for Gears

Numerical Value	Level of Distress
10	None
9	Trace
8	Trace-Light
7	Light
6	Light-Medium
5	Medium
4	Medium-Heavy
3	Heavy
2	Heavy to Catastrophic (Up to 50% of the Gear Tooth Surface not Ratable)
1	Heavy to Catastrophic (Greater than 50% and less than 100% of the Gear Tooth Surface not Ratable)
0	Catastrophic (100% of the Gear Tooth Surface not Ratable)

This scale is intended to be used as a continuous scale with values in tenth-number increments.