



Test Monitoring Center

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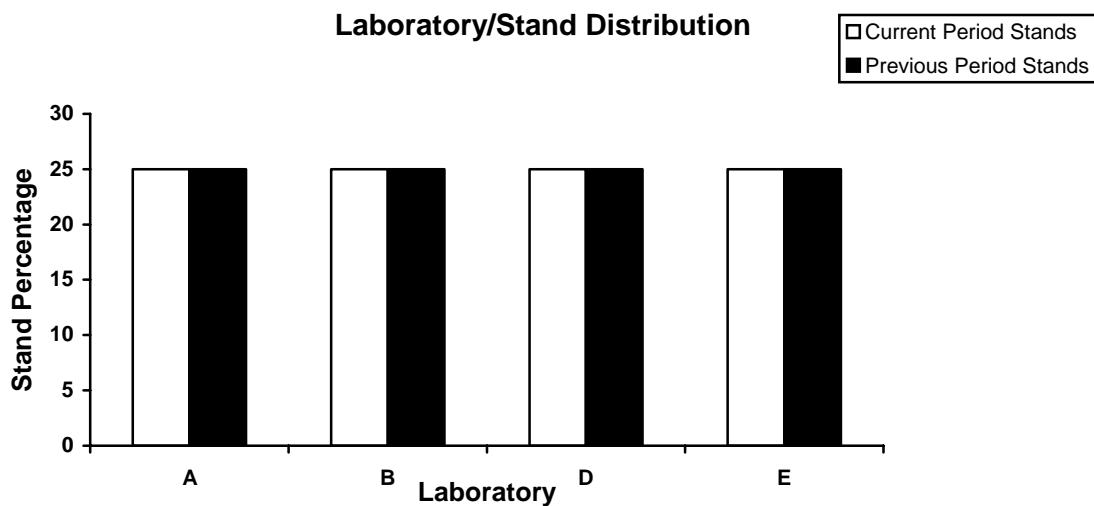
MEMORANDUM: 03-048
DATE: April 28, 2003
TO: Don Bartlett, Chairman, L-37 Surveillance Panel
FROM: Donald Lind
SUBJECT: L-37 Reference Test Status from October 1, 2002 through March 31, 2003

The following is a summary of the L-37 reference oil tests that were reported to the Test Monitoring Center during the period October 1, 2002 through March 31, 2003.

Lab/Stand Distribution

	Reporting Data	Calibrated as of 3/31/03
Number of Laboratories	4	3
Number of Stands	4	3

The following chart shows the laboratory/stand distribution:



The following summarizes the status of the reference oil tests reported to the TMC:

	TMC Validity Codes	Number of Tests
Operationally and Statistically Acceptable	AC	11
Failed Acceptance Criteria	OC	4
Operationally Invalid (Lab Judgment)	LC	0
Not Acceptable For Intended Purpose	MC	0
Aborted	XC	0
Total		15

Lubrited Hardware

There were seven operationally valid reference tests conducted on lubrited hardware. Three on gear batch VL303/P4L514A, three on gear batch V1L686/P4L626A and one on gear batch C1L308/P4L309R. Two of the tests on gear batch VL303/P4L514A were operationally and statistically acceptable and one failed the acceptance criteria. The three tests on gear batch V1L686/P4L626A and one test on gear batch C1L308/P4L309R were operationally and statistically acceptable.

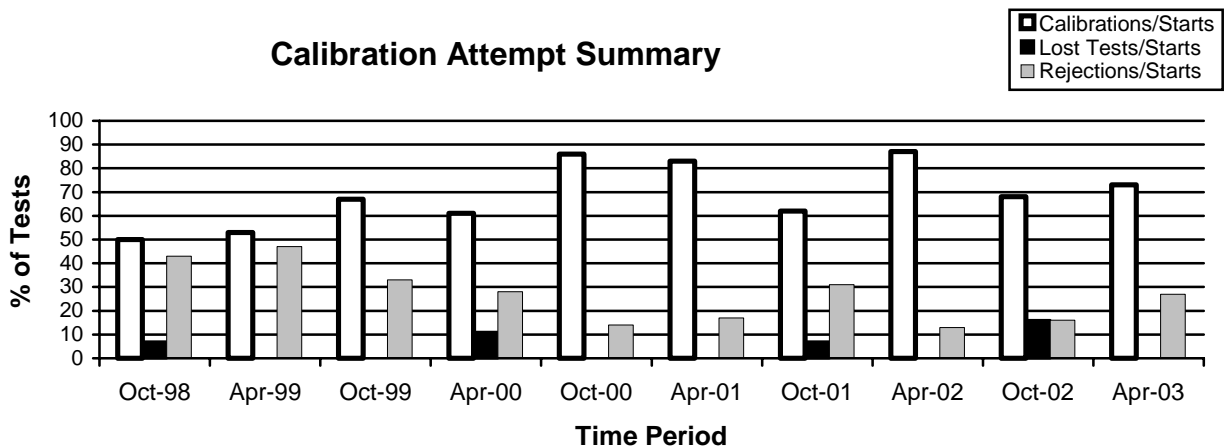
Non-lubrited Hardware

There were eight operationally valid reference tests conducted on non-lubrited hardware, three on gear batch V1L686/P4L626A and five on gear batch V1L176/P4L741A. Two of the tests conducted on gear batch V1L686/P4L626A were operationally and statistically acceptable and one test failed the acceptance criteria. Three of the tests conducted on gear batch V1L176/P4L741A were operationally and statistically acceptable and two tests failed the acceptance criteria.

Additional Tests

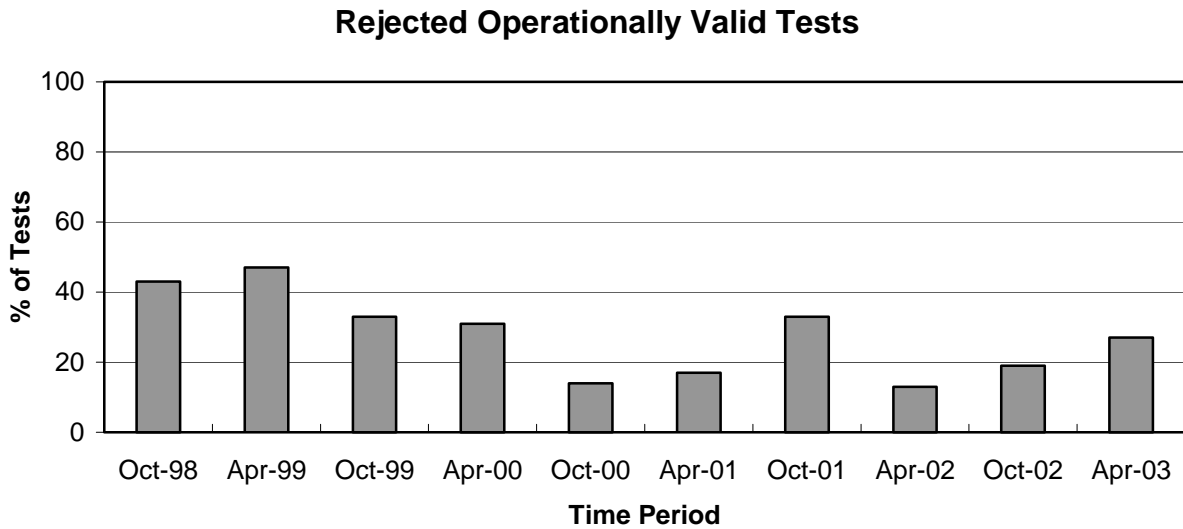
There were 10 additional tests conducted this report period. Nine of the tests were conducted on non-lubrited hardware, gear batch C1L308/P4L318R for evaluation of reference oil 151-3. The additional test was run as a stand check.

Calibrations per start, lost tests per start and rejection per start rates are summarized below:



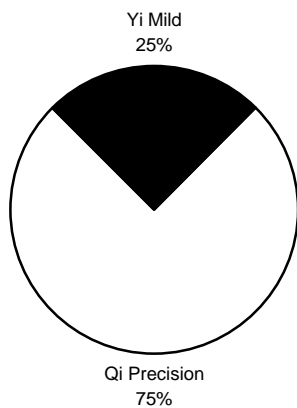
The calibration per start and rejected test per start rates have increased slightly when compared to the previous period. The lost tests per start rate has decreased with respect to the previous period.

The operationally valid statistically rejected test rate, as shown below, indicates an increase with respect to the previous period.

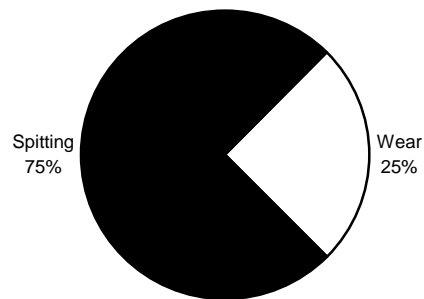


A detailed list of reasons tests failed the acceptance criteria is shown in Table 1. The following charts summarize these reasons with a breakdown by parameter of the failed tests.

Distribution of LTMS Stand Alarms



Distribution of Stand Alarms by Parameter



No LTMS deviations were written this period. There have been no LTMS deviations written in previous report periods.

Severity and Precision

The mean Δ/s by gear batch, overall mean Δ/s , and shift in merits for the operationally and statistically valid calibration tests reported this period are tabulated below for lubrified and non-lubricated hardware.

LUBRICATED HARDWARE						
Parameter	Gear Batch	N	Δ/s	s^D	Overall Δ/s	Overall Shift In Merits
Ridging	V1L686/P4L626A	3	-0.23	0.45	-0.85	-0.91 ^{A,C}
	V1L303/P4L514A	3	-1.80	0.00		
	C1L308/P4L309R	1	0.16	---		
Rippling	V1L686/P4L626A	3	-0.04	1.47	-0.43	-0.33 ^{A,C}
	V1L303/P4L514A	3	-1.49	0.00		
	C1L308/P4L309R	1	1.62	---		
Pitt/Spall	V1L686/P4L626A	3	-0.12	0.10	-0.35	-0.33 ^{B,C}
	V1L303/P4L514A	3	-0.98	0.10		
	C1L308/P4L309R	1	0.86	---		
Wear	V1L686/P4L626A	3	0.84	0.58	0.15	0.17 ^C
	V1L303/P4L514A	3	-0.61	0.00		
	C1L308/P4L309R	1	0.35	---		

^A Level for determining shift in merits (8.0)

^B Level for determining shift in merits (9.3)

^C Used SA standard deviation as published in the LTMS document for determining shift in merits

^D A straight standard deviation was used. The number of tests conducted this report period was too small to calculate an accurate pooled standard deviation.

NON-LUBRICATED HARDWARE						
Parameter	Gear Batch	N	Δ/s	s^D	Overall Δ/s	Overall Shift In Merits
Ridging	V1L686/P4L626A	3	0.49	1.18	0.18	0.15 ^{A,C}
	V1L176/P4L741A	5	-0.01	0.75		
Rippling	V1L686/P4L626A	3	-1.09	1.07	-0.64	-1.08 ^{A,C}
	V1L176/P4L741A	5	-0.37	1.09		
Pitt/Spall	V1L686/P4L626A	3	-8.46	15.27	-2.68	-1.56 ^{B,C}
	V1L176/P4L741A	5	0.79	0.59		
Wear	V1L686/P4L626A	3	0.22	1.25	0.10	0.08 ^C
	V1L176/P4L741A	5	0.03	1.34		

^A Level for determining shift in merits (8.0)

^B Level for determining shift in merits (9.3)

^C Used SA standard deviation as published in the LTMS document for determining shift in merits

^D A straight standard deviation was used. The number of tests conducted this report period was too small to calculate an accurate pooled standard deviation.

Shown below are tables of the mean Δ 's by gear batch and hardware for all laboratories reporting data this report period.

Mean Δ 's (LUBRITED HARDWARE)												
Lab	Ridging			Rippling			Pitt/Spall			Wear		
	V1L686 P4L626A	C1L308/ P4L309R	V1L303/ P4L514A	V1L686 P4L626A	C1L308/ P4L309R	V1L303/ P4L514A	V1L686 P4L626A	C1L308/ P4L309R	V1L303/ P4L514A	V1L686 P4L626A	C1L308/ P4L309R	V1L303/ P4L514A
A	----	----	-1.80	----	----	-1.49	----	----	-0.98	----	----	-0.61
B	0.28	----	----	1.64	----	---	-0.20	----	----	1.18	----	---
D	-0.43	----	----	-0.65	----	----	-0.01	----	----	1.18	----	----
E	-0.55	0.16	---	-1.11	1.62	---	-0.14	0.86	----	0.18	0.35	---

Mean Δ 's (NON-LUBRITED HARDWARE)												
Lab	Ridging			Rippling			Pitt/Spall			Wear		
	V1L686 P4L626A	C1L426/ P4L415A	V1L176/ P4L741A	V1L686 P4L626A	C1L426/ P4L415A	V1L176/ P4L741A	V1L686 P4L626A	C1L426/ P4L415A	V1L176/ P4L741A	V1L686 P4L626A	C1L426/ P4L415A	V1L176/ P4L741A
A	1.79	----	-0.32	-1.71	----	-1.69	0.36	----	0.35	0.94	----	0.59
B	----	----	----	----	----	----	----	----	----	----	----	----
D	-0.16	----	0.19	-0.78	----	0.15	-12.87	----	1.07	-0.14	----	0.18
E	----	----	-0.32	----	----	-0.61	----	----	0.35	----	----	-0.96

Industry Control Charts

Lubrited

Figures 1 through 4 are the lubrited industry control charts for pinion Wear, Rippling, Ridging, and Pitting/Spalling, respectively. Severity and precision EWMA charts for pinion Wear, Rippling, and Pitting/Spalling were in control this report period. Pinion Ridging triggered one severity EWMA action alarm. Subsequent testing has returned EWMA severity to in-control conditions.

Non-lubrited

Figures 5 through 8 are the non-lubrited industry control charts for Pinion Wear, Rippling, Ridging, and Pitting/Spalling, respectively. Severity and precision EWMA charts for pinion Wear, Rippling, and Ridging were in control this report period. Pinion Pitting/Spalling triggered four severity and four precision EWMA action alarms. These alarms were all caused by one test result that was over 26 standard deviations.

TMC Lab Visits

There was one lab visit this report period with one discrepancy to report. The lab was adding approximately an additional 100 ml more of test oil than Section 8.4 of the test procedure allows.

Information Letters

There was one information letter issued this report period. Information Letter 03-01, Sequence Number 26 was issued on February 18, 2003. Items changed with this information letter are documented in the L-37-1 timeline (Table 2).

Reference Oil Status

The following is a listing of reference oils with the expected number of tests remaining at the Test Monitoring Center and at the testing laboratories. L-37 reference oils are shipped in quantities of one gallon per test.

Oil	Number of Tests Remaining				
	Lab A	Lab B	Lab D	Lab E	TMC
127	3	3	2	2	24
128-1	3	9	4	4	80
128-2	4	5	5	5	256
151-2	2	0	2	3	*
151-3	4	6	2	3	**

* 0 Gallons (Multiple test area usage)

** 327 Gallons (Multiple test area usage)

DML/dml

Attachments

c: <ftp://ftp.astmtmc.cmu.edu/docs/gears/137/semiannualreports/137-04-2003.pdf>

L-37 Surveillance Panel

J. L. Zalar

F. M. Farber

Distribution: Email

Listing of Tables and Figures Included as Part of This Report to the L-37 Surveillance Panel

Table 1 Summarizes the Reasons for Failed Tests

Table 2 is the L-37 Industry Timeline

Figure 1 is the Industry Control Chart for Pinion Wear (Lubrited Hardware)

Figure 2 is the Industry Control Chart for Pinion Rippling (Lubrited Hardware)

Figure 3 is the Industry Control Chart for Pinion Ridging (Lubrited Hardware)

Figure 4 is the Industry Control Chart for Pinion Pitting/Spalling (Lubrited Hardware)

Figure 5 is the Industry Control Chart for Pinion Wear (Non-Lubrited Hardware)

Figure 6 is the Industry Control Chart for Pinion Rippling (Non-Lubrited Hardware)

Figure 7 is the Industry Control Chart for Pinion Ridging (Non-Lubrited Hardware)

Figure 8 is the Industry Control Chart for Pinion Pitting/Spalling (Non-Lubrited Hardware)

Table 1

Summary of Reasons for Rejected Tests

Reasons	No. of Tests
Stand Shewhart Severity Alarm (Pinion Wear, Mild)	1
Stand EWMA Precision Alarm (Spitting)	3

Table 2

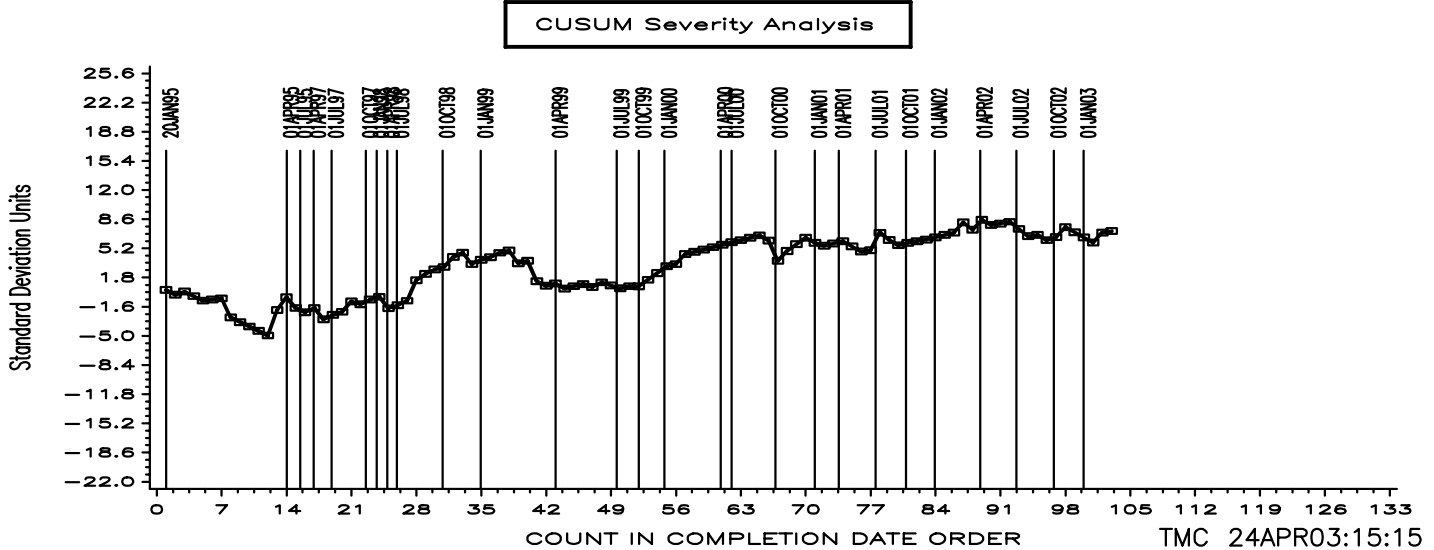
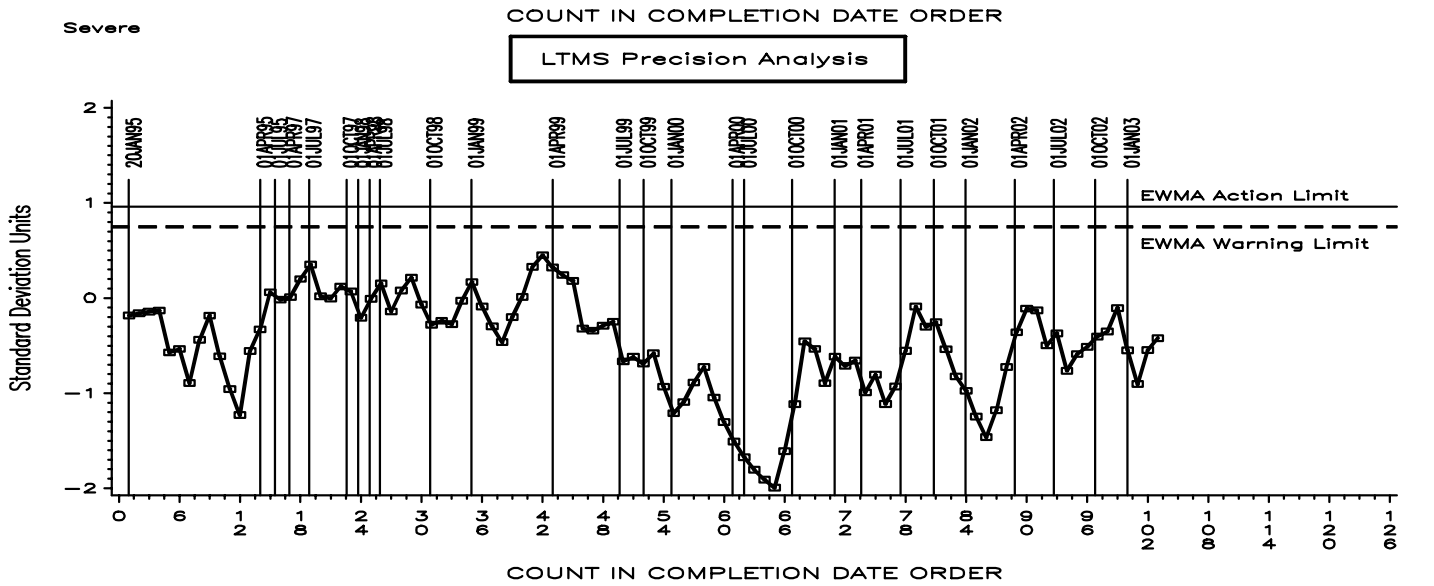
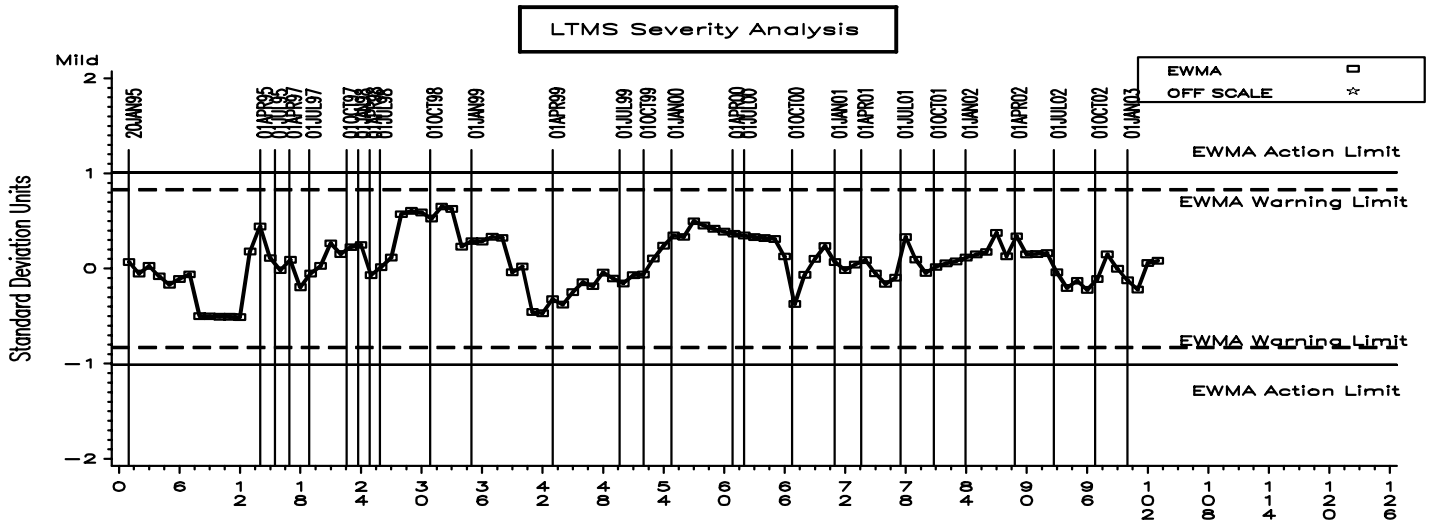
L-37 Timeline		
Effective Date	Topic	IL#
19931221	Report Forms and Dictionary Version 19931209	1
19940104	Rear Cover Plate Sensor Loc.	2
19940104	Data Reporting Response Time	2
19940317	Referencing Schedule	3
19940428	Report Forms and Dictionary Version 19940422	4
19940728	Report Forms and Dictionary Version 19940707	5
19950820	Rating Scale Revision	6
19950820	Report Form 5 Wording Change	6
19950820	Report Forms and Dictionary Version 19950424	6
19960309	Rating Revisions of the Rating Scale	96-1
19960325	Rating Revisions affecting Spalling and Pitting	96-2
19960116	TMC Address	96-2
19960603	Report Forms and Dictionary Version 19960425	96-3
19960603	Revised Wording of Rating Scale	96-3
19960317	Rating Revisions to the Wear Step Area	96-4
19970825	Revised Reference Testing Frequency and Number of Tests for Stands Out of Calibration > 6 months	97-1
19980309	Report Forms and Dictionary Version 19971223	98-1
19980309	Revised Alternate Rating Method For Drive Side Pinion Gear Pitting Values On Gear Set C1L426/P4L415A	98-1
19980309	Test Reporting Clarifications	98-1
19980309	Revisions to Stand Calibration Requirements	98-2
19980309	Restrictions On Reference Oil Analysis	98-2
19980309	Reporting of Non-standard Tests to the TMC	98-2
19980309	LTMS Implementation	98-2
19980310	Report Forms and Dictionary Version 19980203	98-3
19980603	Deviation Percentage Calculation Clarification	98-4
19980901	Combining of Pitting and Spalling Ratings	98-4
19981116	Numerical Rating Precision Clarification	98-5
19990101	Developed Reference Oil Test Targets by Gear Batch (Grandfathered For All Test Starting 19950101)	
19990113	Addition of Exclusion Zone for Determining the Pitting/Spalling Result on Non-lubrited Hardware, Gear Batch V1L303/P4L514A	99-1
19990113	Deletion of Section A8.3.5	99-1
19990503	Updated Reference oil 128-1 Targets (18 Tests), Gear Batch V1L303/P4L514A (Grandfathered For All Test Starting 19950101)	
19990510	Revisions to Precision and Bias Statement	99-2
19990728	Cover Plate Thermocouple Location	99-3
20000613	Root/Tip Polishing Comment for V1L686/P4L626A Non-lubrited Gears	00-1, Sequence No. 20
20000613	Pitting/Spalling Table A9.1 Clarifications	00-1, Sequence No. 20
20001001	CRC Reference Photography of Gear Distress Photographs	00-2, Sequence No. 21
20001115	Correction Factor for V1L686/P4L626A Lubrited Gears	01-1, Sequence No. 22
20010612	Ring Correction Factor for V1L686/P4L626A Lubrited Gears	01-2, Sequence No. 23
20011101	Addition of Annex 12 Addressing Distress Rating Exclusion Comments	01-2, Sequence No. 23
20011101	Revised Report Forms	01-2, Sequence No. 23
20020101	CRC Rating Manual 21	02-1, Sequence No. 24
20020211	Revised Report Forms and Data Dictionary	02-1, Sequence No. 24
20020211	Rating With Magnification	02-2, Sequence No. 25

Table 2 (Continued)

	L-37 Timeline	
Effective Date	Topic	IL#
20030401	Rater Calibration Monitoring System	03-1, Sequence No. 26

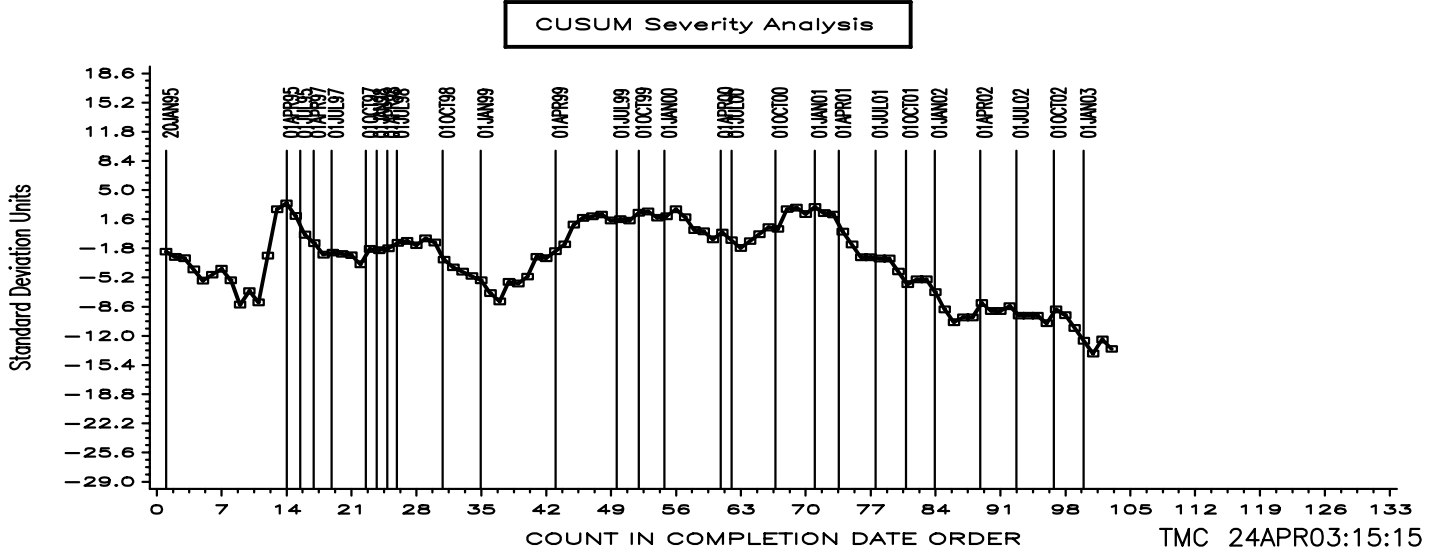
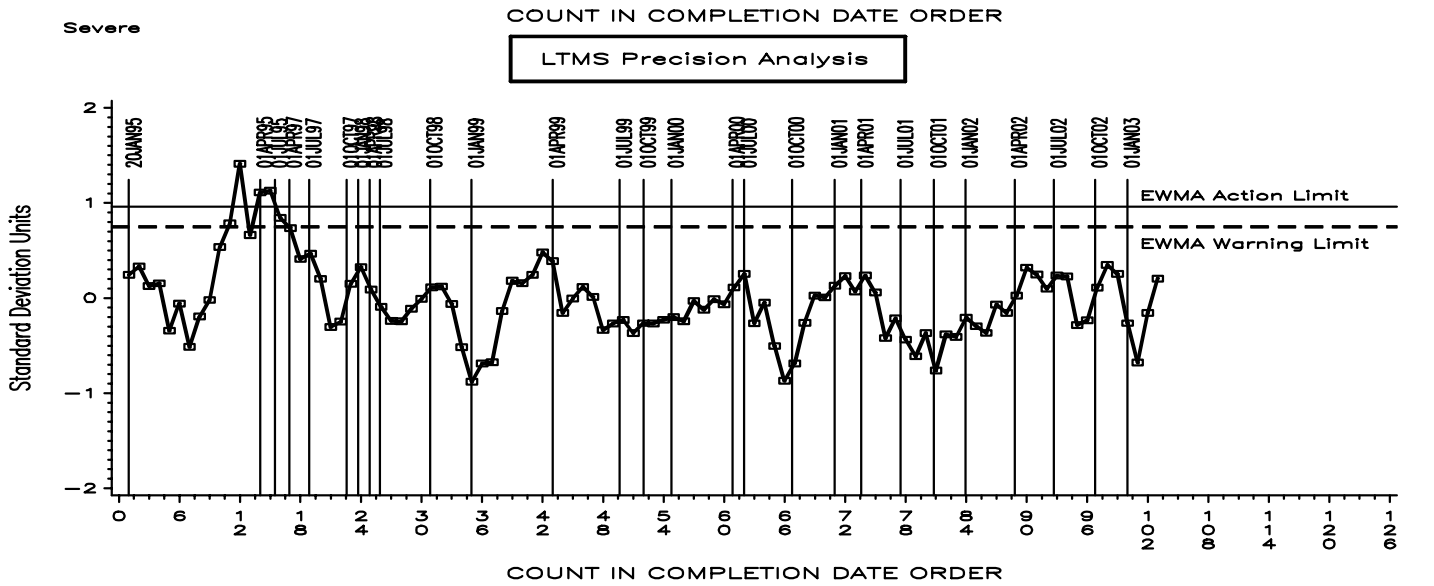
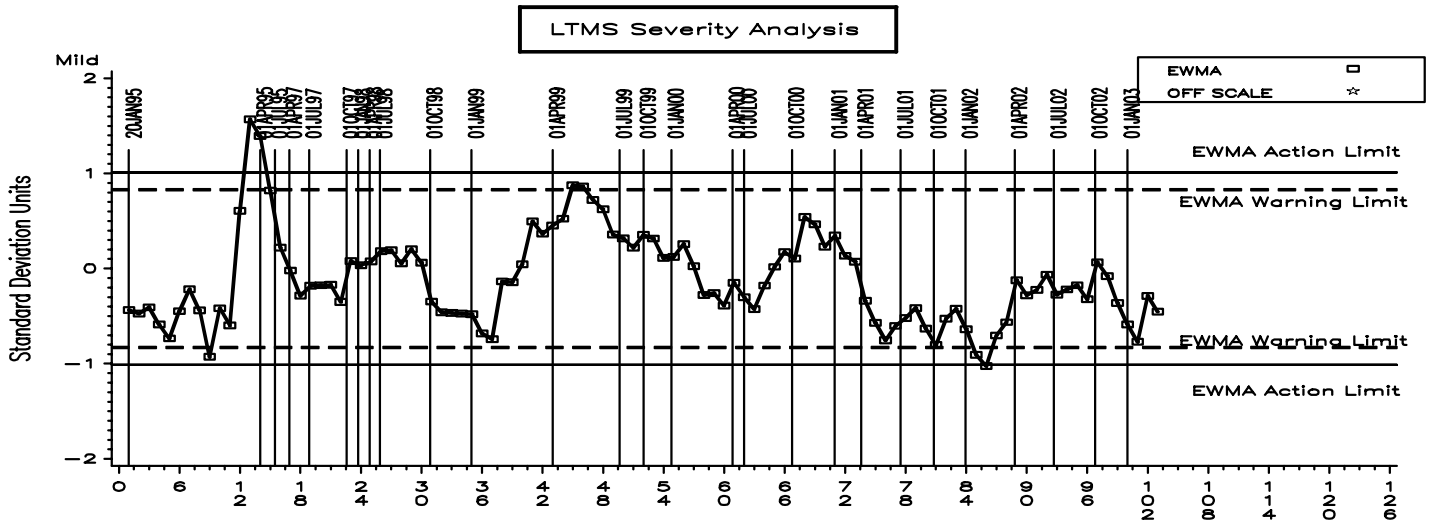
L-37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR WEAR



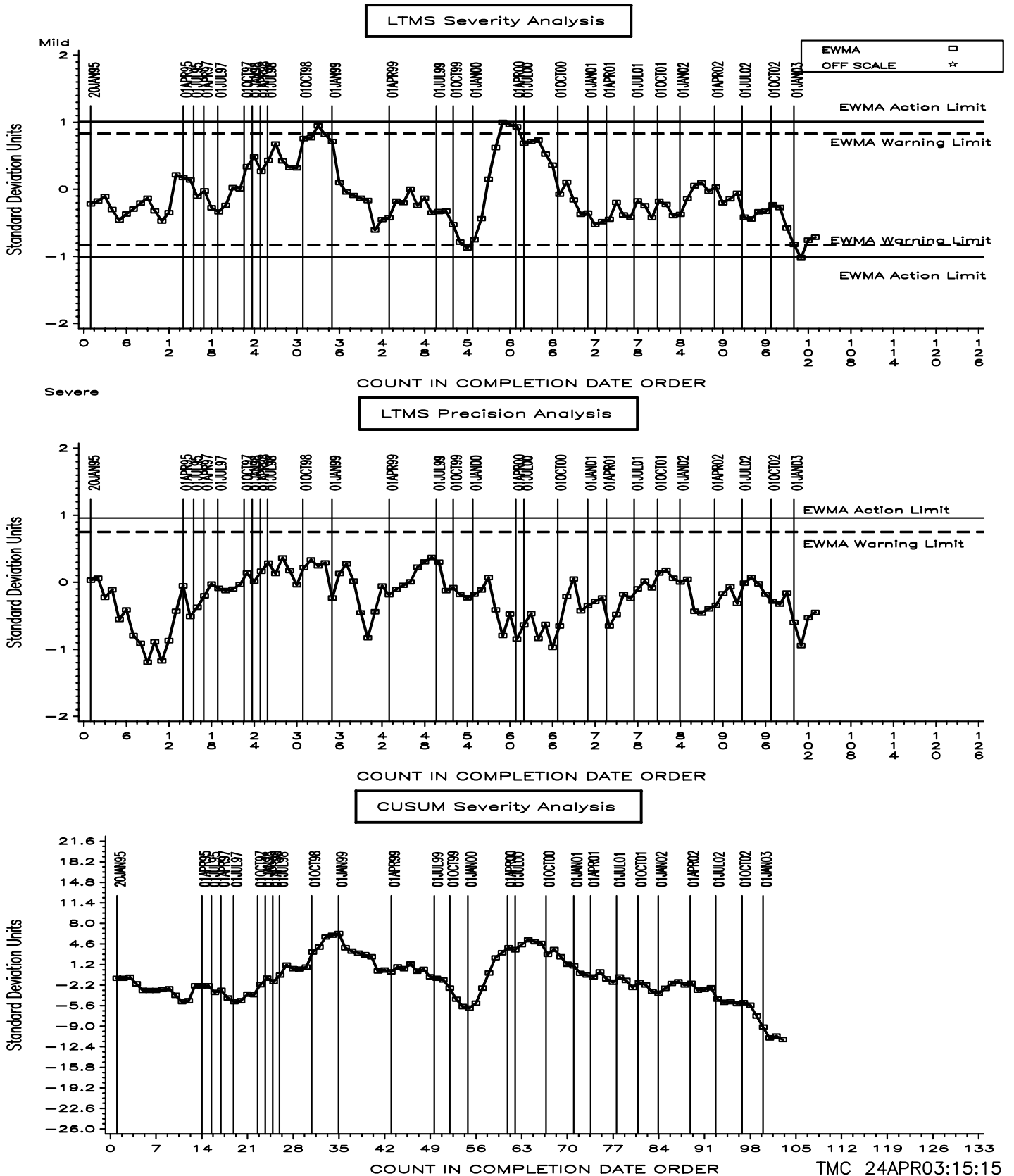
L-37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR RIPPLING

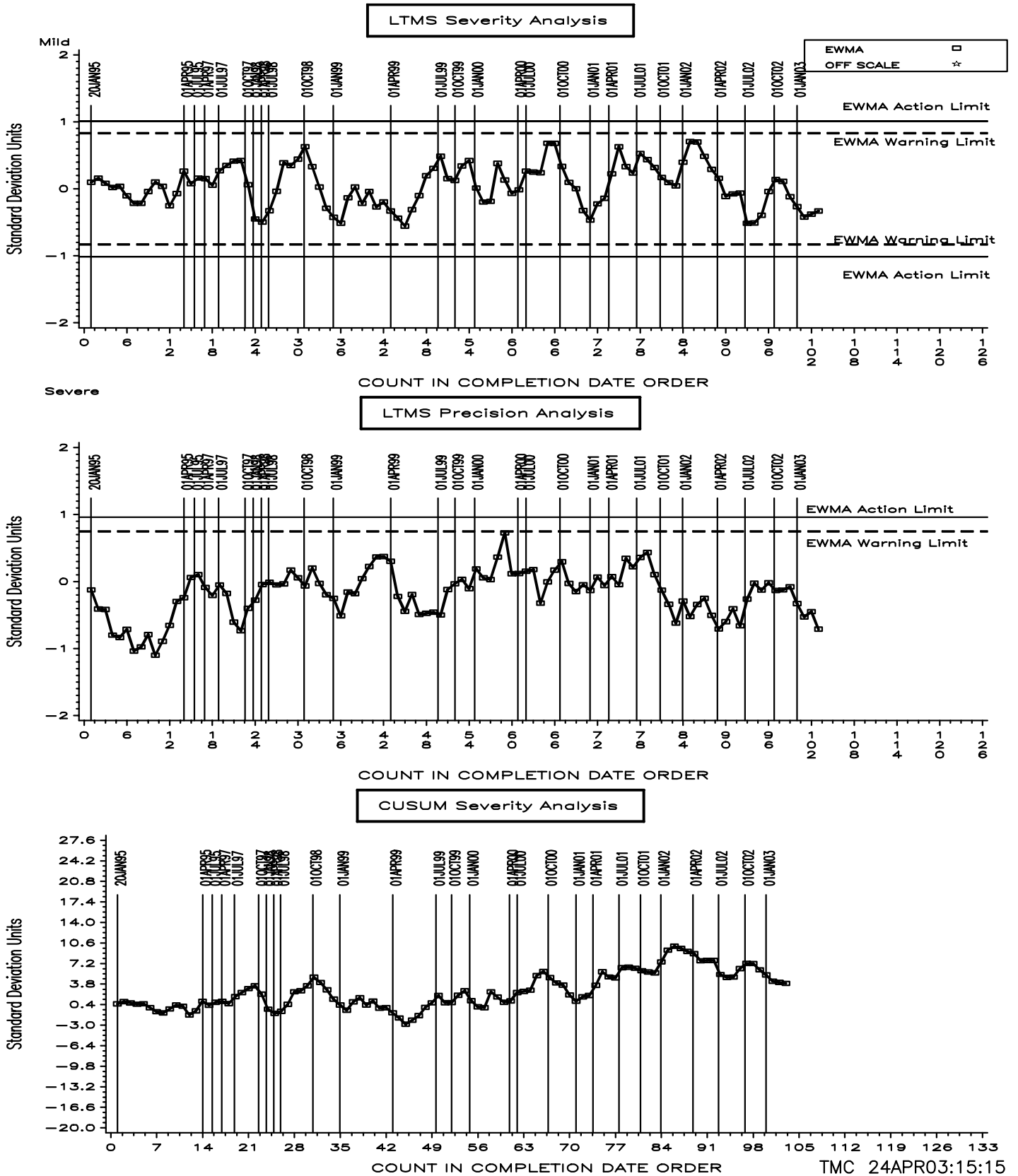


L-37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR RIDGING

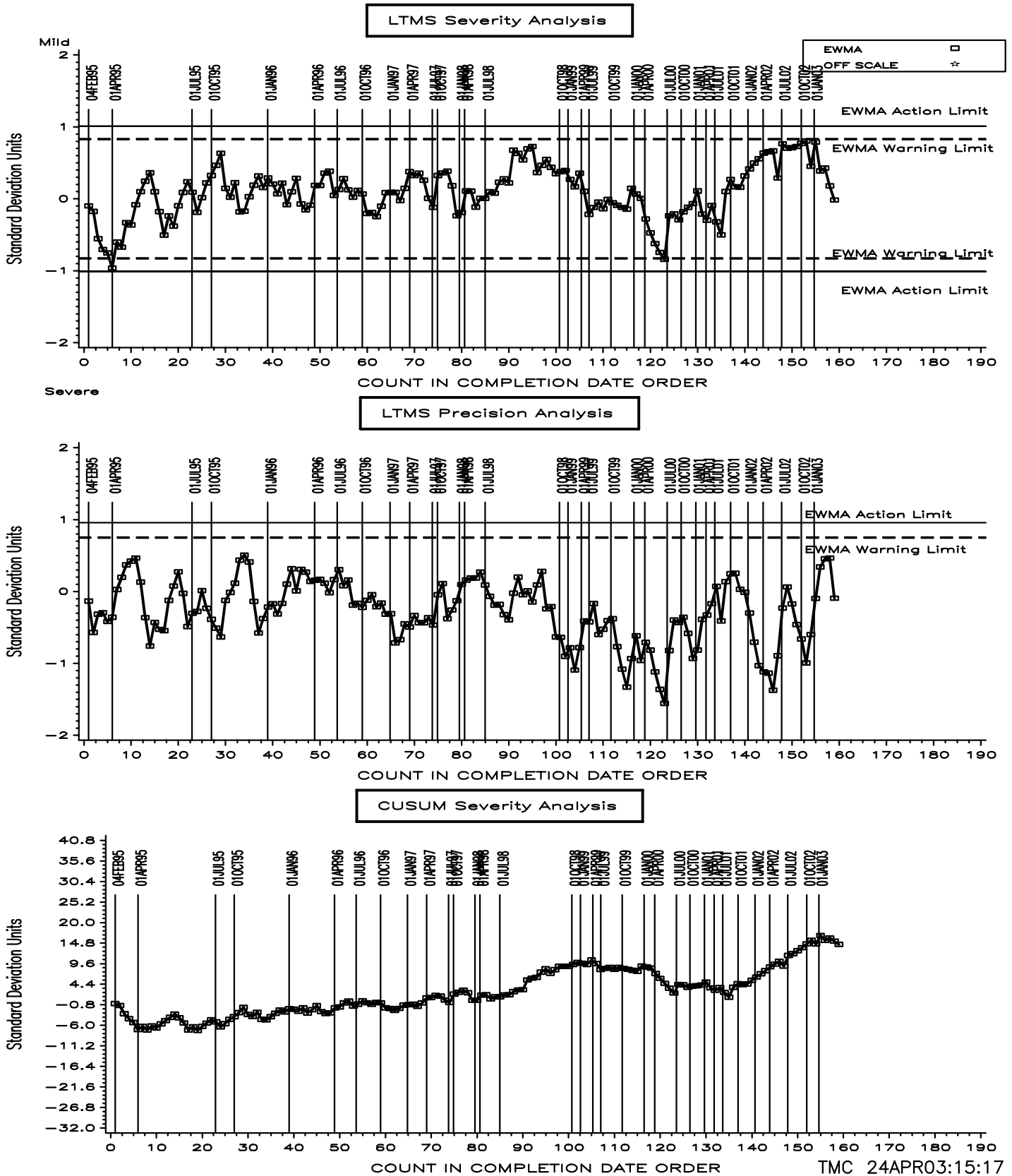


L-37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR PITTING/SPALLING



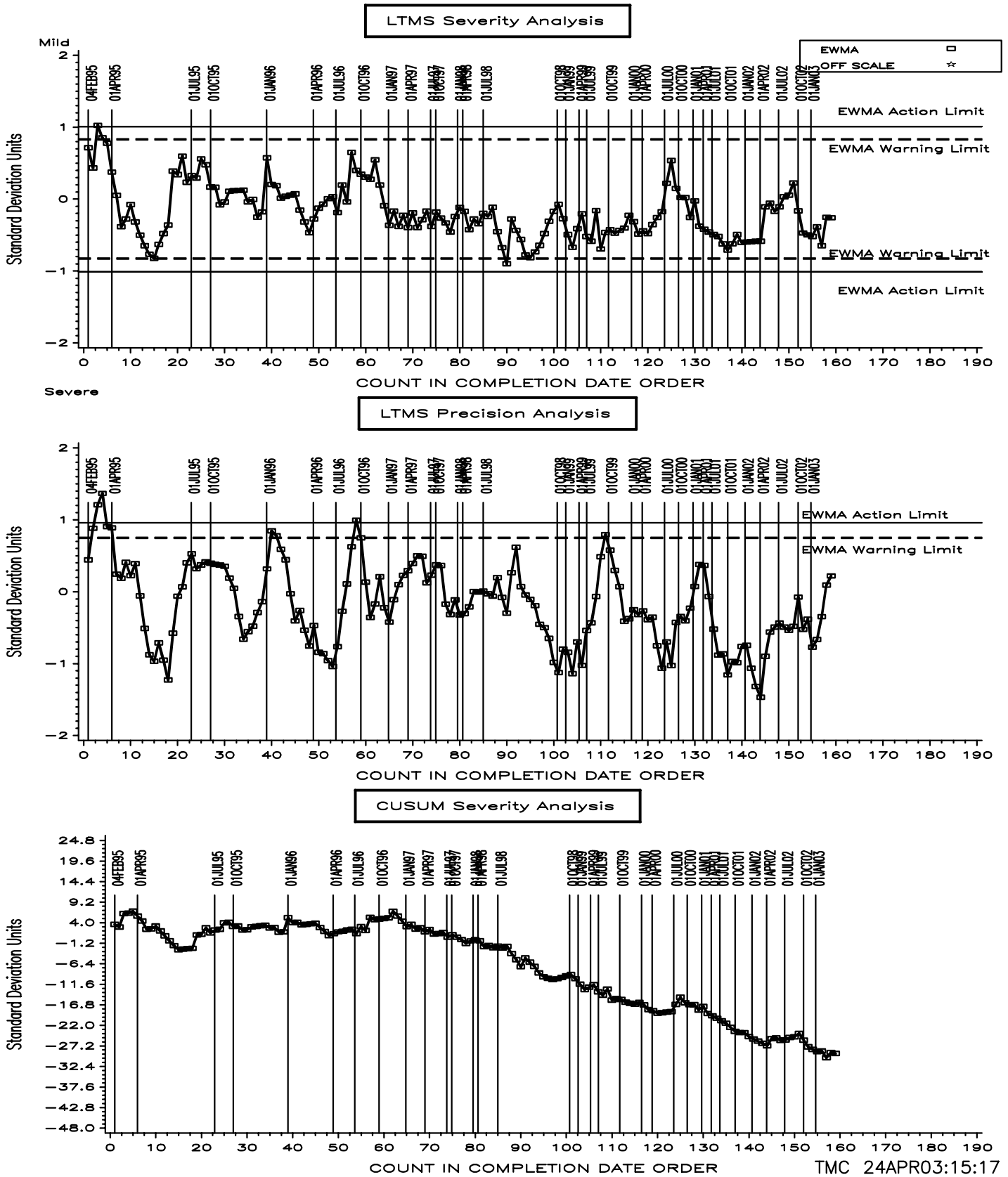
L-37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR WEAR



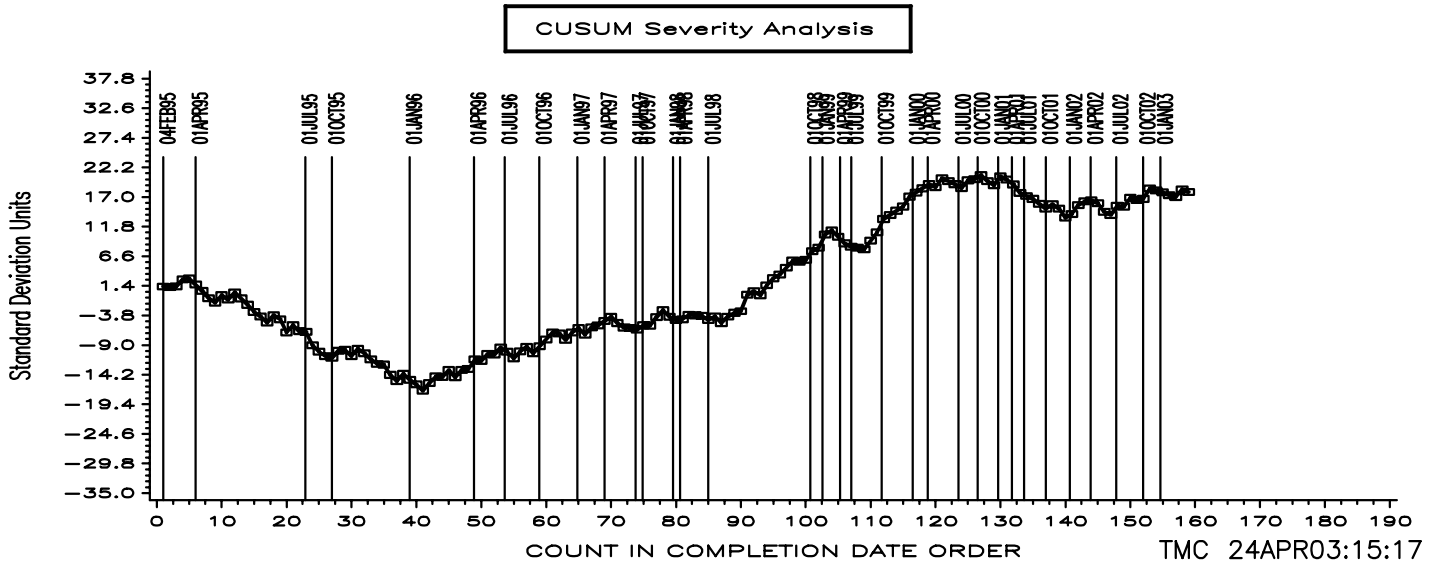
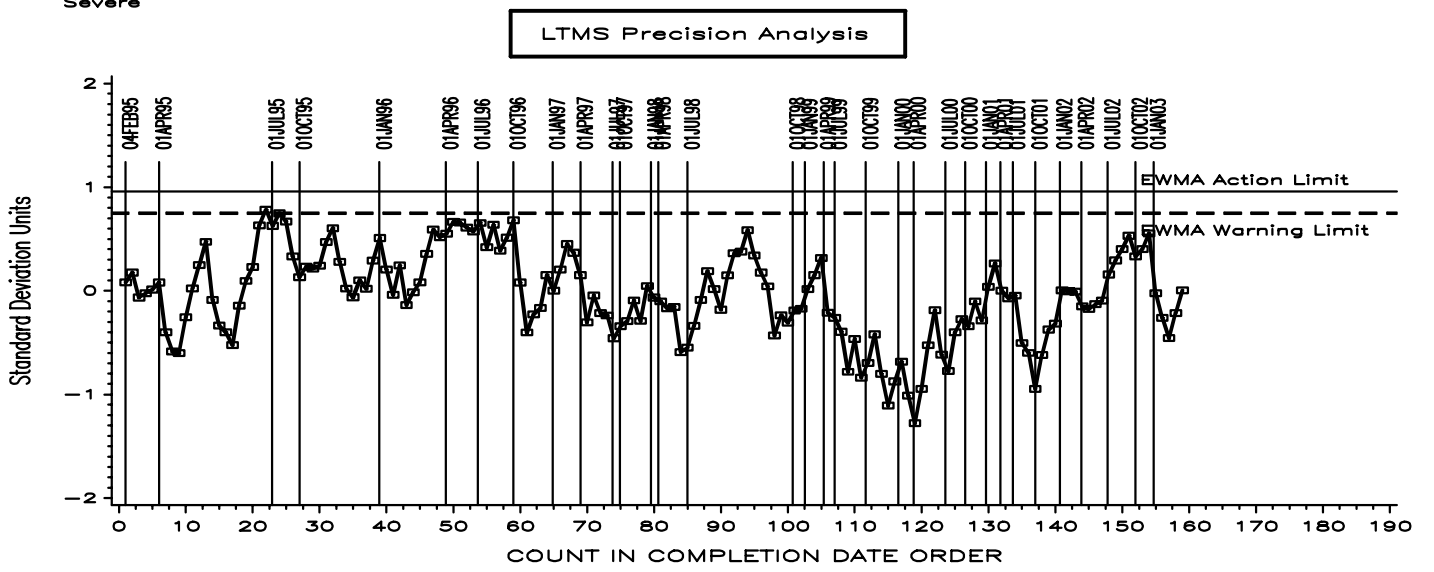
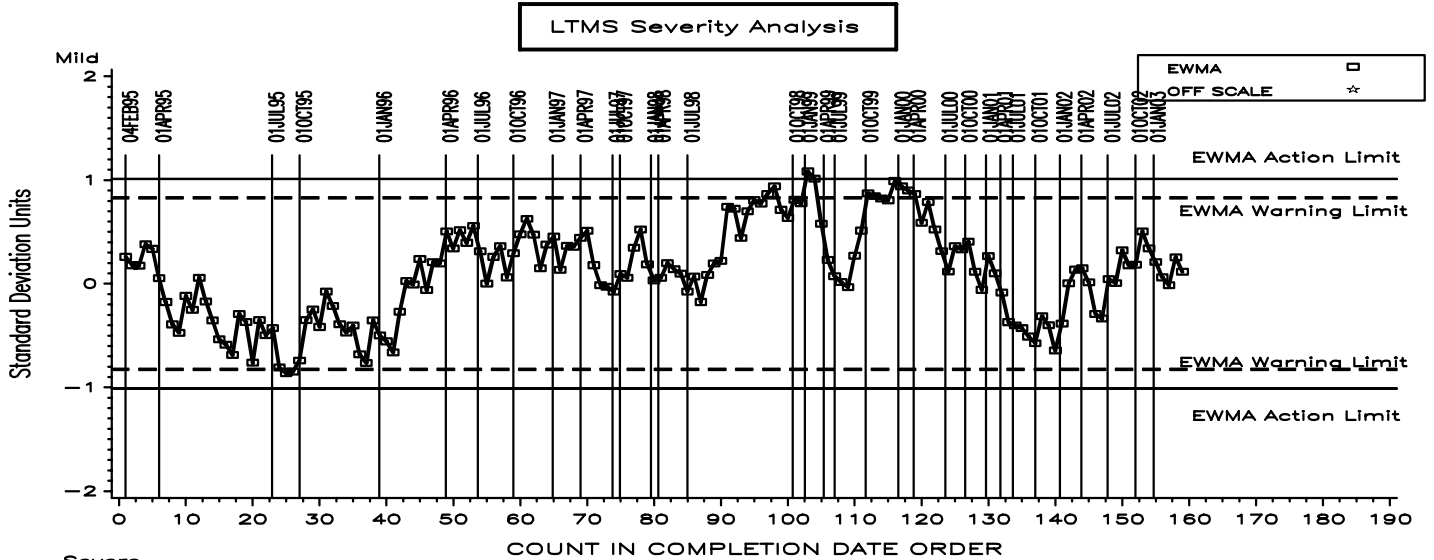
L-37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR RIPPING



L-37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR RIDGING



L-37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR PITTING/SPALLING

