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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

June 4th, 2013

Reply to:
Chris Prengaman
The Lubrizol Corporation
29400 Lakeland Blvd.
Wickliffe, OH 44092
(440) 347-4225
(440) 347-2377 (FAX)
crpr@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 15th, 2013 S.P. Meeting**

Please direct any corrections or comments to my attention.

Sincerely,

Date: 2013.06.07 11:53:11 -04'00'

Chris Prengaman, Chairman
L-37 Surveillance Panel

Report of Meeting
L-37 Surveillance Panel Meeting
Warrendale, PA
May 15th, 2013

Attendees:

Voting Members in **BOLD**
Gottwald, Thomas – Afton Chemical
Boschert, Tom – Afton Chemical
Keisler, Marc – Afton Chemical
Kearney, Bill – Afton Chemical
Dharte, John – American Axle & Manufacturing
Parke, Scott – ASTM TMC
Suresh, Arunya – BASF
Zakarian, Jack - Chevron
Guzikowski, Joe – Dana
Dewitt, Mike – Dana
Maloney, Tom – Dana
Fairchild, Scott – Dana
Mosher, Donna - Eaton
Banas, Rob – ExxonMobil
Kanga, Percy – ExxonMobil
Zreik, Khaled – General Motors
Smith, Dale – Intertek Automotive Research
Trader, Angela – Intertek Automotive Research
Barrera, Tony – Intertek Automotive Research
Prengaman, Chris – Lubrizol
Hamilton, Larry – Lubrizol
Umerley, Matt – Lubrizol
Gropp, Jerry – Lubrizol
Bubonic, Brad - Lubrizol
McGlone, Bruce – Meritor
Muransky, Troy - Meritor
Koehler, Brian – Southwest Research Institute
Jackson, Matt – Southwest Research Institute
Dwornick, Bridget – US Army RDECOM/TARDEC
Athey, Allison – Volvo

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

1.0 & 2.0 Membership and Agenda Review

It was noted that the attendance sheet has a number of mistakes on it. C. Prengaman shared that he will correct and find the more updated version for use at the next in person meeting.
No change in voting membership.

3.0 Approval of Meeting Minutes

Motion: Motion to approve prior minutes that have been posted for review on the TMC website.

1. 4/10/13 – Teleconference
2. 2/6/13 – Surveillance Panel Meeting

Approved by voice vote unanimously.

4.0 Summary of Parts Build Process

C. Prengaman shared that now that the hardware is approved and labs are running tests, in a good month, a lab can easily burn through 25 axles – so the industry can consume ~200 a month. Inventories at labs are starting to run low. Based on current build rates, it is a high probability that labs may run out of hardware.

The group had discussion over the spreadsheet that had been circulating over number of hardware built to date.

M. Dewitt Request: Verify counts of axles shipped & what remain to be built and supply back to Dana.

M. Dewitt shared that Dana was increasing some resources to allow for up to 10 axles to be built a week and will begin shipping them to the labs 10 at a time, rotating the labs each week. Every 40 units will alternate Lubrite / Non-Lubrite as has been the process.

M. Dewitt reported he would take to his management if there were other options available at Dana to build the axles quicker.

5.0 Lab Built Hardware Discussion

Discussion was had over labs being able to build their own axles using the extra gearsets built from this batch with rebuild parts and used housings. Some or all of the labs to date have been saving housings from completed tests.

C. Prengaman presented potential language changes to the procedure that would allow lab builds of this batch to occur. More detail is going to be needed for the contact pattern, the nomenclature may be Dana specific and what classifies what length and flank rating. (see attached proposal).

The labs asked if rebuild parts could be purchased from Dana – M. Dewitt will follow up to provide contact for this within Dana.

6.0 Discussion of L-37 Correction Factors - TMC

S. Parke provided an overview of the 13-1 Information Letter and the correction factor chosen for Non-lubrited, Canadian Pinion Ripple. The value chosen in transform was 0.7885 to correlate to an effective correction of a 5 to a 8. Using the current value, a merit rating of 4 will correct to a 7.5 and could be rounded up to an 8.

The group discussed this approach compared to a lower value that would bring a 5 to a 7.9 and round to a 8. A correction factor of .7566 will be used for this.

Motion: Change correction factor to 0.7566 to keep a 4 from rounding up to a 8 for non-lubrited, Canadian pinion ripple.
1st J. Zakarian 2nd D. Smith
Motion Passes : 10 Y – 0 N – 1 A

7.0 Reference Oil Discussion

152-2 Introduction & 155-1 Introduction

S. Parke presented data on the reference oil quantity available at the labs. Both 152-1 (depleted) and 155 (low) are out/in low supply.

Motion: To accept and begin use of 152-2 and 155-1 in place of 152-1 and 155 effective today. Targets will be re-calculated at 10,20 and 30 tests per the normal process.
1st 2nd C. Prengaman
Motion passes by unanimous voice vote (10-0-0)

8.0 New Business

9.0 Adjournment

Motion to adjourn .

Respectfully Submitted

Chris Prengaman

D6121 (L-37) ASTM Surveillance Panel Meeting

May 15th, 2013
10:00 am –11:00 am EST
PRI - Warrendale, PA

Agenda

1) Call to order/Agenda review

2) Membership Review

3) Approval of Meeting Minutes

1. 4/10/13 – Teleconference
2. 2/6/13 – Surveillance Panel Meeting

4) Rebuilt Hardware Update – Dana

5) Lab Rebuilt Hardware

6) Discussion of L-37 Correction Factors - TMC

7) Reference Oil Discussion

- 152-2 Introduction
- 155-1 Introduction

8) New business

9) Adjournment

Call in number → **216-706-7052 code 324160**

Lab	Total Available	2006 Housings for Maumee Build (March 2012)		Axles Shipped From Dana		Axles Received after March 2012		Axles Owed?	
		Lubrited	Non-Lubrited	Lubrited	Non-Lubrited	Lubrited	Non-Lubrited	Lubrited	Non-Lubrited
SwRI	212	105	107	90	46	40	40	65	67
Afton	229	100	119	63	48	40	40	60	79
Intertek	180	89	91	62	40	40	40	49	51
LZ	249	99	150	58	46	40	40	59	110
Total	870	393	467	273	180	160	160	233	307
		subtotal 860		subtotal 453		subtotal 320		subtotal 540	

Original PO Count 974

Remaining Housing in labs for rebuild	
SwRI	0
Afton	252
Intertek	0
LZ	90
Dana Inventory	156
sum unbuild	498
Axles received	320
axles in shipment	40
axles in inventory	498
Total Axles	858
Missing Units	**12**

Possible rebuild parts for 060AA100			
Part Number	**Description**	**Qty**	
30271	Pinion Nut	1	
42449	Pinion Seal	1	
34801 as required	Pre- Load Shim	1	
30291-1,-2,-3	Pinion Position Shim	1	
30276-1,-2,-3,-4	Diff. Shims	2	
40638	Ring Gear Screws (120-140 Lbs/Ft.)	12	
34686	Cover Gasket (Replaced by 34687)	1	
781904	Tube Cap	1	*occasionally needed
	Cover Screws (30-40 Lbs/Ft.)		
	Bearing cap (70-90 Lbs/Ft.)		
550360-1	Inner Pinion Cone (HM803146 Timken)	1	
550361-1	Inner Pinion Cup (HM803110 Timken)	1	
550358-1	Outer Pinion Cone (HM88542 Timken)	1	
550359-1	Outer Pinion Cup (HM88510 Timken)	1	
550363-1	Diff. Bearing Cup (382S Timken)	2	
550362-1	Diff. Bearing Cone (387A Timken)	2	

Current Procedure & Proposed Changes

8.2 *Preparation of Axle:*

8.2.X If required, assemble a gear unit using new V1L528/P4T883A gear sets, Dana rebuilt parts list (see appendix X) and using Dana Model 60 Maintenance Manual. Apply gear contact pattern grease on the drive and coast side of the ring. Place a 30 ± 5 lbf-ft (40.7 N•m ± 6.8 N•m) turning torque on the ring and pinion. Rotate ring and pinion through the gear contact pattern grease on the drive and coast side.

8.2.1 Record the "as received" drive side contact pattern length and flank values as noted on the axle housing from Dana Corp.[10] Length values of L^2 and L^3 and flank values of F^{-1}, F^0, and F^{+1} are considered acceptable. Note any adjustments that are made to the axle prior to testing in the comments section of the test report. Test labs pattern and report, in the test report, axle housings from prior gear batches that do not have contact pattern markings. *For V1L528/P4T883A units and If the axle is built at the test lab, determine and record values for the pattern length and flank, Only Length values of L2 and L3 and flank values of F-1, F0 and F+1 are considered acceptable.*

8.2.2 *Break and Turn Torque Measurements*—Determine and record the torques required to break and to turn the pinion shaft of the completely assembled test unit.

8.2.3 *Backlash Measurements*—Record the backlash on the test axle reported from the manufacturer. To be acceptable, the backlash reported by the manufacturer shall be between 0.004 to 0.012 in. (0.102 mm to 0.305 mm).

8.2.3.1 If the test axle does not have a reported backlash from the manufacturer, the average backlash, as measured in 8.2.3.2, shall be between 0.004 and 0.009 in. (0.102 mm to 0.229 mm).

8.2.3.2 Remove the cover plate. Measure and record backlash at four equally spaced locations. Report the average and the four readings.

8.2.X If the axle is built at the test lab, Follow Dana Model 60 Maintenance Manual6 if contact pattern or backlash needs to be adjusted.

Discussion of Application of L-37 V1L528 Correction Factors

At the December 18-19, 2012 surveillance panel meeting, TMC was instructed to compute transformed correction factors that would equate to 1, 2, and 3 demerits for use with the new V1L528 hardware.

A summary of the result, published with Information Letter 13-1, is shown on the following page.

Summary of V1L528 Correction Factors and Exclusions

Component	Hardware	Conditions	Parameter	Transformation	Additive Correction	Effective Merit Correction	Spitting Exclusion ('spitting', abbreviation of spalling/pitting)
Pinion	Nonlubrited	Standard	RIDG	-ln(10.5-x)	0.3365	1	
			RIPP	-ln(10.5-x)	0.3365	1	
			SPIT	-ln(10.5-x)			Report 4th lowest tooth
			WEAR				
Pinion	Nonlubrited	Canadian	RIDG	-ln(10.5-x)			
			RIPP	-ln(10.5-x)	0.7885	3	
			SPIT	-ln(10.5-x)			Report 4th lowest tooth
			WEAR				
Pinion	Lubrited	Standard	RIDG	-ln(10.5-x)	0.3365	1	
			RIPP	-ln(10.5-x)			
			SPIT	-ln(10.5-x)			Report 2nd lowest tooth
			WEAR				
Pinion	Lubrited	Canadian	RIDG	-ln(10.5-x)	0.5878	2	
			RIPP	-ln(10.5-x)	0.5878	2	
			SPIT	-ln(10.5-x)			Report 2nd lowest tooth
			WEAR				
Ring	Lubrited	Canadian	RIDG	-ln(10.5-x)	0.3365	1	
			RIPP	-ln(10.5-x)			
			SPIT	-ln(10.5-x)			
			WEAR				

Discussion of Application of L-37 V1L528 Correction Factors

It has been pointed out that, while the 1 and 2-merit correction factors function as intended, a problem can arise with the 3-merit correction depending on how LRI results reporting is handled.

The table on the following page shows the effects of transforming the original rating, adding the 1, 2, or 3-merit correction factor, and transforming the value back to a merit value for all ratings from 0 to 10.

1, 2, & 3 Merit Correction Factors

(for –ln(10.5-x) transformation)

Merit Rating	Transfomed	Correction Factor	Total	Back-Transformed To Merit	Delta To Original Rating	Delta To Original Rating %
10	0.6931	0.3365	1.0296	10.1	0.1	1.4%
9	-0.4055	0.3365	-0.0690	9.4	0.4	4.8%
8	-0.9163	0.3365	-0.5798	8.7	0.7	8.9%
7	-1.2528	0.3365	-0.9163	8.0	1.0	14.3%
6	-1.5041	0.3365	-1.1676	7.3	1.3	21.4%
5	-1.7047	0.3365	-1.3682	6.6	1.6	31.4%
4	-1.8718	0.3365	-1.5353	5.9	1.9	46.4%
3	-2.0149	0.3365	-1.6784	5.1	2.1	71.4%
2	-2.1401	0.3365	-1.8036	4.4	2.4	121.4%
1	-2.2513	0.3365	-1.9148	3.7	2.7	271.4%
0	-2.3514	0.3365	-2.0149	3.0	3.0	

10	0.6931	0.5878	1.2809	10.2	0.2	2.2%
9	-0.4055	0.5878	0.1823	9.7	0.7	7.4%
8	-0.9163	0.5878	-0.3285	9.1	1.1	13.9%
7	-1.2528	0.5878	-0.6650	8.6	1.6	22.2%
6	-1.5041	0.5878	-0.9163	8.0	2.0	33.3%
5	-1.7047	0.5878	-1.1169	7.4	2.4	48.9%
4	-1.8718	0.5878	-1.2840	6.9	2.9	72.2%
3	-2.0149	0.5878	-1.4271	6.3	3.3	111.1%
2	-2.1401	0.5878	-1.5523	5.8	3.8	188.9%
1	-2.2513	0.5878	-1.6635	5.2	4.2	422.2%
0	-2.3514	0.5878	-1.7636	4.7	4.7	

10	0.6931	0.7885	1.4816	10.3	0.3	2.7%
9	-0.4055	0.7885	0.3830	9.8	0.8	9.1%
8	-0.9163	0.7885	-0.1278	9.4	1.4	17.0%
7	-1.2528	0.7885	-0.4643	8.9	1.9	27.3%
6	-1.5041	0.7885	-0.7156	8.5	2.5	40.9%
5	-1.7047	0.7885	-0.9162	8.0	3.0	60.0%
4	-1.8718	0.7885	-1.0833	7.5	3.5	88.6%
3	-2.0149	0.7885	-1.2264	7.1	4.1	136.4%
2	-2.1401	0.7885	-1.3516	6.6	4.6	231.8%
1	-2.2513	0.7885	-1.4628	6.2	5.2	518.2%
0	-2.3514	0.7885	-1.5629	5.7	5.7	

Discussion of Application of L-37 V1L528 Correction Factors

The row displaying the final, back-transformed value of 8.0 is highlighted. Note that all figures are shown complying with the data dictionary field lengths (shown on following page).

Note that for the 3-merit correction, the final reported test result for an original rated value of 4 will be 7.5.

TEST METHOD D6121
L-37
Form 1
Test Result Summary Sheet

Oil Test			
Lab: CC	Stand: CCCCC		Stand Run : CCCC
Start Date: YYYYMMDD	Date Completed: YYYYMMDD	EOT Time: HH:MM	Test Length: HH:MM
TMC Oil Code: CCCCCC	Laboratory Oil Code: CCCCCCCCCCCCCCCCCCC		Viscosity Grade: CCCCCCC
Oil Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC			
Formulation Stand Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC			
Latest Information Letter Test Was Run Under: CCCCCCCC			
Test Hardware: CCCCCCCCCCC	Test Version: CCCCCCCC		
Pinion Batch: CCCCCCCC	Ring Batch: CCCCCCCC		

Last Reference Oil Calibrating Stand Information - Fill Out For Non-reference Oil Tests Only			
Stand: CCCCC	Stand Run: CCCC	TMC Oil Code: CCCCCC	Date Completed: YYYYMMDD
Pinion Batch: CCCCCCCC		Ring Batch: CCCCCCCC	
Test Hardware: CCCCCCCCCCC		Test Version: CCCCCCCC	

	Ring Gear Results				
	Wear	**Rippling**	**Ridging**	**Pitting/Spalling**	**Scoring**
Original Merit Results [C]	S12	S12	S12	S12.1	S12
Transformed Results	S12.1234	S12.1234	S12.1234	S12.1234	S12.1234
Correction Factor	S12.1234	S12.1234	S12.1234	S12.1234	S12.1234
Corrected Transformed Results	S12.1234	S12.1234	S12.1234	S12.1234	S12.1234
Severity Adjustment [A]	S12.1234	S12.1234	S12.1234	S12.1234	S12.1234
Final Transformed Results	S12.1234	S12.1234	S12.1234	S12.1234	S12.1234
Final Merit Results	S12.1	S12.1	S12.1	S12.1	S12.1

	Pinion Gear Results				
	Wear	**Rippling**	**Ridging**	**Pitting/Spalling**	**Scoring**
Original Merit Results [B,C]	S12	S12	S12	S12.1	S12
Transformed Results	S12.1234	S12.1234	S12.1234	S12.1234	S12.1234
Correction Factor	S12.1234	S12.1234	S12.1234	S12.1234	S12.1234
Corrected Transformed Results	S12.1234	S12.1234	S12.1234	S12.1234	S12.1234
Severity Adjustment [A]	S12.1234	S12.1234	S12.1234	S12.1234	S12.1234
Final Transformed Results	S12.1234	S12.1234	S12.1234	S12.1234	S12.1234
Final Merit Results	S12.1	S12.1	S12.1	S12.1	S12.1

[A] AT THE PRESENT TIME THERE ARE NO SEVERITY ADJUSTMENTS
[B] WITH ANY APPLICABLE EXCLUSIONS APPLIED
[C] IF TOOTH BREAKAGE OCCURS, LEAVE RESULTS BLANK AND REPORT IN COMMENT SECTION

Discussion of Application of L-37 V1L528 Correction Factors

The specification limit for J2360 is given as “8 or greater” (see following page).

The GL forms used for LRI do not include instructions for rounding test results or a data dictionary to define field lengths.

The question has been asked whether giving the pass limit as “8” and not “8.0”, carries with it any implication that results reported to LRI for J2360 consideration ought to be rounded to a whole number.

Discussion of Application of L-37 V1L528 Correction Factors

J2360 L-37 Specification

3.3.6.1 Gear Distress – Low-Speed and High-Torque Conditions

Satisfactory performance shall be demonstrated when the oil is tested in accordance with ASTM D 6121 (L-37) using untreated and phosphate-treated gear assemblies and prevents gear-tooth ridging, rippling, pitting, welding, spalling, excessive wear or other surface distress and objectionable deposits and does not produce excessive wear, pitting or corrosion of bearing rollers, or races under conditions of high-speed, low-torque and low-speed, high-torque. The oil shall meet the criteria in Table 3. For grades SAE 70W, 70W-xx, 75W and 75W-xx oils, the test shall be modified such that the gear conditioning portion of the test shall start at a temperature of 104 °C and the gear test phase shall be start at a temperature of 93 °C (i.e. Canadian Version).

TABLE 3 – ASTM D 6121 (L-37) TEST LIMITS

Category	ASTM Rating	Comments
Ridging	8 or greater	Compare overall appearance to closest gear on rating board
Rippling	8 or greater	Same as above
Wear	5 or greater	Same as above
Spalling/ Pitting	9.3 or greater	At heel end of pinion tooth only—elsewhere not allowed
Scoring	10	Not allowed

Discussion of Application of L-37 V1L528 Correction Factors

If a 3-merit corrected RIPPFNL value reported in the ASTM test report to one decimal place as 7.5 is rounded to a whole number for LRI reporting, it will round to 8 (a passing result).

This would mean that the rated value necessary to pass is 4 merits, not 5.

Recall that the surveillance panel's intent was to derive a transformed correction factor that would move a 5 to an 8, not a 4 to an 8.

Discussion of Application of L-37 V1L528 Correction Factors

How to address this?

The 3-merit correction factor could be reduced to ensure that the corrected value of an original 4 would never exceed 7.5.

Revising the correction of 0.7885 downward to 0.7566 would do this (see following page).

Discussion of Application of L-37 V1L528 Correction Factors

Revised 3 Merit Correction Factor

(for –ln(10.5-x) transformation)

Merit Rating	Transfomed	Correction Factor	Total	Back-Transformed To Merit	Delta To Original Rating	Delta To Original Rating %
10	0.6931	0.7566	1.4497	10.3	0.3	2.7%
9	-0.4055	0.7566	0.3511	9.8	0.8	8.8%
8	-0.9163	0.7566	-0.1597	9.3	1.3	16.6%
7	-1.2528	0.7566	-0.4962	8.9	1.9	26.5%
6	-1.5041	0.7566	-0.7475	8.4	2.4	39.8%
5	-1.7047	0.7566	-0.9481	7.9	2.9	58.4%
4	-1.8718	0.7566	-1.1152	7.4	3.4	86.2%
3	-2.0149	0.7566	-1.2583	7.0	4.0	132.7%
2	-2.1401	0.7566	-1.3835	6.5	4.5	225.6%
1	-2.2513	0.7566	-1.4947	6.0	5.0	504.2%
0	-2.3514	0.7566	-1.5948	5.6	5.6	

Discussion of Application of L-37 V1L528 Correction Factors

This approach *requires* rounding test results to one decimal in order for a rated 5 to pass (unrounded, the 5 becomes 7.9).

Discussion of Application of L-37 V1L528 Correction Factors

Unresolved is whether it is desirable/appropriate/intended/permitted to round results to a whole number for LRI reporting.

Shown on the following page are RIDG correction factors used for the V1L686 hardware batch.

V1L686 RIDG Correction Factors

Standard Conditions

(for –ln(10.5-x) transformation)

Merit Rating	Transfomed	Correction Factor	Total	Back-Transformed To Merit	Delta To Original Rating	Delta To Original Rating %
10	0.6931	0.5186	1.2117	10.2	0.2	2.0%
9	-0.4055	0.5186	0.1131	9.6	0.6	6.7%
8	-0.9163	0.5186	-0.3977	9.0	1.0	12.6%
7	-1.2528	0.5186	-0.7342	8.4	1.4	20.2%
6	-1.5041	0.5186	-0.9855	7.8	1.8	30.3%
5	-1.7047	0.5186	-1.1861	7.2	2.2	44.5%
4	-1.8718	0.5186	-1.3532	6.6	2.6	65.8%
3	-2.0149	0.5186	-1.4963	6.0	3.0	101.2%
2	-2.1401	0.5186	-1.6215	5.4	3.4	172.0%
1	-2.2513	0.5186	-1.7327	4.8	3.8	384.4%
0	-2.3514	0.5186	-1.8328	4.2	4.2	

V1L686 RIDG Correction Factors

Canadian Conditions

(for –ln(10.5-x) transformation)

Merit Rating	Transfomed	Correction Factor	Total	Back-Transformed To Merit	Delta To Original Rating	Delta To Original Rating %
10	0.6931	0.6065	1.2996	10.2	0.2	2.3%
9	-0.4055	0.6065	0.2010	9.7	0.7	7.6%
8	-0.9163	0.6065	-0.3098	9.1	1.1	14.2%
7	-1.2528	0.6065	-0.6463	8.6	1.6	22.7%
6	-1.5041	0.6065	-0.8976	8.0	2.0	34.1%
5	-1.7047	0.6065	-1.0982	7.5	2.5	50.0%
4	-1.8718	0.6065	-1.2653	7.0	3.0	73.9%
3	-2.0149	0.6065	-1.4084	6.4	3.4	113.7%
2	-2.1401	0.6065	-1.5336	5.9	3.9	193.3%
1	-2.2513	0.6065	-1.6448	5.3	4.3	432.0%
0	-2.3514	0.6065	-1.7449	4.8	4.8	

Discussion of Application of L-37 V1L528 Correction Factors

Whether a 6 standard/5 Canadian test passes depends on how results are rounded for LRI reporting.

What has been lab practice for this hardware?

What is desirable/appropriate/intended/permitted?

Initials*	Name	Voting Status	Company Name & Address	Phone/Email Info
AA	Athey, Allison	Voting	Volvo GGT 13302 Pennsylvania Avenue Hagerstown, Maryland 21740	Phone: 301-573-5684 Fax: E-Mail: allison.athey@volvo.com
RCB	Banas, Rob	Voting	ExxonMobil Fuels, Lubriacnts & Specialties 114 Arcadia Park Dr. Canton, GA 30114	Phone: 678-493-3930 Fax: E-Mail: rob.a.banas@exxonmobil.com
	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
TCB	Boschert, Tom	Non Voting	Afton Chemical 500 Spring Street Richmond, VA 23219	Phone: 804-788-5202 Fax: E-Mail: tom.boschert@aftonchemical.com
	Bubonic, Brad	Non Voting	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092	Phone: 440-347-5325 Fax: E-Mail: brad.bubonic@lubrizol.com
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