27. L-37 LTMS Requirements

The following are the specific L-37 calibration test requirements.

A. Reference Oils and Parameters

The critical parameters are Pinion Ridging, Pinion Rippling, Pinion Pitting/Spalling, Pinion Wear, and Pinion Scoring. The reference oils required for test stand and test laboratory calibration are reference oils accepted by the ASTM L-37 Surveillance Panel. The means and standard deviations for the current reference oils for each critical parameter are presented below.

RIDGING
Unit of Measure: Merits

Hardware	Pinion Batch	Reference Oil	Mean	Standard Dev.	Acceptance Band
LUBRITED	L247	128-1	7.40	0.516	6 - 8
		151-3	8.80	0.422	8 - 10
		155	9.00	0.000	9 - 9
	V1L686	128-1	6.35	0.813	5 - 8
		151-3	6.43	1.207	4 - 9
		152	5.25	0.500	4 - 6
		153	5.00	0.000	5 - 5
		155	7.00	0.000	7 - 7
NONLUBRITED	V1L417	151-3	9.47	0.507	9 - 10
		152	9.17	0.408	8 - 10
		152-1	9.47	0.640	8 - 10
		153	9.00	0.816	8 - 10
		153-1	8.80	0.616	8 - 10
		155	9.50	0.527	9 - 10
	V1L500	152-1	8.85	0.689	8 - 10
		155	9.07	0.594	8 - 10

RIPPLING
Unit of Measure: Merits

Hardware	Pinion Batch	Reference Oil	Mean	Standard Dev.	Acceptance Band
LUBRITED	L247	128-1	7.60	1.075	6 - 10
		151-3	8.60	0.516	8 - 10
		155	8.00	0.000	8 - 8
	V1L686	128-1	7.20	1.473	5 - 10
		151-3	8.71	0.463	8 - 10
		152	8.25	0.500	7 - 9
		153	8.00	0.000	8 - 8
		155	9.00	0.000	9 - 9
NONLUBRITED	V1L417	151-3	9.33	0.606	8 - 10
		152	9.17	0.408	8 - 10
		152-1	9.40	0.507	8 - 10
		153	8.25	0.500	7 - 9
		153-1	8.90	0.447	8 - 10
		155	9.60	0.516	9 - 10
	V1L500	152-1	9.39	0.506	8 - 10
		155	9.33	0.488	8 - 10

PITTING/SPALLING
Unit of Measure: Merits

Hardware	Pinion Batch	Reference Oil	Mean	Standard Dev.	Acceptance Band
LUBRITED	L247	128-1	9.02	0.892	7 - 10
		151-3	9.49	0.586	8 - 10
		155	9.30	0.000	9.3 - 9.3
	V1L686	128-1	9.77	0.421	9 - 10
		151-3	9.68	0.632	9 - 10
		152	9.53	0.359	9 - 10
		153	9.30	0.424	9 - 10
		155	9.90	0.000	9.9 - 9.9
NONLUBRITED	V1L417	151-3	9.71	1.080	8 - 10
		152	9.90	0.000	9.9 - 9.9
		152-1	9.44	1.782	6 - 10
		153	9.88	0.050	9.8 - 10
		153-1	9.89	0.049	9.8 - 10
		155	9.90	0.040	9.8 - 10
	V1L500	152-1	9.89	0.028	9.8 - 9.9
		155	9.84	0.124	9.6 - 10

WEAR
Unit of Measure: Merits

Hardware	Pinion Batch	Reference Oil	Mean	Standard Dev.	Acceptance Band
LUBRITED	L247	128-1	5.80	0.422	5 - 7
		151-3	6.00	0.000	6 - 6
		155	6.00	0.000	6 - 6
	V1L686	128-1	6.40	0.598	5 - 7
		151-3	6.57	0.598	5 - 8
		152	6.25	0.500	5 - 7
		153	5.50	0.707	4 - 7
		155	7.00	0.000	7 - 7
NONLUBRITED	V1L417	151-3	8.00	0.587	7 - 9
		152	8.00	0.632	7 - 9
		152-1	8.00	0.378	7 - 9
		153	7.50	0.577	6 - 9
		153-1	7.55	0.605	6 - 9
		155	8.00	0.289	7 - 9
	V1L500	152-1	7.46	0.519	7 - 8
		155	7.47	0.516	7 - 8

SCORING
Non-lubrited & Lubrited Test Hardware
Unit of Measure: Merits

At the present time, no targets are available for Scoring. As a result, Pinion Scoring cannot be charted. However, the TMC will monitor the reporting of scoring values for results that are different from 10.00 and report occurrences to the surveillance panel. Any reference oil test exhibiting Pinion Scoring less than 10.00 is unacceptable for calibration.

B. Acceptance Criteria

1. New Stand

- A minimum of three (3) operationally valid calibration tests must be conducted with results falling within the acceptance bands. Two of the three tests are to be conducted on either non-lubrited or lubrited hardware (laboratory choice). The remaining test is to be conducted on the other type of hardware.

- Reference oil assignment is dependent on hardware and gear batch selection by the laboratory. See Section 3 below for approved gear batches and oil assignments.

- All operationally valid calibration test results must be charted to determine if the test stand is currently "in control" as defined by the control charts from the Lubricant Test Monitoring System. Note that non-lubrited and lubrited hardware test results are charted separately.

2. Existing Test Stand

- The test stand must have previously been accepted into the system by meeting LTMS calibration requirements.

- All operationally valid calibration test results on approved hardware and reference oils, as outlined in Section 3 below, must be charted to determine if the test stand is currently "in control" as defined by the control charts from the Lubricant Test Monitoring System. Note that non-lubrited and lubrited hardware test results are charted separately.

- Alternate lubrited and non-lubrited hardware with each reference oil calibration sequence.

3. Reference Oil Assignment

Once test stands have been accepted into the system, the TMC will assign reference oils for continuing calibration according to the following reference oil mix:

Test Hardware	Pinion/Ring Batch	Reference Oil	Assignment Frequency
Lubrited	C1L308/P4L309R	128-1	100%
		128-2	
	C1L426/P4L404A	128-1	100%
		128-2	
	V1L303/P4L514A	128-1	100%
		128-2	
	V1L686/P4L626A	128-1	25%
		128-2	
		155	25%
		152	25%
		153	25%
	L247/T758A	128-1	33.3%
		128-2	33.3%
		155	33.3%
Non-Lubrited	C1L308/P4L318R	128-1	100%
		128-2	
	C1L426/P4L415A	128-1	100%
		128-2	
	V1L303/P4L514A	128-1	100%
		128-2	
	V1L686/P4L626A	128-1	50%
		128-2	
		155	50%
		155	
	V1L176/P4L741A	128-1	50%
		128-2	
		155	50%
	V1L351/P4T771	155	50%
		152	25%
		153	25%
	V1L417/P4L792	155	50%
		152	25%
		153	25%
	V1L500/P4T813	152-1	25%
		153-1	25%
		155	50%

4. Control Charts.

In Section 1, the construction of the control charts that constitute the Lubricant Test Monitoring System is outlined. The constants used for the construction of the control charts for the L-37, and the response necessary in the case of control chart limit alarms, are depicted below. Note that control charting all critical parameters is required.

LUBRICANT TEST MONITORING SYSTEM CONSTANTS

		EWMA Chart				Shewhart Chart	
		LAMBDA		K		K	
Chart Level	Limit Type	Precision	Severity	Precision	Severity	Precision	Severity
Stand	Warning	0.2	--	2.24	--	--	1.80
	Action	0.2	0.2	2.81	1.96	2.10	1.80
Lab	Action	0.2	0.2	2.81	3.03	--	1.80
Industry	Warning	0.2	0.2	2.24	2.49	--	--
	Action	0.2	0.2	2.88	3.03	--	--

The following are the steps that must be taken in the case of exceeding control chart limits.

- Exceed EWMA test stand chart action limit for precision
  - Remove test stand from the system. Notify the TMC. Correct test stand precision problem. Follow requirements for entry of a new test stand into the system.
- Exceed EWMA test stand chart warning limit for precision
  - Immediately begin two calibration tests on the test stand.
- Exceed Shewhart test stand chart limit for precision
  - Conduct an additional calibration test.
- Exceed EWMA laboratory chart limit for precision or severity
  - Notify the TMC for guidance.

- Exceed EWMA test stand chart action limit for severity

  – Calculate test stand Severity Adjustment (SA) for each parameter that exceeds action limit, using the current test stand EWMA (Z_i) as follows:

    Non-lubrited Test Hardware:

Ridging:	$SA = (-Z_i) \times (0.666)$
Rippling:	$SA = (-Z_i) \times (0.557)$
Pitting/Spalling:	$SA = (-Z_i) \times (0.847)$
Wear:	$SA = (-Z_i) \times (0.713)$

    Lubrited Test Hardware:

Ridging:	$SA = (-Z_i) \times (1.430)$
Rippling:	$SA = (-Z_i) \times (0.476)$
Pitting/Spalling:	$SA = (-Z_i) \times (0.579)$
Wear:	$SA = (-Z_i) \times (0.519)$

Confirm calculations with the TMC.

  – SA calculations are for information purposes only.

- Result outside acceptance band

  – Conduct an additional calibration test.

The following industry issues are handled by the TMC and do not require individual laboratory action.

- Exceed EWMA industry chart action limit

  – TMC to notify surveillance panel chairman. Meeting of the TMC and the surveillance panel required to determine course of action.

- Exceed EWMA industry chart warning limit

  – TMC to notify surveillance panel chairman. Coordination of TMC and surveillance panel required to discuss potential problem.

L-37 Reference Oil Targets																	
						Ridging			Rippling			Spitting			Wear		
Hardware	Pinion Batch	Oil	n	From	To	x	s	Bands	x	s	Bands	x	s	Bands	x	s	Bands
LUBRITED	C1L308	128	15	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	6.35	0.813	5 - 8	7.20	1.473	5 - 10	9.77	0.421	9 - 10	6.40	0.598	5 - 7
		151-3	21	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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

L-37 Reference Oil Targets																	
						Ridging			Rippling			Spitting			Wear		
Hardware	Pinion Batch	Oil	n	From	To	x	s	Bands	x	s	Bands	x	s	Bands	x	s	Bands
		151-3	14	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	30	19000101	***	9.47	0.507	9 - 10	9.33	0.606	8 - 10	9.71	1.080	8 - 10	8.00	0.587	7 - 9
		152	6	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	9.50	0.527	9 - 10	9.60	0.516	9 - 10	9.90	0.040[2]	9.8 - 10	8.00	0.289[2]	7 - 9
	V1L500	152-1	13	19000101	***	8.85	0.689	8 - 10	9.39	0.506	8 - 10	9.89	0.028	9.8 - 9.9	7.46	0.519	7 - 8
		155	15	19000101	***	9.07	0.594	8 - 10	9.33	0.488	8 - 10	9.84	0.124	9.6 - 10	7.47	0.516	7 - 8
	V1L686	127	9	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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	19000101	***	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

1 *** = currently in effect

2 Values adjusted from actual data per 20110511 Surveillance Panel action.

APPENDIX B

HISTORY OF INDUSTRY CORRECTION FACTORS
APPLICABLE TO LTMS DATA

Test Area	Effective	Description
IIIF	None	None
IIIG	None	None
IIIGA	None	None
IIIGB	July 24, 2009	Add 1.61 to PHOS
IVA	None	None
VG	July 1, 2005	For Fuel Batch TF2221LS20, Add 0.19 to AEV; Add 2.175 to AES and divide by 1.192 Add 0.54 to APV; Add 0.627 to RCS and divide by 1.041
VG	November 10, 2007	For Fuel Batch TF2221LS20, Add 0.12 to AEV; Add 0.42 to AES ; Add 0.39 to APV; Add 0.23 to RCS
VG	May 26, 2009	For Fuel Batch XC2721NX10, Add 3.011 to AEV and divide by 1.356; Add 1.325 to APV and divide by 1.207
VG	October 1, 2009	For Fuel Batch XC2721NX10, Subtract 0.24 from APV; subtract 0.12 from AEV.
VIB	None	None
VID	None	None
VIII	None	None
1M-PC	None	None
1K	None	None
1N	May 1, 2004	Add -1.135 to ln(TLHC+1)
1P	None	None
1R	None	None
C13	None	None
ISB	None	None
ISM	June 28, 2007	Add +1.7 to Crosshead Wear At 3.9% Soot Add +19.1 to Injector Adjusting Screw Wear At 3.9% Soot
T-8	None	None
T-8E	None	None
T-10A	None	None
T-11	September 14, 2005	Add -0.39% to Soot @ 12cSt Vis. Inc., Add 1274 cP to MRV Vis.
T-11	December 6, 2005	Add -0.36% to Soot @ 12cSt Vis. Inc., Add 713 cP to MRV Vis.
T-11	March 24, 2006	Add -0.35% to Soot @ 12cSt Vis. Inc., Add 956 cP to MRV Vis.

HISTORY OF INDUSTRY CORRECTION FACTORS
APPLICABLE TO LTMS DATA (continued)

T-12	Batch R Piston Ring & Cylinder Liner Hardware	Multiply Average Cylinder Liner Wear by 0.58
	SWTN Hardware Completed On or Before May 18,2011	Multiply Average Top Ring Weight Loss by 0.95
		Multiply Average Cylinder Liner Wear by 0.86
		$\Delta Lead_{Final}$ = exp[(ln(ΔLead) x 0.95)]
		$\Delta Lead\ (250\text{-}300)_{Final}$ = exp[(ln(ΔLead 250-300) x 1.03)]
		OC = exp[(ln($OC_{100\text{-}300}$) x 0.96)]
	SWTN Hardware Completed On or After May 19,2011	Multiply Average Top Ring Weight Loss by 0.92
		Multiply Average Cylinder Liner Wear by 0.83
		$\Delta Lead_{Final}$ = exp[(ln(ΔLead) x 0.92)]
		$\Delta Lead\ (250\text{-}300)_{Final}$ = exp[(ln(ΔLead 250-300) x 0.93)]
		OC = exp[(ln($OC_{100\text{-}300}$) x 0.95)]
RFWT	None	None
EOAT	None	None
L-33-1	None	None
L-37	None	None
L-42	None	None
L-60-1	None	None
HTCT	None	None
OSCT	None	None

APPENDIX C

HISTORY OF SEVERITY ADJUSTMENT (SA)
STANDARD DEVIATIONS

Test	Parameter	s	Effective Dates	
			From	To
Sequence IIIF	VIS80	0.0129546	20000610	***
	APV	0.220	20000610	***
	WPD	0.658	20000610	***
	VIS60	0.17334	20011115	***
Sequence IIIG	PVIS	0.2919	20030501	***
	WPD	0.60	20030501	***
	ACLW	0.1936	20030501	20040120
		0.1903	20040121	***
Sequence IIIGA	MRV Viscosity	0.30763	20031103	20040526
Sequence IIIGB	Phos. Retention	2.33	20081112	***
Sequence IVA	ACW	9.47	19980819	20010524
		12.50	20010525	20050630
		12.52	20050701	***
Sequence VG	AES	0.61	19980916	19990531
		0.68	19990601	19991115
		0.55	19991116	20000524
		0.51	20000525	20001116
		0.47	20001117	20041231
		0.45	20050101	***
	RCS	0.56	19980916	19990531
		0.32	19990601	19991115
		0.28	19991116	20000524
		0.24	20000525	20001116
		0.33	20001117	20041231
		0.25	20050101	***
	AEV	0.23	19980916	19990531
		0.10	19990601	19991115
		0.11	19991116	20000524
		0.10	20000525	20001116
		0.09	20001117	20041231
		0.10	20050101	***
	APV	0.32	19980916	19990531
		0.26	19990601	19991115
		0.17	19991116	20000524
		0.18	20000525	20001116
		0.17	20001117	20041231
		0.20	20050101	***
	OSCRNSLG	27.34	19980916	19990531
		18.10	19990601	19991115
		3.40	19991116	20000524
		0.828[1]	20000525	20001116
		0.742[1]	20001117	20041231
		0.793[1]	20050101	***

1 Transformation ln(OSCRNSLG + 1) adopted 20000525.

HISTORY OF SEVERITY ADJUSTMENT (SA)
STANDARD DEVIATIONS (Continued)

Test	Parameter	s	Effective Dates	
			From	To
Sequence VIB	FEI1	0.18	19980825	***
	FEI2	0.17	19980825	***
Sequence VID	FEI1	0.14	20090422	20091202
	FEI2	0.16	20090422	20091202
	FEI1	0.12	20091203	***
	FEI2	0.14	20091203	***
Sequence VIII	TBWL	3.40	19980829	19991116
		5.28	19991117	20020205
		4.80	20020206	***
	10hr. Stripped Vis.	None	--	--
1M-PC	WTD	50.5	19930914	***
	TGF	16.1	19930914	***
1K	WDK	35.6	19900506	***
	TGF	15.7	19900506	***
	TLHC	1.1	19900506	***
	OC	None	--	--
1N	WDN	27.1	19930314	***
	TGF	14.6	19930314	***
	TLHC	0.9	19930314	***
	OC	None	--	--
1P	TGC	7.740	19970219	***
	TLC	13.150	19970219	***
	AOC	0.3238	19970219	***
	WDP	57.60	19970219	***
	EOTOC	0.5177	19970219	***
1R	WDR	29.0	20010701	***
	TGC	9.70	20010701	***
	TLC	7.84	20010701	***
	IOC	1.32	20010701	***
	EOTOC	1.35	20010701	***
C13	TGC	None	--	--
	TLC	None	--	--
	OCΔ	None	--	--
	R2TC	None	--	--
ISB	Camshaft Wear	None	--	--
	Tappet Wt. Loss	None	--	--
ISM	X-Head Wear	None	--	--
	OFDP	None	--	--
	Average Sludge	None	--	--
	Adj. Screw Wear	None	--	--
T-8	Vis. Inc. @ 3.8%	1.19	19940401	19960930
	Vis. Inc. @ 3.8%	0.93	19961001	19990131
	Vis. Inc. @ 3.8%	0.90	19990201	***

HISTORY OF SEVERITY ADJUSTMENT (SA)
STANDARD DEVIATIONS (Continued)

Test	Parameter	s	Effective Dates	
			From	To
T-8E	Rel. Vis. @ 4.8% 50% DIN Shear	0.26	19970127	***
	Rel. Vis. @ 4.8% 100% DIN Shear	0.27	20020306	***
T-10A	MRV Viscosity	511	20001201	20020115
		643	20020116	20020924
		496	20020925	20030121
		497	20030122	***
T-11	Soot@4.0 cSt Vis	0.23	20050528	***
	Soot@12.0 cSt Vis	0.21	20030308	***
	Soot@15.0 cSt Vis	0.26	20050528	***
	MRV Viscosity	1097	20030308	***
T-12	Cyl. Liner Wear	1.6	20050219	***
	Top Ring Wt. Loss	24.9	20050219	***
	Oil Consumption	0.0610	20050219	***
	ΔPB @ EOT	0.2880	20050219	***
	ΔPB 250-300 h	0.3630	20050219	***
RFWT	Ave. Wear	0.08	19930527	19941016
	Ave. Wear	0.05	19941017	19950625
	Ave. Wear	0.04	19950626	***
EOAT	Average Aeration	0.25	19990101	***
T-12A	MRV Viscosity	331	20100216	***
L-33-1	Rust	0.350	20020611	***
L-37 Nonlubrited	Pinion Ridging	0.666	19000101	***
	Pinion Rippling	0.557	19000101	***
	Pinion Spitting	0.847	19000101	***
	Pinion Wear	0.713	19000101	***
L-37 Lubrited	Pinion Ridging	1.430	19000101	***
	Pinion Rippling	0.476	19000101	***
	Pinion Spitting	0.579	19000101	***
	Pinion Wear	0.519	19000101	***

HISTORY OF SEVERITY ADJUSTMENT (SA)
STANDARD DEVIATIONS (Continued)

Test	Parameter	s	Effective Dates	
			From	To
L-42	% Scoring	None	--	--
L-60-1	Vis. Inc.	0.15	19940603	20050420
		0.08	20050421	***
	Pentane	0.73	19940603	20050420
		0.20	20050421	***
	Carbon/Varnish	0.45	19940603	20050420
		0.44	20050421	***
	Sludge	0.16	19940603	***
	Toluene	0.75	19940603	20050420
		0.34	20050421	***
HTCT	Cycles	None	--	--
OSCT	Elongation	None	--	--
	Shore Hardness	None	--	--
	Volume Change	None	--	--