



Test Monitoring Center

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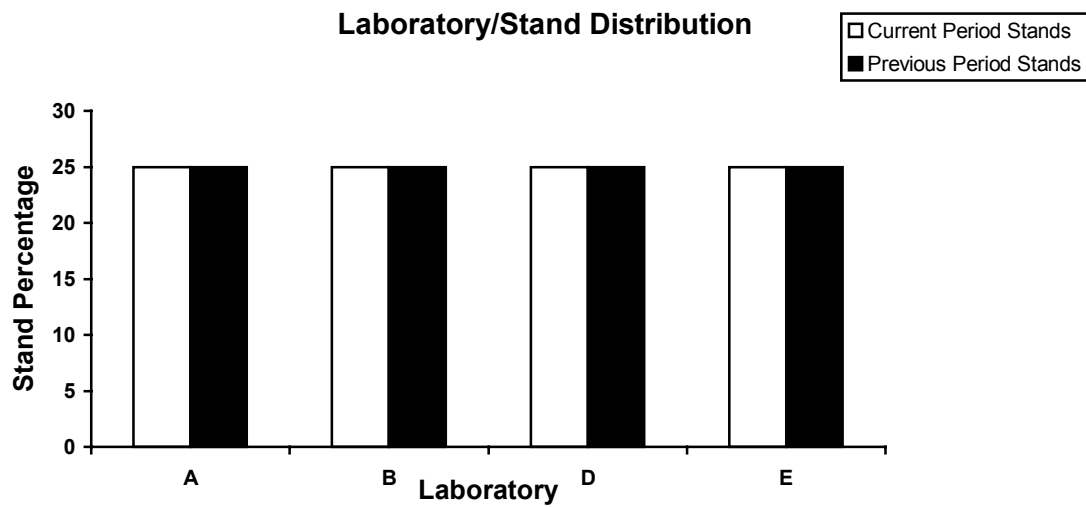
MEMORANDUM: 00-149
DATE: October 23, 2000
TO: Don Bartlett, Chairman, L-37 Surveillance Panel
FROM: Donald Lind
SUBJECT: L-37 Reference Test Status from April 1, 2000 through September 30, 2000

The following is a summary of the L-37 reference oil tests that were reported to the Test Monitoring Center during the period April 1, 2000 through September 30, 2000.

Lab/Stand Distribution:

	Reporting Data	Calibrated as of 9/30/00
Number of Laboratories	4	4
Number of Stands	4	4

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	No. of Tests
Operationally and Statistically Acceptable	AC	12
Failed Acceptance Criteria	OC	2
Lab Rejected	LC	0
Aborted	XC	0
Total		14

Non-lubrited Hardware:

There were eight operationally valid reference tests conducted on non-lubrited hardware, seven on gear batch V1L686/P4L626A and one on gear batch V1L303/P4L514A. The one test on gear batch V1L303/P4L514A was operationally and statistically acceptable. Gear batch V1L686/P4L626A had six tests that were operationally and statistically acceptable and one test that failed the acceptance criteria.

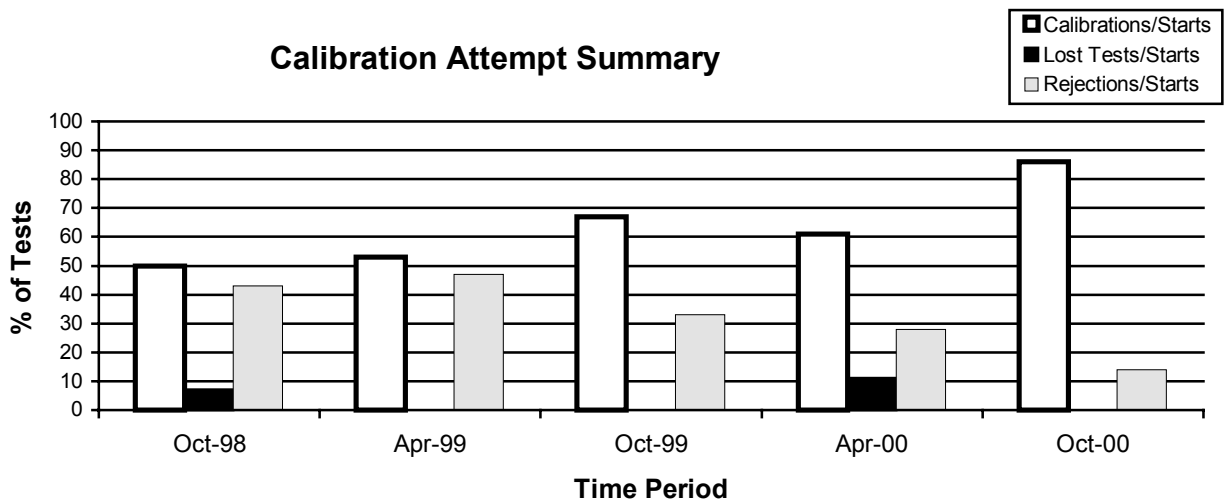
Lubrited Hardware:

There were six operationally valid reference tests conducted on lubrited hardware. All six tests were run on gear batch V1L303/P4L514A. Five tests were operationally and statistically acceptable and one test failed the acceptance criteria.

Additional Tests:

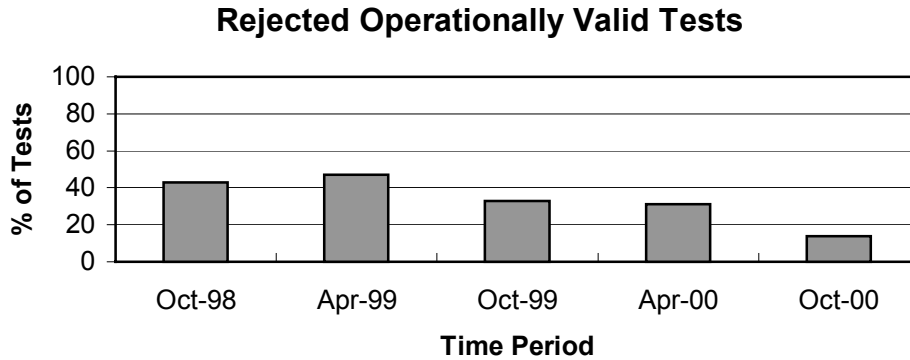
There were 48 tests conducted for the lubrited gear batch V1L686/P4L626A approval and to develop statistical targets.

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

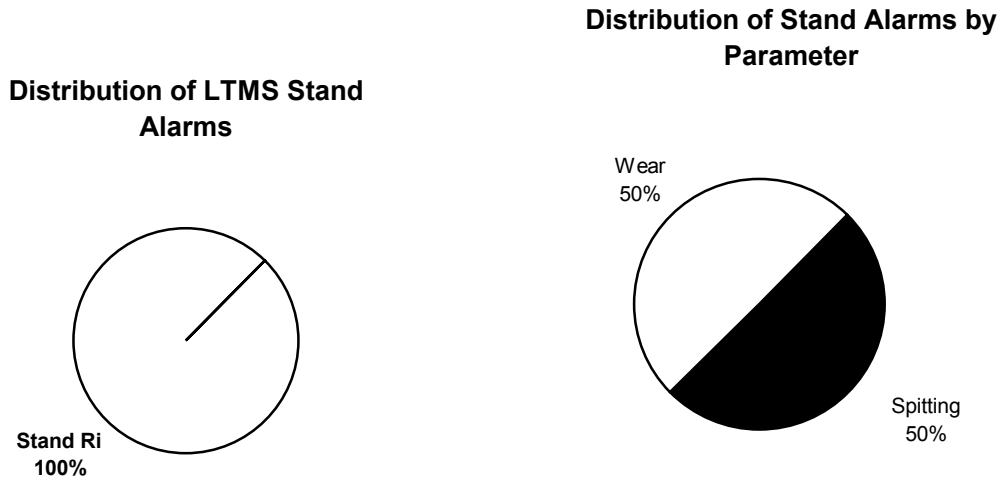


The calibration per start rate has increased when compared to the previous period. The lost test per start and rejected test per start rates have decreased with respect to the previous period.

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

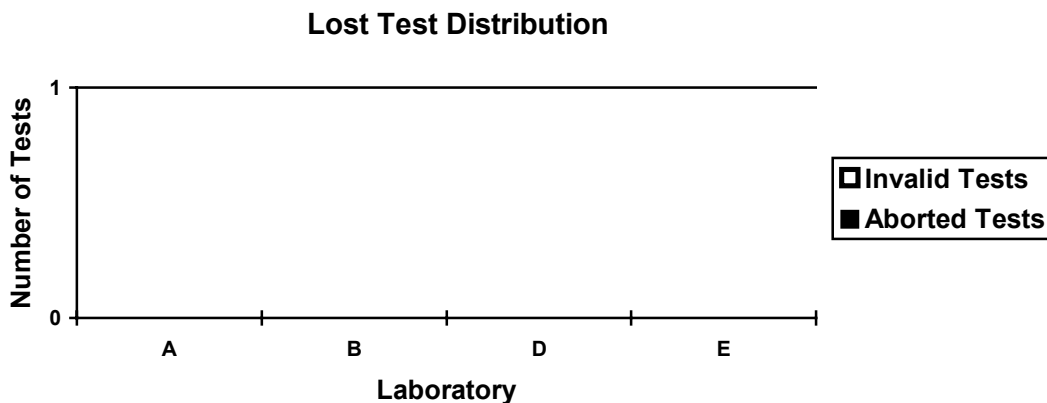


A detailed list of reasons tests failed the acceptance criteria is shown in Table 1. The following charts summarize these reasons with a breakdown by parameter of the failed tests:



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

The laboratory distribution of lost tests is shown below. There were no lost tests this report period.



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 lubrited and non-lubrited hardware.

LUBRITED HARDWARE						
Parameter	Gear Batch	N	Δ/s	s^D	Overall Δ/s	Overall Shift In Merits
Ridging	V1L303/P4L514A	6	0.26	0.61	0.26	0.23 ^{A, C}
Rippling	V1L303/P4L514A	6	0.23	0.88	0.23	0.16 ^{A, C}
Pitt/Spall	V1L303/P4L514A	6	0.85	0.91	0.85	0.54 ^{B, C}
Wear	V1L303/P4L514A	6	0.13	0.36	0.13	0.15 ^C

^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-LUBRITED HARDWARE						
Parameter	Gear Batch	N	Δ/s	s^D	Overall Δ/s	Overall Shift In Merits
Ridging	V1L686/P4L626A	7	0.13	0.96	0.20	0.17 ^{A, C}
	V1L303/P4L514A	1	0.74	---		
Rippling	V1L686/P4L626A	7	0.29	1.18	0.22	0.29 ^{A, C}
	V1L303/P4L514A	1	-0.28	---		
Pitt/Spall	V1L686/P4L626A	7	0.41	0.81	0.35	0.12 ^{B, C}
	V1L303/P4L514A	1	-0.07	---		
Wear	V1L686/P4L626A	7	-0.49	1.26	-0.61	-0.46 ^C
	V1L303/P4L514A	1	-1.43	---		

^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		
	C1L308/ P4L309R	C1L426/ P4L404A	V1L303/ P4L514A	C1L308/ P4L309R	C1L426/ P4L404A	V1L303/ P4L514A	C1L308/ P4L309R	C1L426/ P4L404A	V1L303/ P4L514A	C1L308/ P4L309R	C1L426/ P4L404A	V1L303/ P4L514A
A	----	----	0.81	----	----	-0.91	----	----	0.20	----	----	0.27
B	----	----	-0.30	----	----	0.80	----	----	1.55	----	----	-0.17
D	----	----	-0.30	----	----	-0.91	----	----	1.38	----	----	0.27
E	----	----	0.81	----	----	0.80	----	----	0.20	----	----	0.27

Mean Δ /s (NON-LUBRITED HARDWARE)												
Lab	Ridging			Rippling			Pitt/Spall			Wear		
	V1L686/ P4L626A	C1L426/ P4L415A	V1L303/ P4L514A	V1L686/ P4L626A	C1L426/ P4L415A	V1L303/ P4L514A	V1L686/ P4L626A	C1L426/ P4L415A	V1L303/ P4L514A	V1L686/ P4L626A	C1L426/ P4L415A	V1L303/ P4L514A
A	-0.16	----	----	-1.02	----	----	0.12	----	----	-0.93	----	----
B	-0.53	----	0.74	0.15	----	-0.28	-0.44	----	-0.07	-1.23	----	-1.43
D	0.75	----	---	1.25	----	---	1.16	----	---	0.29	----	---
E	-0.53	----	---	0.15	----	---	-0.44	----	---	-1.23	----	---

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, Pitting/Spalling, and Rippling were in control this report period. Pinion Ridging triggered one mild severity EWMA warning alarm this report period.

Non-lubrited:

Figures 5 through 8 are the non-lubrited industry control charts for Pinion Wear, Rippling, Ridging, Pitting/Spalling, respectively. Severity and precision EWMA charts for Pinion Rippling and Pitting/Spalling were in control this report period. Pinion Ridging triggered one mild severity EWMA warning alarm this report period. Pinion wear triggered one severe severity EWMA warning alarm this report period.

TMC Lab Visits:

There were two lab visits with no discrepancies to report this report period.

Information Letters:

There were two information letters issued during this period. Information Letter 00-1 was issued on July 24, 2000 and Information Letter 00-2 was issued on September 27, 2000. Items changed with these information letters are documented in the L-37 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	2	3	3	3	43
128-1	2	3	4	5	149
129	4	3	1	4	26
151-2	5	2	5	3	*
151-3	4	3	1	4	**

* 28 Gallons (Multiple test area usage)

** 674 Gallons (Multiple test area usage)

DML/dml

Attachments

c: L-37 Surveillance Panel

<ftp://www.tmc.astm.cmri.cmu.edu/docs/gear/137/semiannualreports/137-10-2000.pdf>

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 Precision Alarm (Pinion Wear)	1
Stand Shewhart Precision Alarm (Pinion Pitting/Spalling)	1

Table 3

Summary of Reasons for Lost Tests

Reasons	No. of Tests

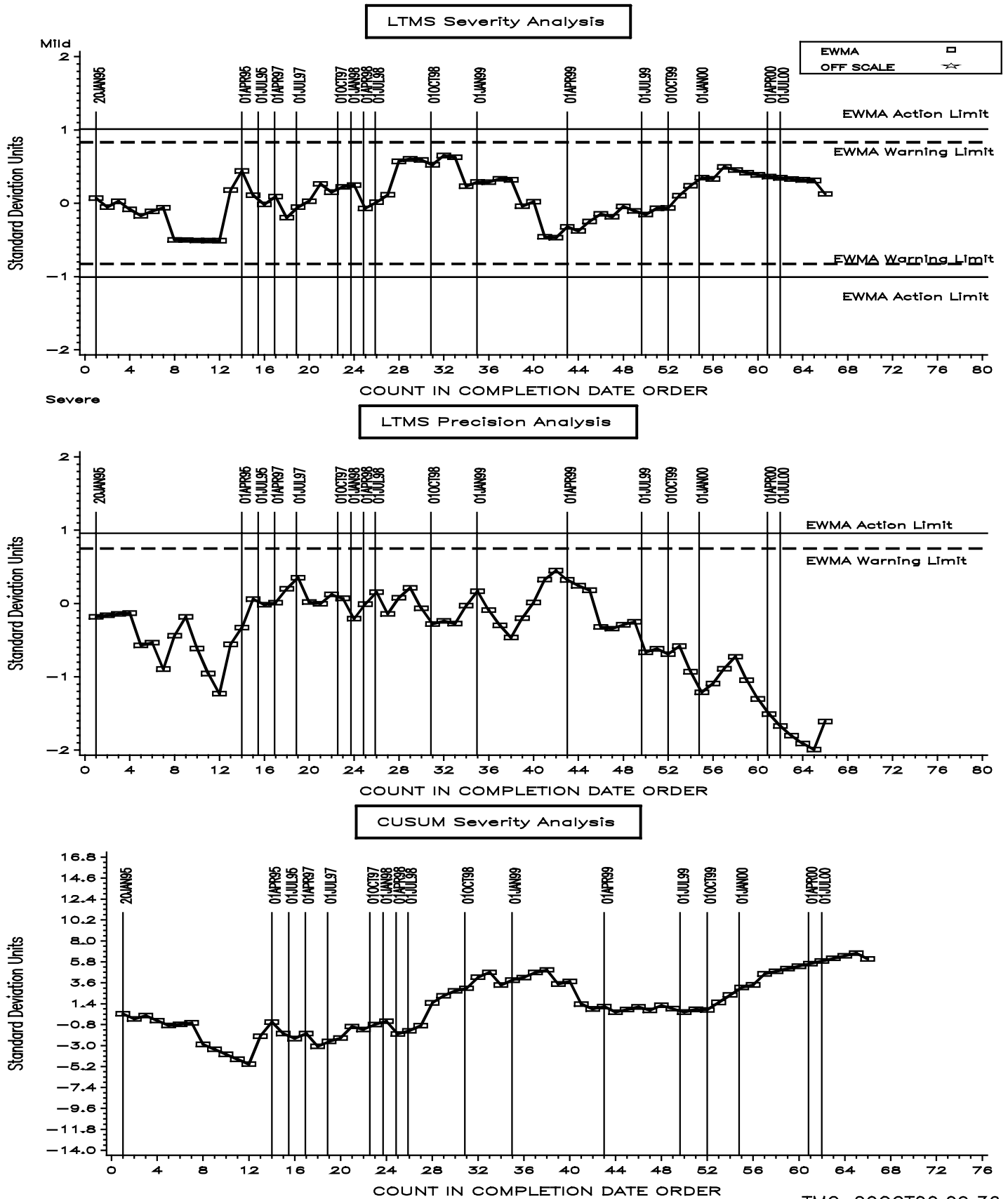
Table 2

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 Line Polishing Comment for V1L686/P4L626A	00-1
20001001	CRC Reference Photography of Gear Distress Photographs	00-2

L-37 INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR WEAR (MERITS) LUBRITED

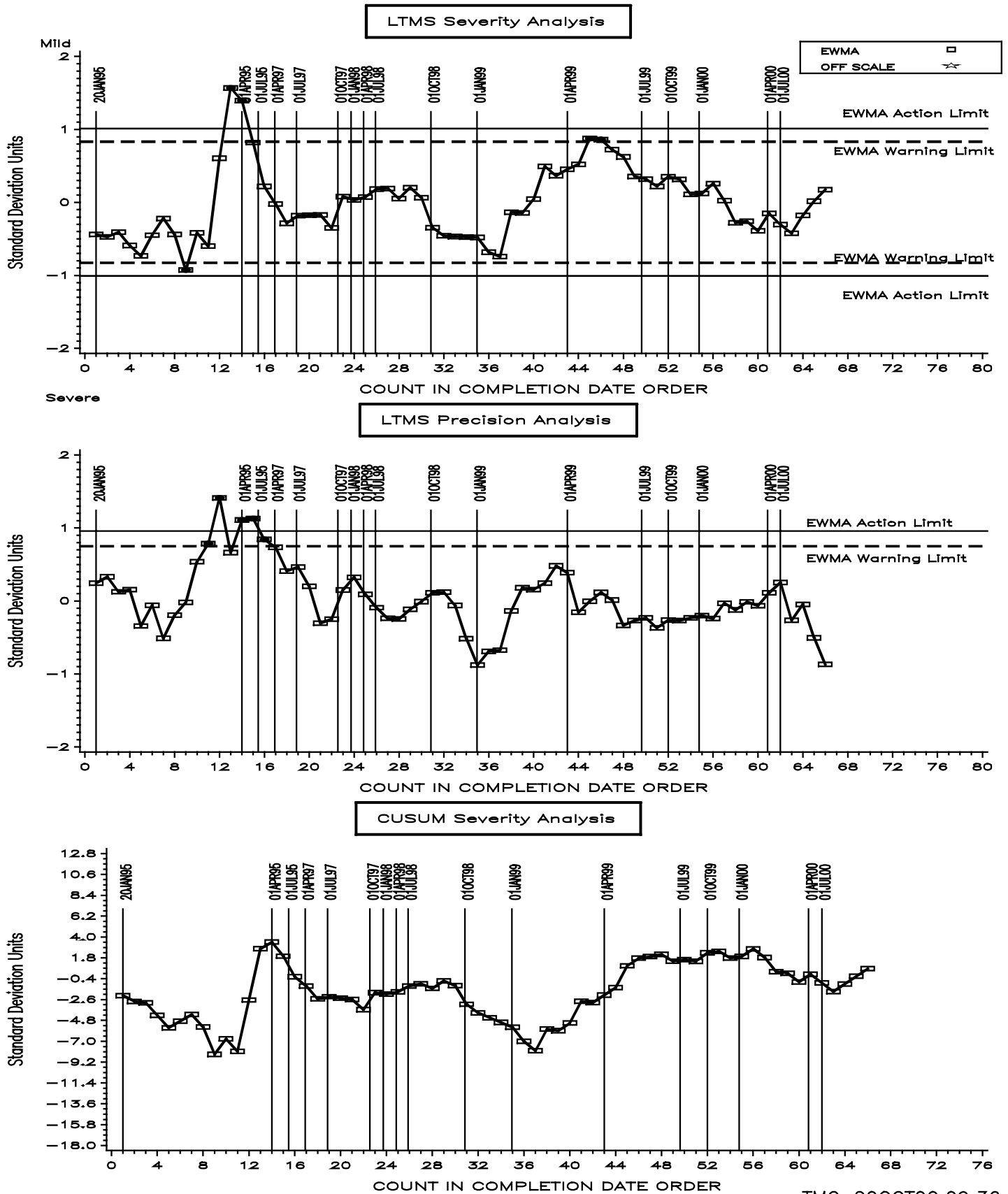
Figure 1



L-37 INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR RIPPLING (MERITS) LUBRITED

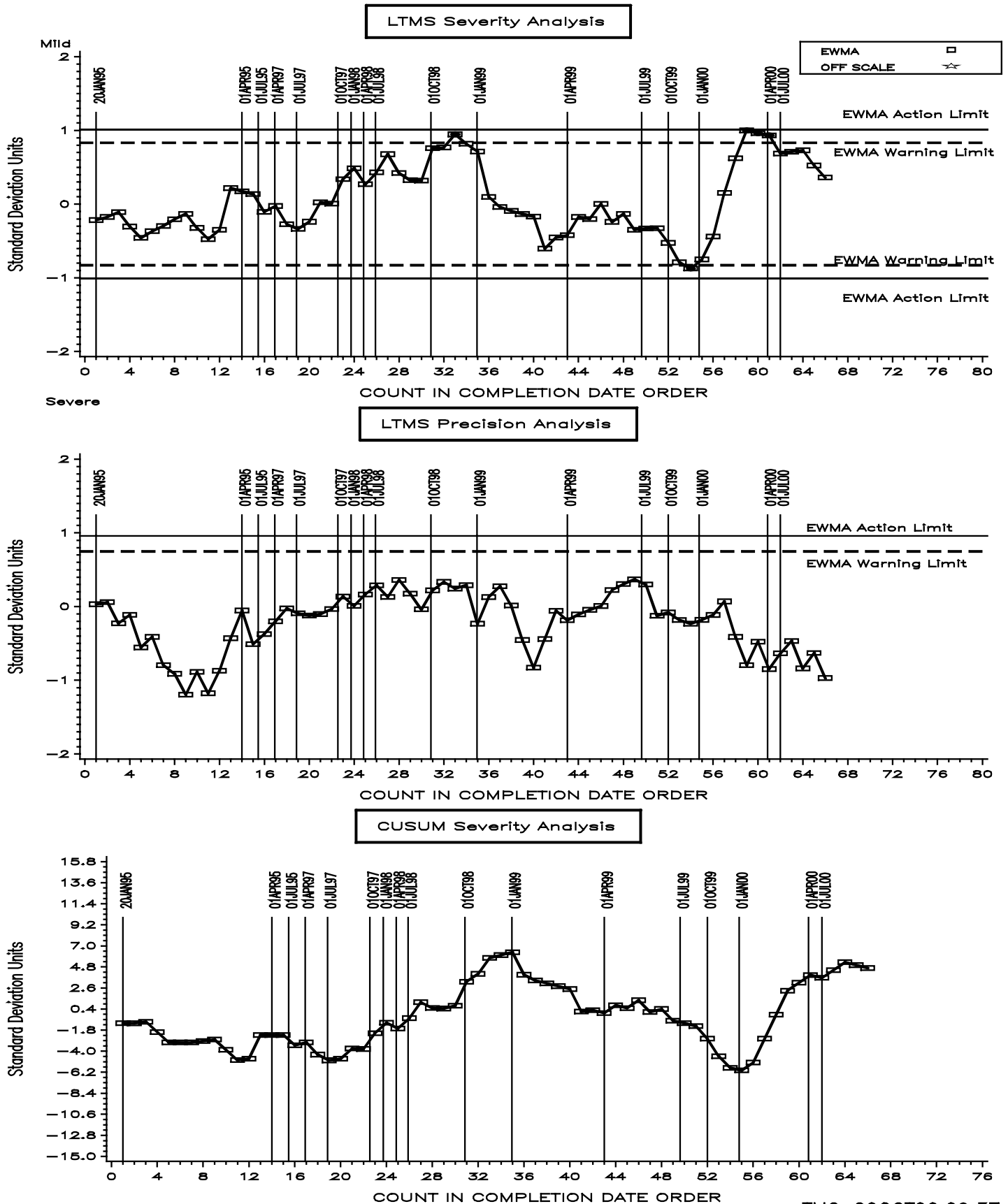
Figure 2



L-37 INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR RIDGING (MERITS) LUBRITED

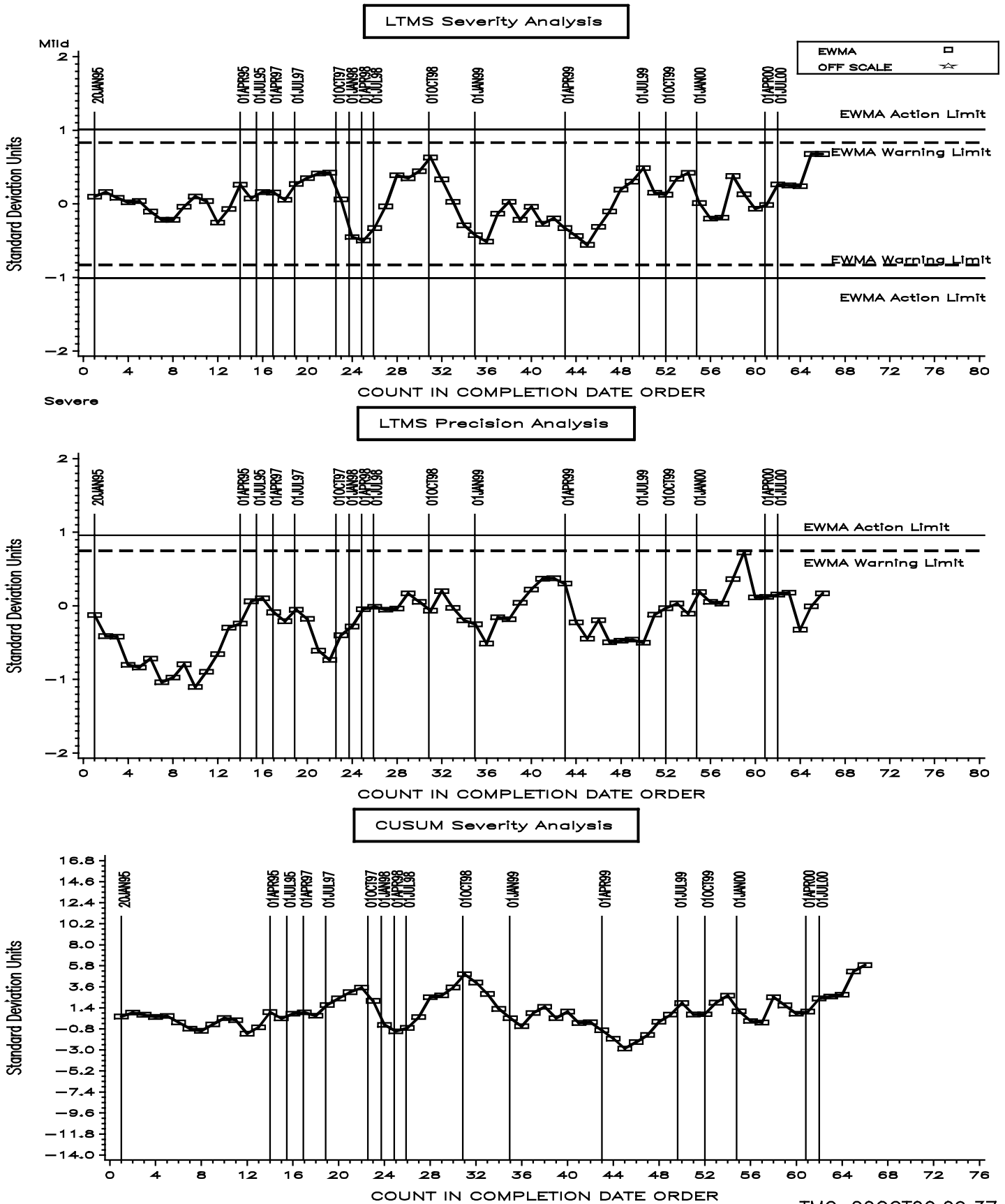
Figure 3



L-37 INDUSTRY OPERATIONALLY VALID DATA

FINAL REF. PINION GEAR PITTING/SPALLING (MERITS) LUBRITED

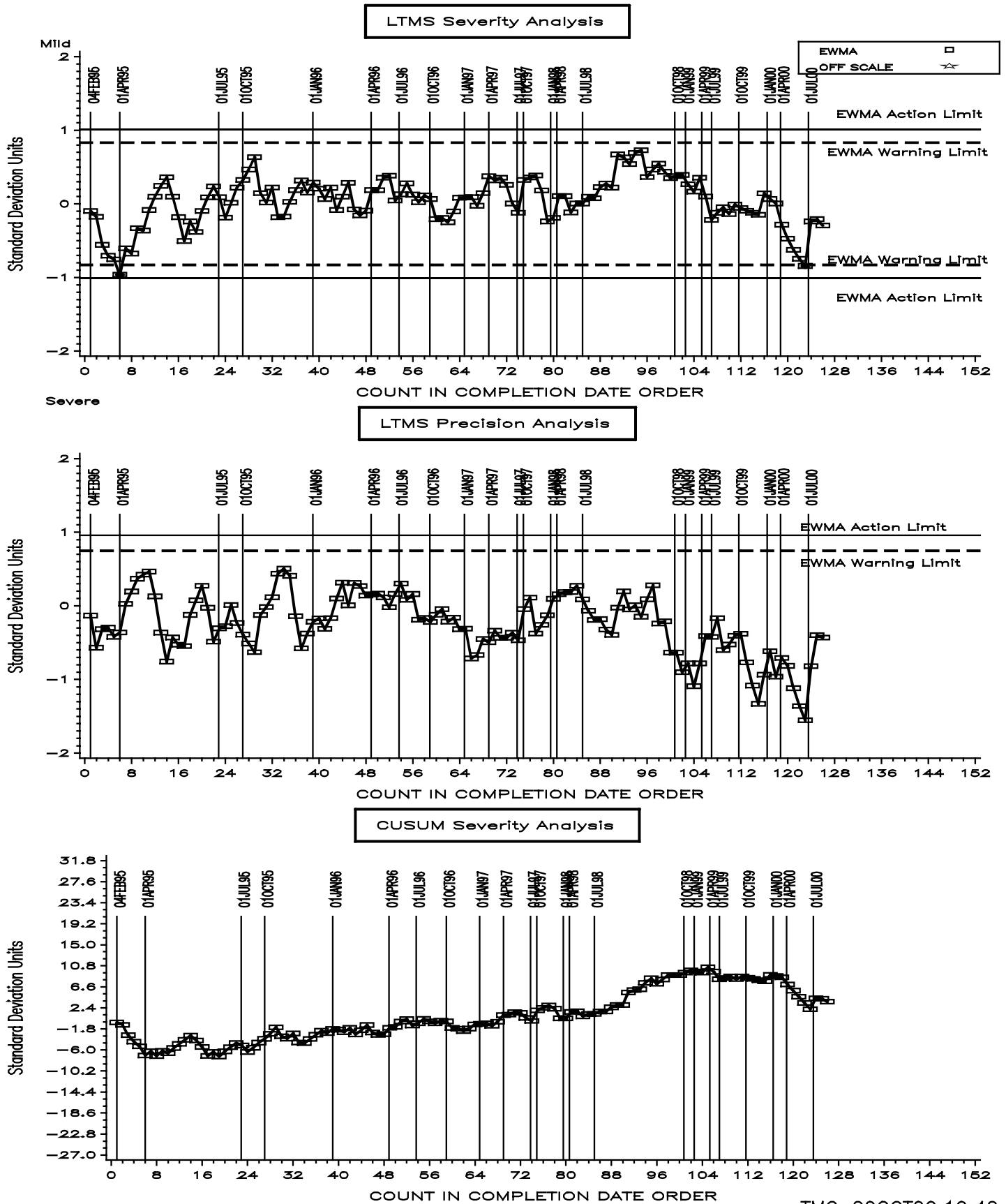
Figure 4



L-37 INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR WEAR (MERITS) NONLUBRITED

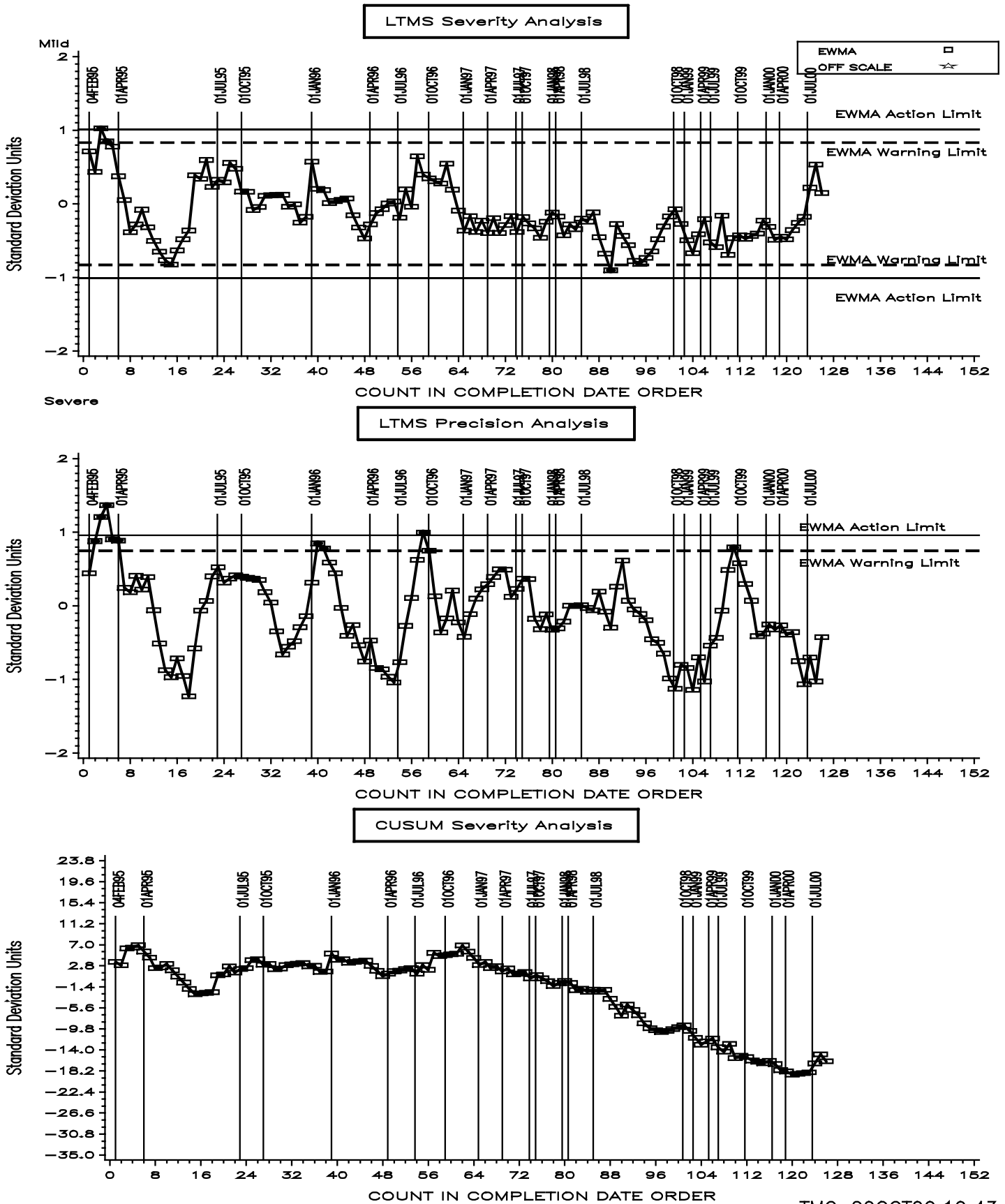
Figure 5



L-37 INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR RIPPLING (MERITS) NONLUBRITED

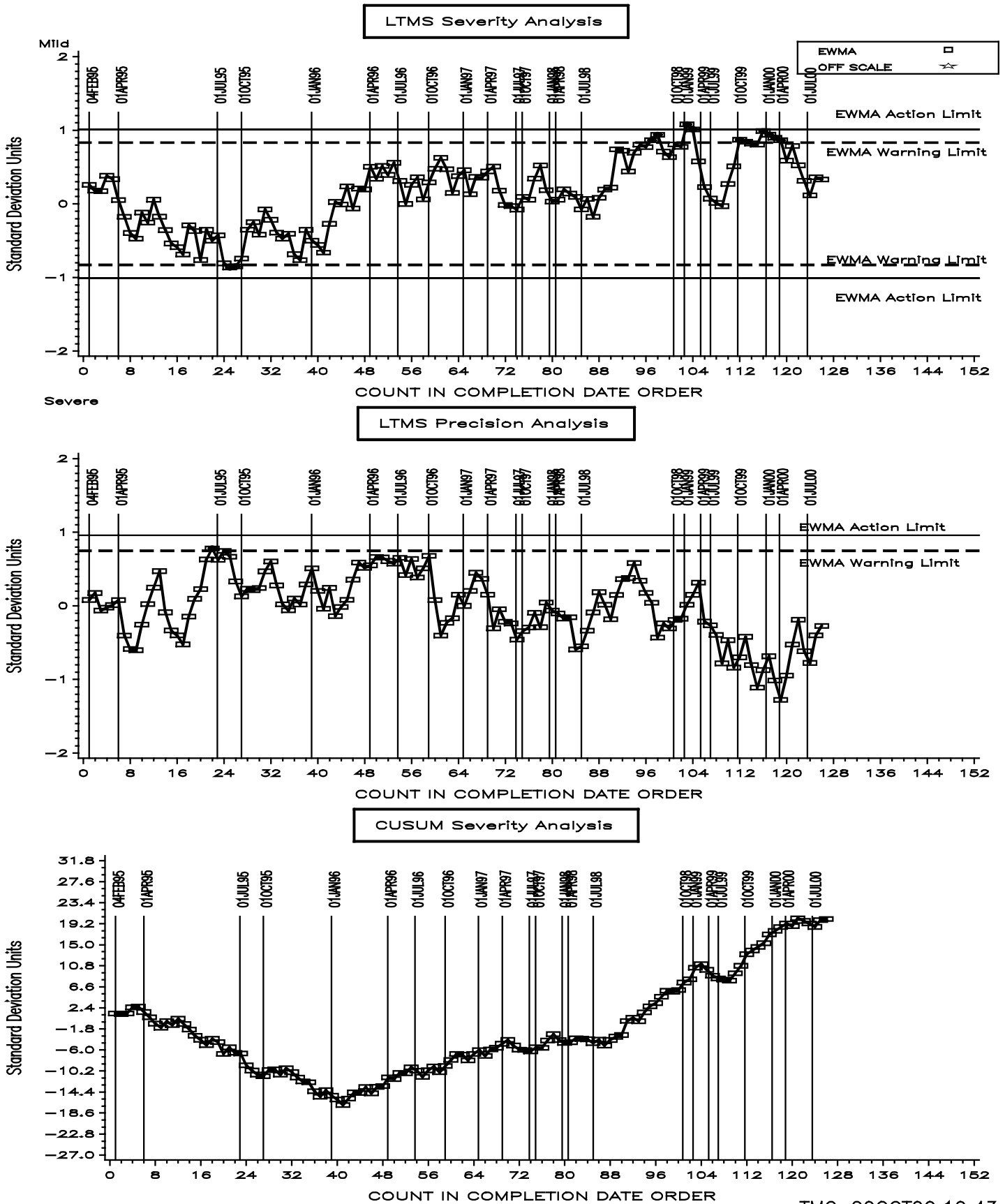
Figure 6



L-37 INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR RIDGING (MERITS) NONLUBRITED

Figure 7



L-37 INDUSTRY OPERATIONALLY VALID DATA

FINAL REF. PINION GEAR PITTING/SPALLING (MERITS) NONLUBRITED

Figure 8

