A Program of ASTM International

Test Monitoring Center

@ Carnegie Mellon University
6555 Penn Avenue, Pittsburgh, PA 15206, USA

http://astmtmc.cmu.edu
412-365-1000

MEMORANDUM: 15-009

DATE: April 10, 2015

TO: Chris Prengaman, Chairman, L-37 Surveillance Panel

FROM: Scott Parke

SUBJECT: L-37 Testing from October 1, 2014 through March 31, 2015

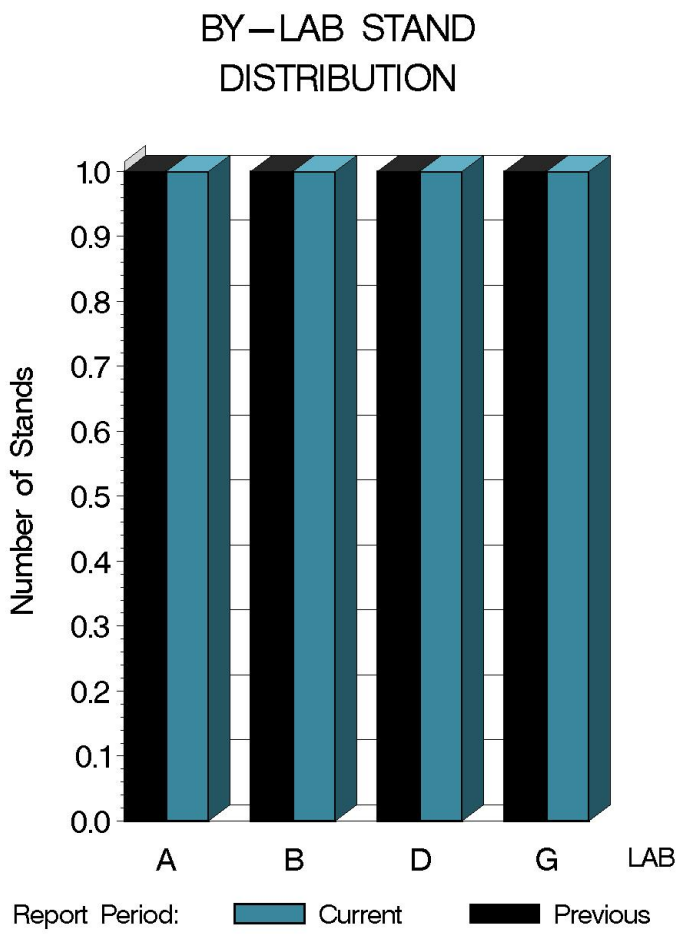
Please find attached a summary of reference oil testing activity this period.

SDP/sdp/mem15-009.sdp.doc
cc: Frank Farber
Jeff Clark
L-37 Surveillance Panel
ftp://ftp.astmtmc.cmu.edu/docs/gear/l37/semiannualreports/l37-04-2015.pdf

Distribution: email

L-37 (D6121)

	Reporting Data	Calibrated on 3-31-15
Number of Labs	4	3
Number of Stands	4	3



10:34:29 09APR2015

L-37 (D6121)

Test Distribution by Oil and Validity

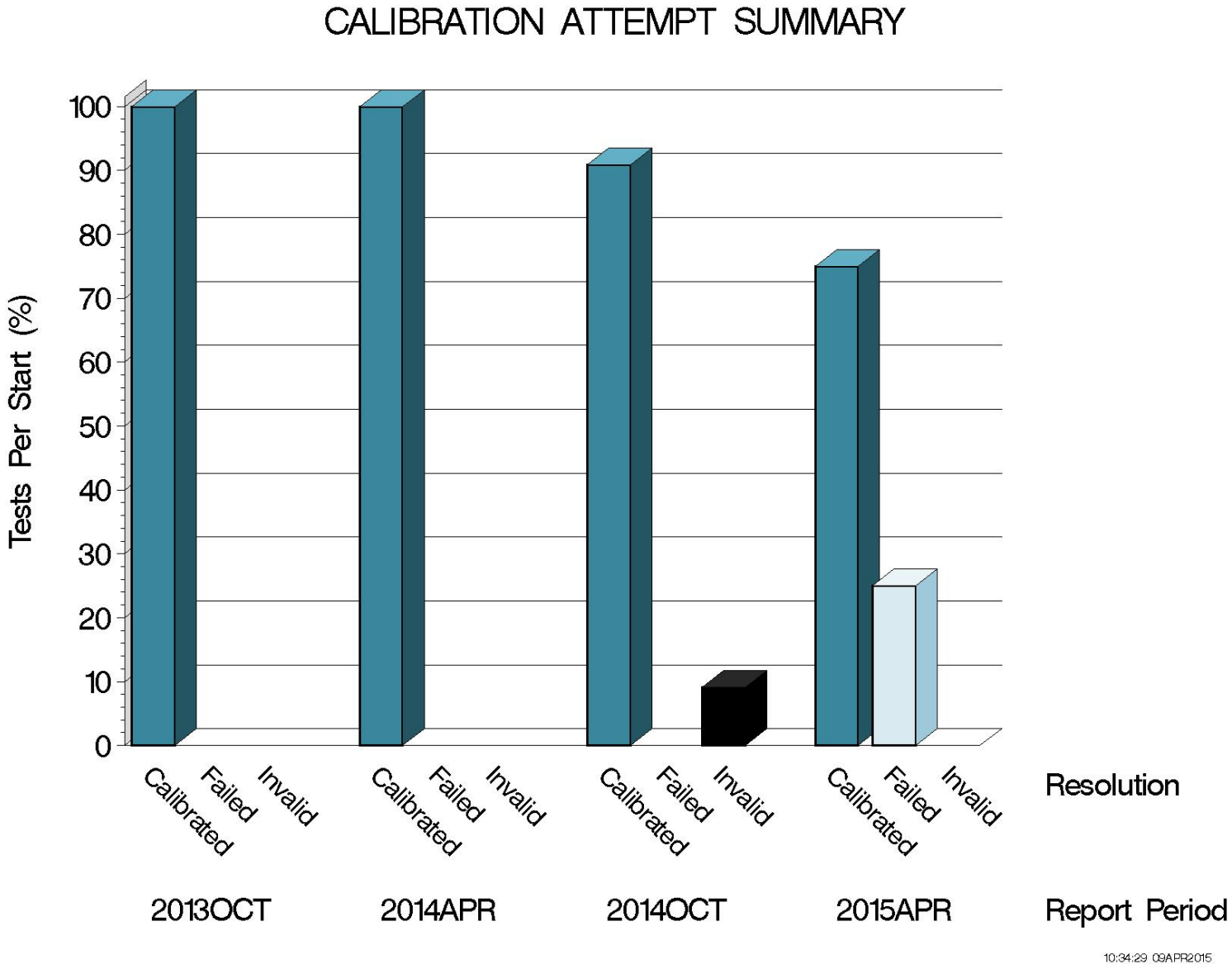
		134	152-1	152-2	155	155-1	Totals Last Period	Totals This Period
Accepted for calibration	AC	0	0	1	4	1	10	6
Rejected (Mild)	OC	1	0	0	0	0	0	1
Rejected (Severe)	OC	0	0	0	0	0	0	0
Rejected (Precision)	OC	0	0	1	0	0	0	1
Invalidated calibration	RC	0	0	0	0	0	1	0
Acceptable info run	NI	9	0	5	0	0	11	14
Unacceptable info run	MI	1	0	1	0	0	0	2
Aborted info run	XI	0	0	0	0	0	1	0
Total		11	0	8	4	1	23	24

L-37 (D6121)

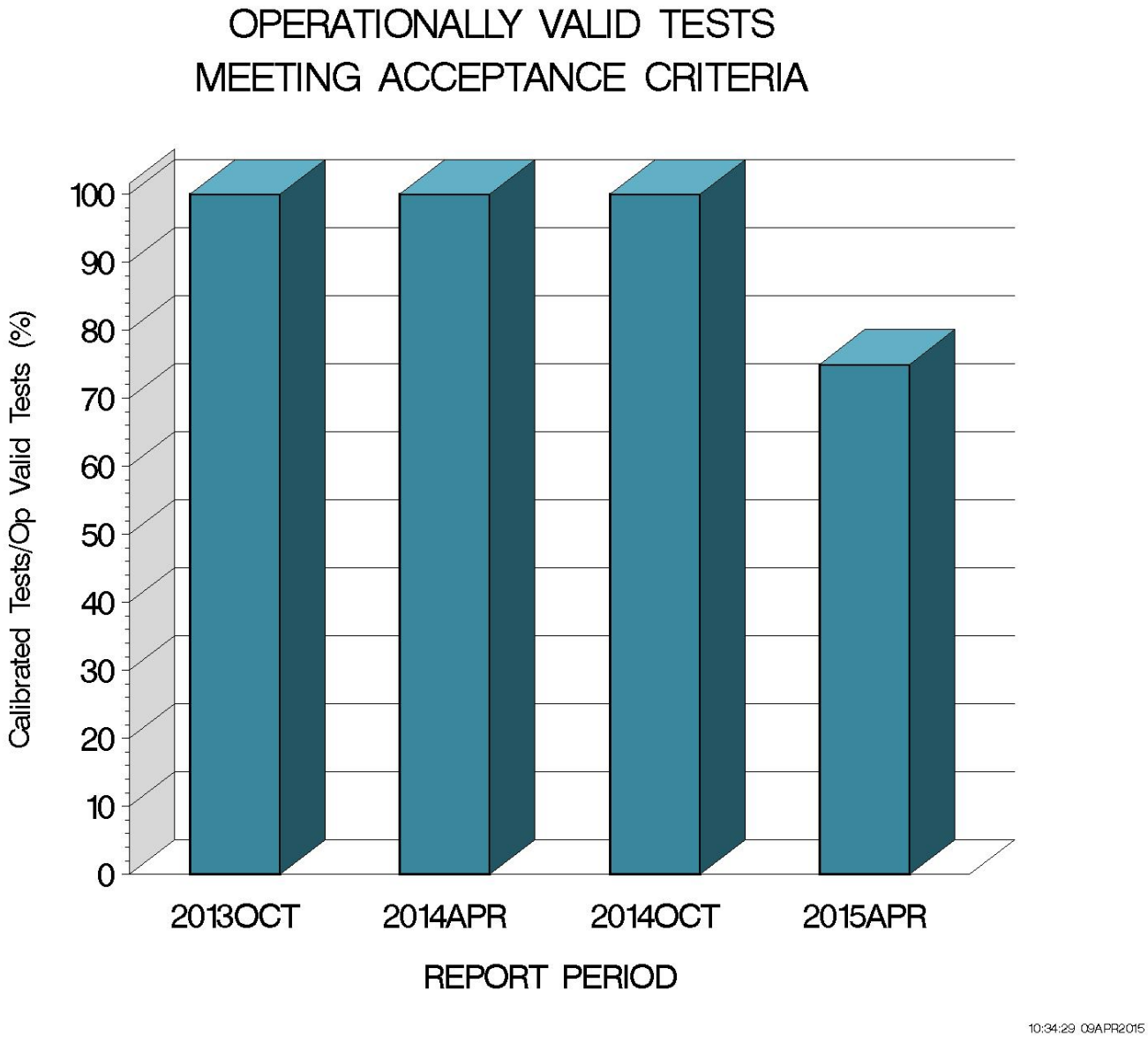
Calibration Attempt Detail

	Gear Batch	Acceptable	Failed	Total
LUBRITED	V1L500/P4T813	0	0	0
	V1L528/P4T883A	4	1	5
	Total	4	1	5
NONLUBRITED	V1L500/P4T813	0	0	0
	V1L528/P4T883A	2	1	3
	Total	2	1	3

L-37 (D6121)


CALIBRATION ATTEMPT SUMMARY
Tests Per Start (%)
100
90
80
70
60
50
40
30
20
10
0
Calibrated
Failed
Invalid
Resolution
2013OCT
2014APR
2014OCT
2015APR
Report Period
10:34:29 09APR2015

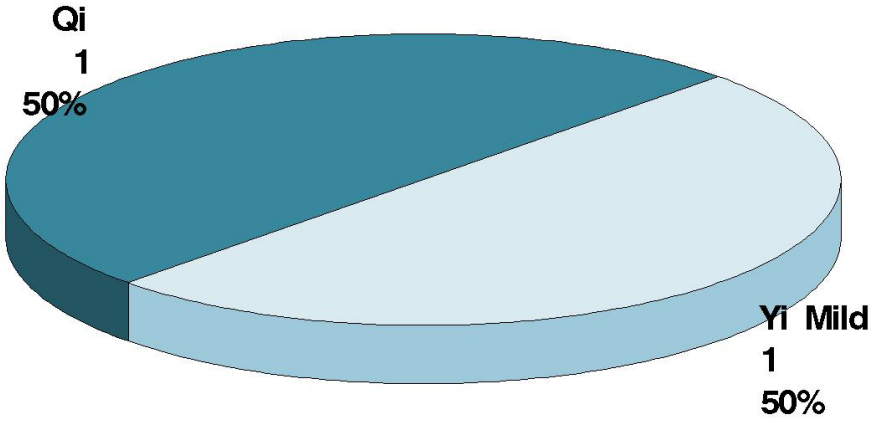
L-37 (D6121)


OPERATIONALLY VALID TESTS
MEETING ACCEPTANCE CRITERIA
Calibrated Tests/Op Valid Tests (%)
100
90
80
70
60
50
40
30
20
10
0
2013OCT
2014APR
2014OCT
2015APR
REPORT PERIOD
10:34:29 09APR2015

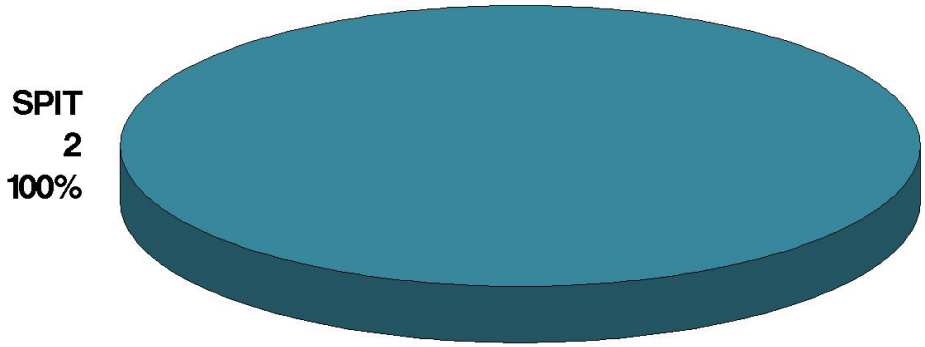
L-37 (D6121)

CAUSES FOR FAILED TESTS

By Alarm Type



By Parameter



L-37 (D6121)

CAUSES FOR LOST TESTS

			Oil					Validity			Loss Rate		
Lab	Cause		134	152-1	152-2	155	155-1	RC	LC	XI	Lost	Starts	%
	No tests were lost.										0	24	0%
		Lost	0	0	0	0	0	0	0	0			
		Starts	11	0	8	4	1	24	24	24			
		%	0%	0%	0%	0%	0%	0%	0%	0%			

Two tests intended for use in the Lab-built Axle approval process failed to meet the reference acceptance limits and were therefore unusable for that purpose. One test used oil 134 but was mild on SPIT. The other used 152-2 but was severe on RIDG and RIPP. These tests were assigned an ‘MI’ validity. A third test also used 152-2 and was acceptable but could not be used without the other two. This test was assigned an ‘NI’ validity. None of these three tests is used in control charting.

L-37 (D6121)

GEAR BATCH SEVERITY

LUBRITED HARDWARE						
Parameter	Gear Batch	N	Δ/s	s[A]	Overall Δ/s	Overall Shift (in Merits)[B]
RIDG	V1L528/P4T883A	5	-1.716	3.314	-1.716	-2.454
RIPP	V1L528/P4T883A	5	0.768	0.764	0.768	0.365
SPIT	V1L528/P4T883A	5	-13.951	31.469	-13.951	-8.078
WEAR	V1L528/P4T883A	5	-1.431	3.824	-1.431	-0.743

[A] Because the number of tests completed this period was too small to compute a representative pooled standard deviation, the straight standard deviation is shown.

[B] As computed using SA standard deviation published in the LTMS document.

L-37 (D6121)

GEAR BATCH SEVERITY (continued)

NON-LUBRITED HARDWARE						
Parameter	Gear Batch	N	Δ/s	s[A]	Overall Δ/s	Overall Shift (in Merits)[B]
RIDG	V1L528/P4T883A	3	0.851	0.609	0.851	0.567
RIPP	V1L528/P4T883A	3	0.592	0.069	0.592	0.330
SPIT	V1L528/P4T883A	3	1.811	1.819	1.811	1.534
WEAR	V1L528/P4T883A	3	0.482	0.030	0.482	0.343

[A] Because the number of tests completed this period was too small to compute a representative pooled standard deviation, the straight standard deviation is shown.

[B] As computed using SA standard deviation published in the LTMS document.

L-37 (D6121)

LAB SEVERITY

LUBRITED HARDWARE						
Gear Batch	Lab	N	RIDG	RIPP	SPIT	WEAR
V1L528/P4T883A	A	1	-2.643	0.203	0.000	0.370
V1L528/P4T883A	B	2	-2.437	1.603	-35.122	-3.947
V1L528/P4T883A	D	1	-2.643	0.203	0.000	0.370
V1L528/P4T883A	G	1	1.582	0.226	0.488	0.000

NON-LUBRITED HARDWARE						
Gear Batch	Lab	N	RIDG	RIPP	SPIT	WEAR
V1L528/P4T883A	D	2	0.499	0.552	0.761	0.499
	G	1	1.554	0.671	3.911	0.447

L-37 (D6121)

SUMMARY OF SEVERITY & PRECISION

Severity
Nonlubrited – A 9.6 merit SPIT result on oil 134 has industry SPIT severity exceeding the mild EWMA warning limit. The other test parameters remain within limits. Lubrited – A result on oil 152-2 with WEAR=5, RIDG=4, RIPP=10, and SPIT=7 (Yi = -8.26, -6.33, 1.55, and -70.24 respectively) has industry charts currently exceeding the severe EWMA alarm limit for WEAR, RIDG, and SPIT.

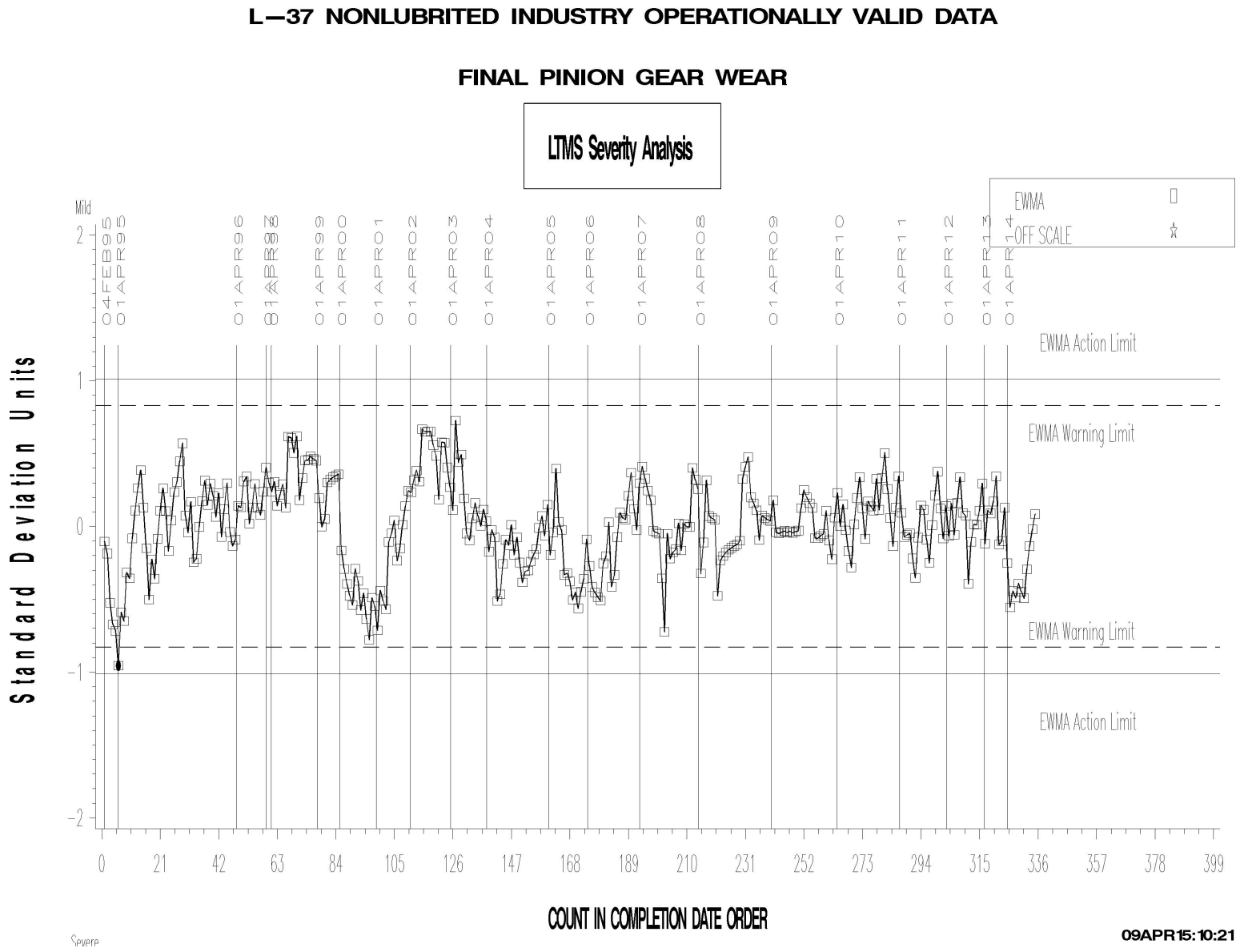
L-37 (D6121)

SUMMARY OF SEVERITY & PRECISION (cont.)

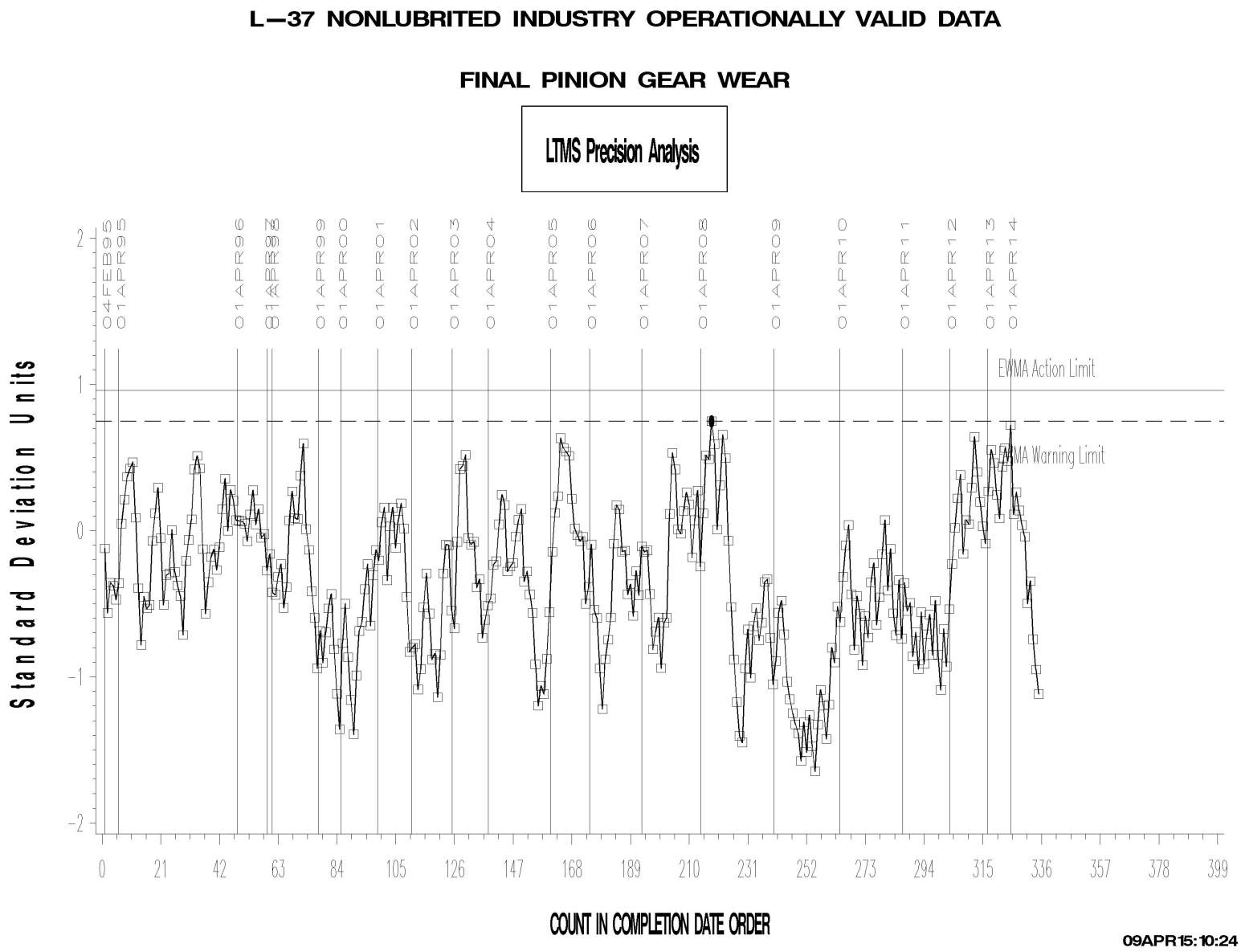
Precision
Nonlubrited – Precision performance remained within control chart limits. Lubrited – Due to the extremity of the 152-2 result described above (Yi = -70.24), precision for SPIT currently exceeds the EWMA precision

Industry control charts follow.

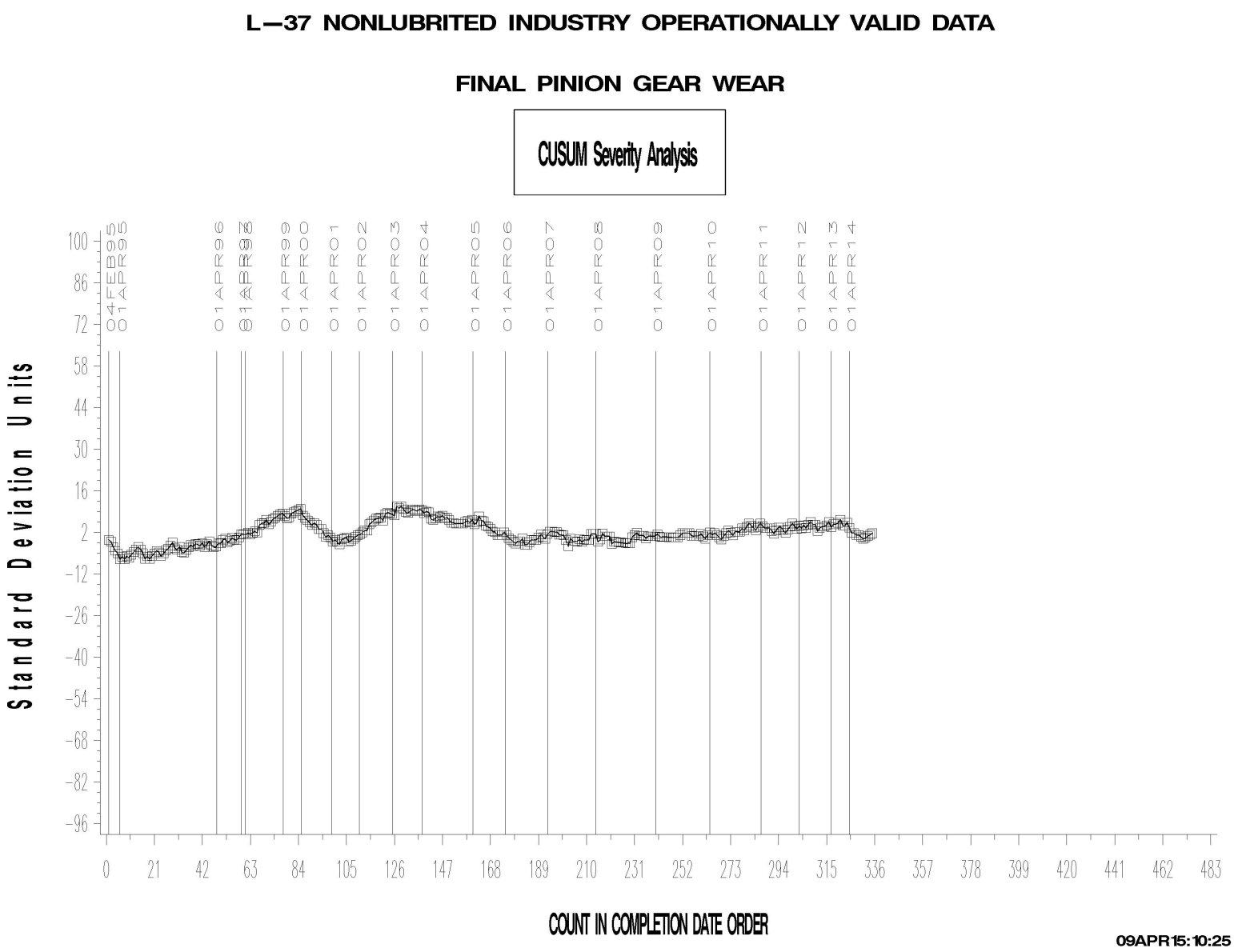
L-37 (D6121)


L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR WEAR
LTMS Severity Analysis
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
Mild
2
1
0
-1
-2
04FEB95
01APR96
01APR97
01APR98
01APR99
01APR00
01APR01
01APR02
01APR03
01APR04
01APR05
01APR06
01APR07
01APR08
01APR09
01APR10
01APR11
01APR12
01APR13
01APR14
0
21
42
63
84
105
126
147
168
189
210
231
252
273
294
315
336
357
378
399
COUNT IN COMPLETION DATE ORDER
09APR15:10:21

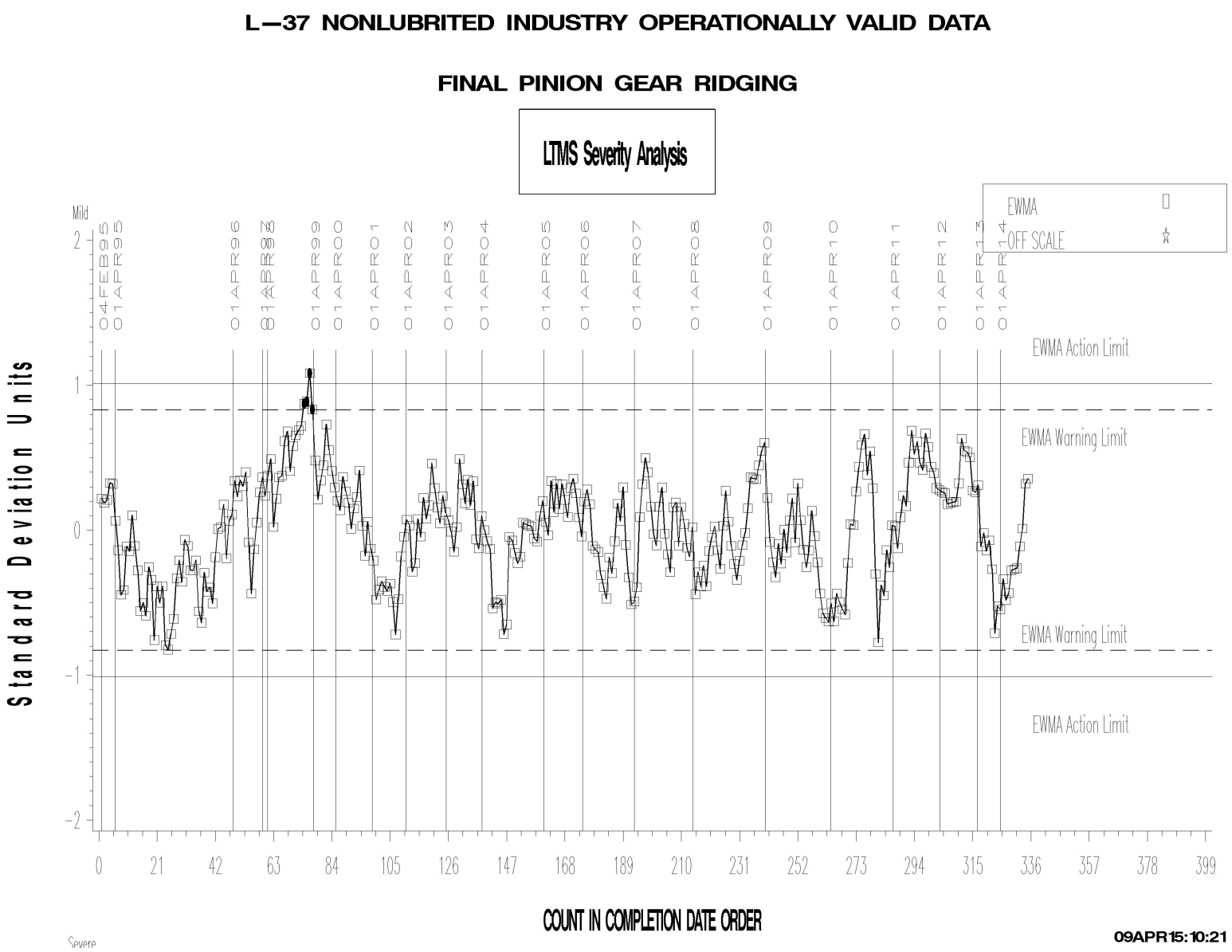
L-37 (D6121)


L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR WEAR
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
09APR15:10:24

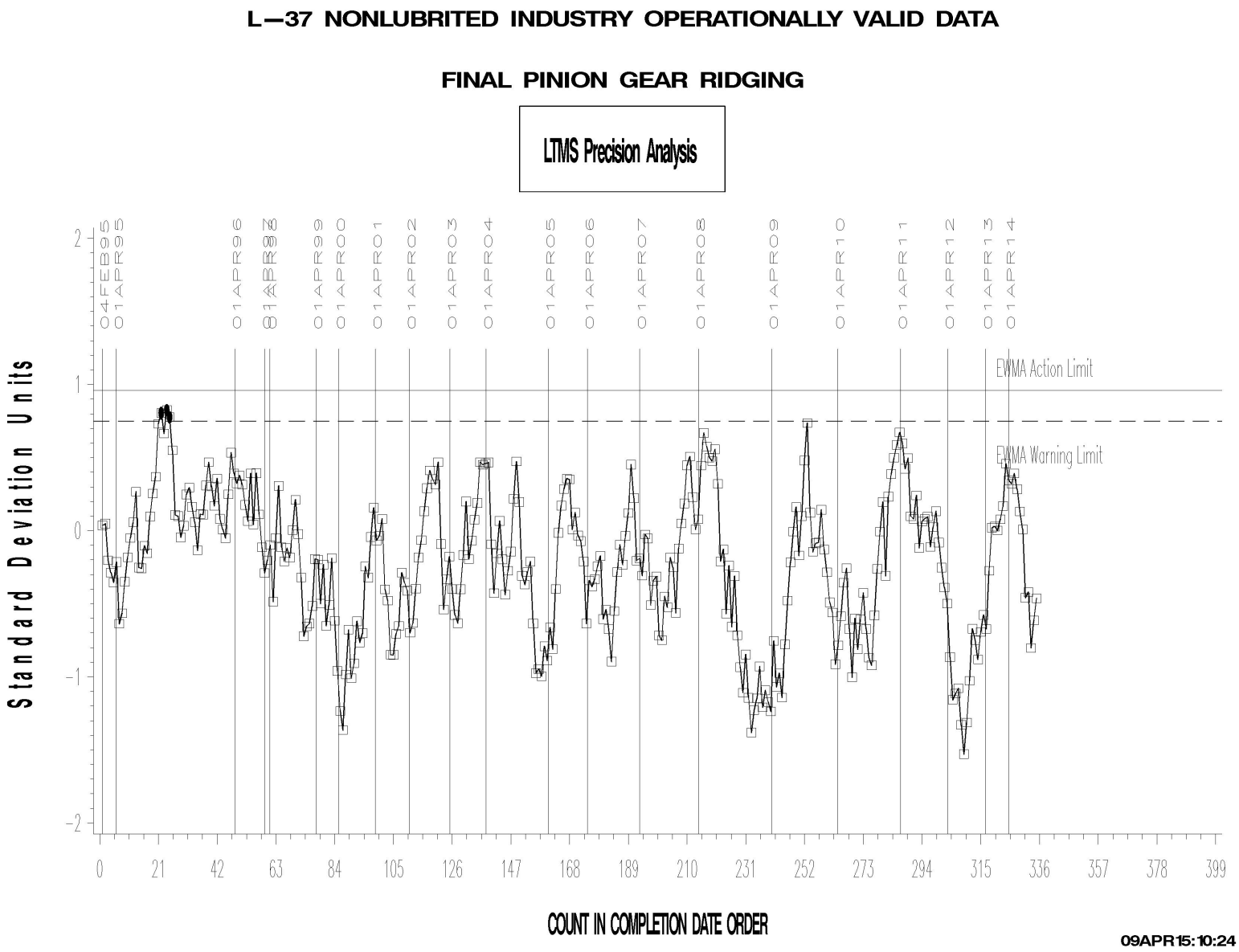
L-37 (D6121)


L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR WEAR
CUSUM Severity Analysis
Standard Deviation Units
100
86
72
58
44
30
16
2
-12
-26
-40
-54
-68
-82
-96
04FEB95
01APR95
01APR96
01APR97
01APR98
01APR99
01APR00
01APR01
01APR02
01APR03
01APR04
01APR05
01APR06
01APR07
01APR08
01APR09
01APR10
01APR11
01APR12
01APR13
01APR14
0
21
42
63
84
105
126
147
168
189
210
231
252
273
294
315
336
357
378
399
420
441
462
483
COUNT IN COMPLETION DATE ORDER
09APR15:10:25

L-37 (D6121)


L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIDGING
LTMS Severity Analysis
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
Mild
2
1
0
-1
-2
0
21
42
63
84
105
126
147
168
189
210
231
252
273
294
315
336
357
378
399
COUNT IN COMPLETION DATE ORDER
09APR15:10:21

L-37 (D6121)

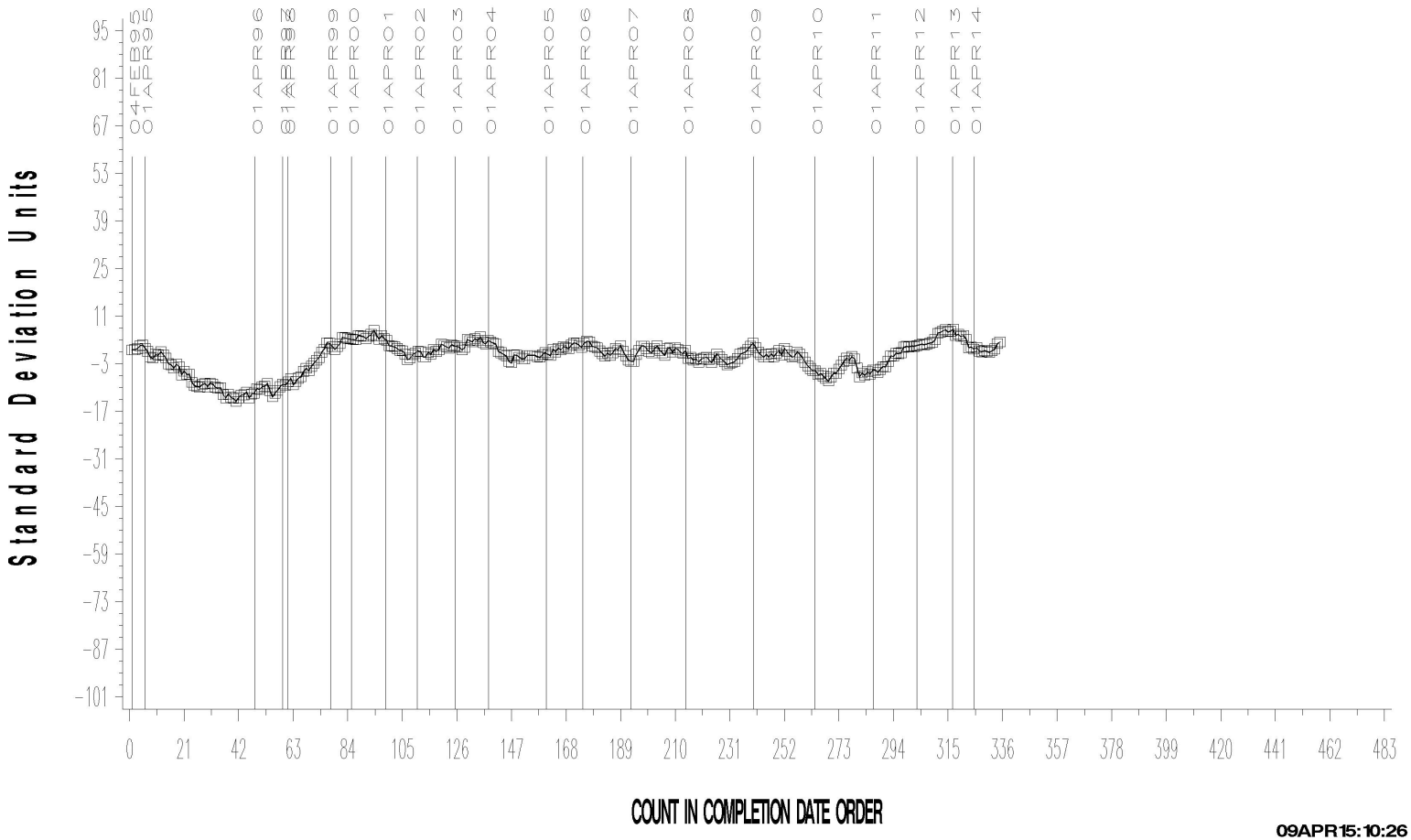

L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIDGING
LTMS Precision Analysis
Standard Deviation Units
2
1
0
-1
-2
04FEB95
01APR95
01APR96
01APR97
01APR98
01APR99
01APR00
01APR01
01APR02
01APR03
01APR04
01APR05
01APR06
01APR07
01APR08
01APR09
01APR10
01APR11
01APR12
01APR13
01APR14
EWMA Action Limit
EWMA Warning Limit
0
21
42
63
84
105
126
147
168
189
210
231
252
273
294
315
336
357
378
399
COUNT IN COMPLETION DATE ORDER
09APR15:10:24

L-37 (D6121)

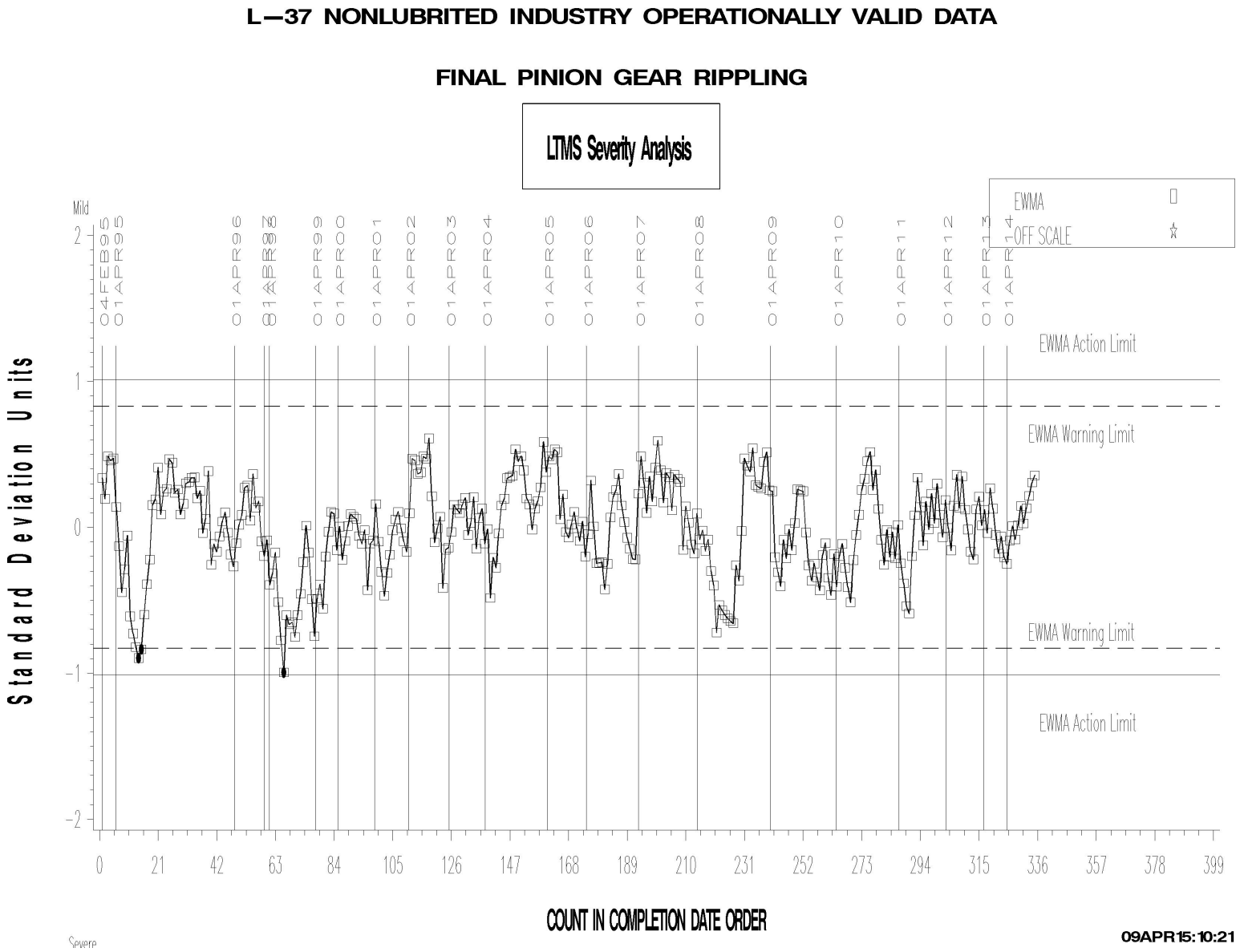
L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR RIDGING

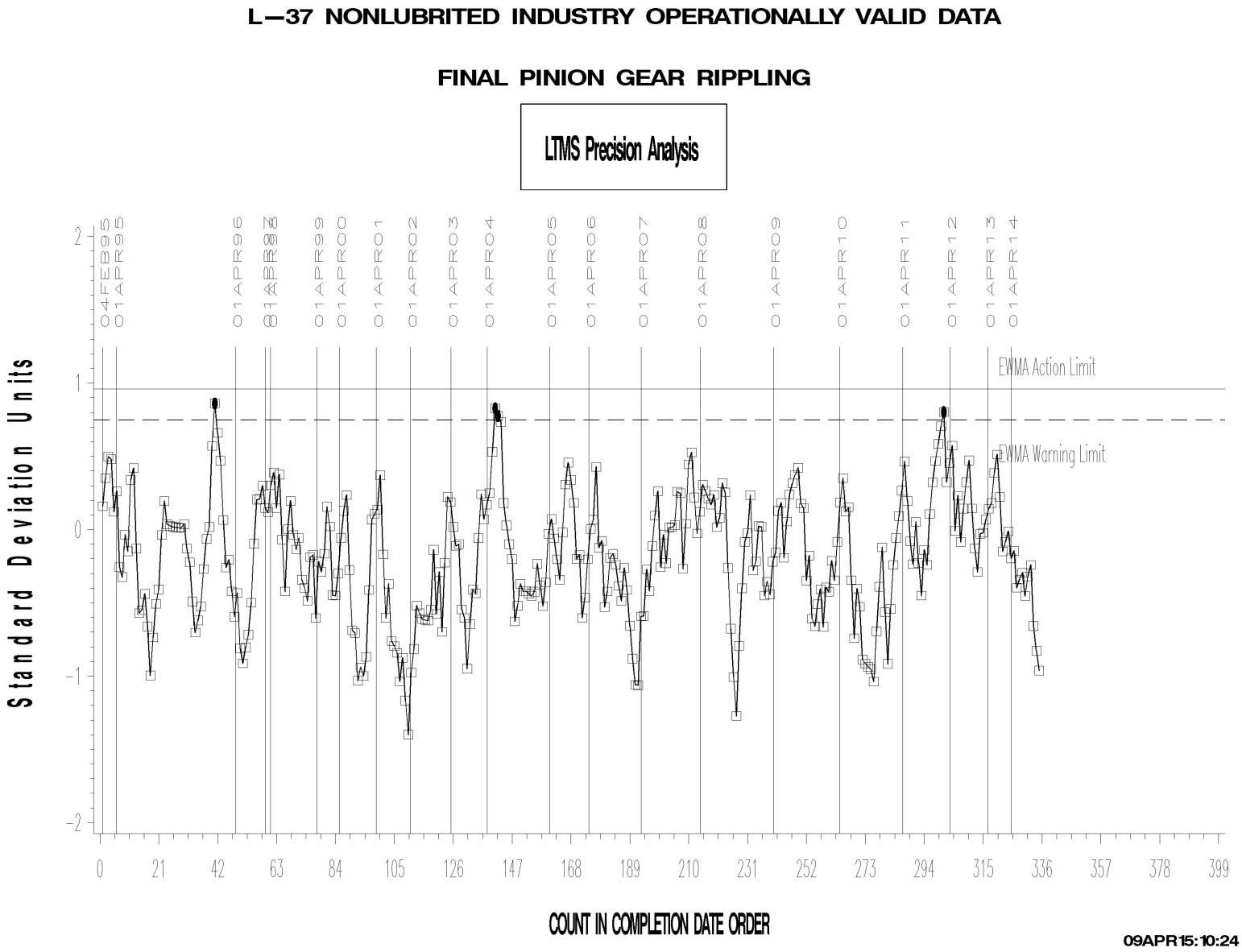
CUSUM Severity Analysis



L-37 (D6121)


L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIPPLING
LTMS Severity Analysis
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
Mild
2
1
0
-1
-2
04FEB95
01APR95
01APR96
01APR97
01APR98
01APR99
01APR00
01APR01
01APR02
01APR03
01APR04
01APR05
01APR06
01APR07
01APR08
01APR09
01APR10
01APR11
01APR12
01APR13
01APR14
0
21
42
63
84
105
126
147
168
189
210
231
252
273
294
315
336
357
378
399
COUNT IN COMPLETION DATE ORDER
09APR15:10:21

L-37 (D6121)

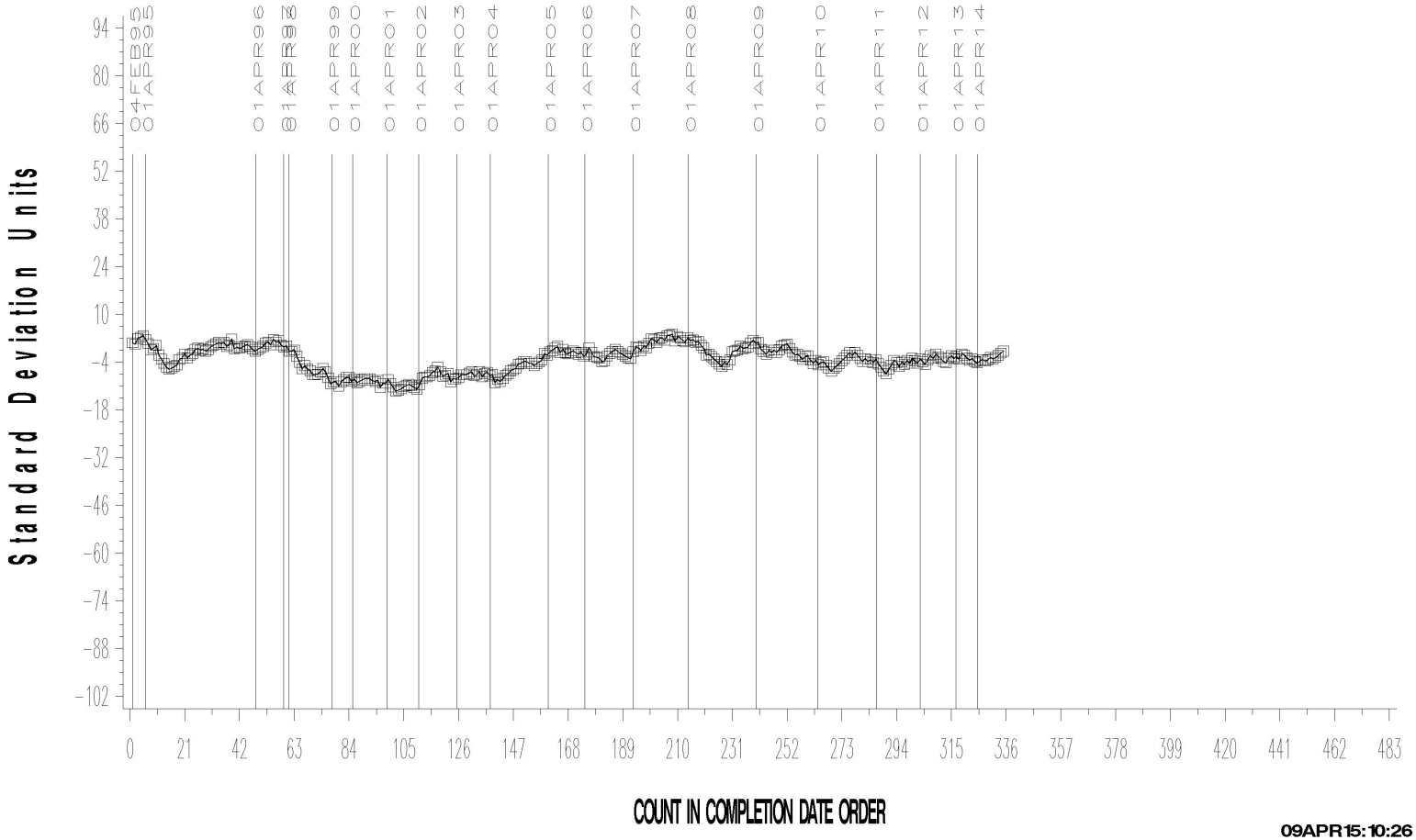

L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIPPLING
LTMS Precision Analysis
Standard Deviation Units
2
1
0
-1
-2
04FEB95
01APR95
01APR96
01APR97
01APR98
01APR99
01APR00
01APR01
01APR02
01APR03
01APR04
01APR05
01APR06
01APR07
01APR08
01APR09
01APR10
01APR11
01APR12
01APR13
01APR14
EWMA Action Limit
EWMA Warning Limit
0
21
42
63
84
105
126
147
168
189
210
231
252
273
294
315
336
357
378
399
COUNT IN COMPLETION DATE ORDER
09APR15:10:24

L-37 (D6121)

L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR RIPPLING

CUSUM Severity Analysis

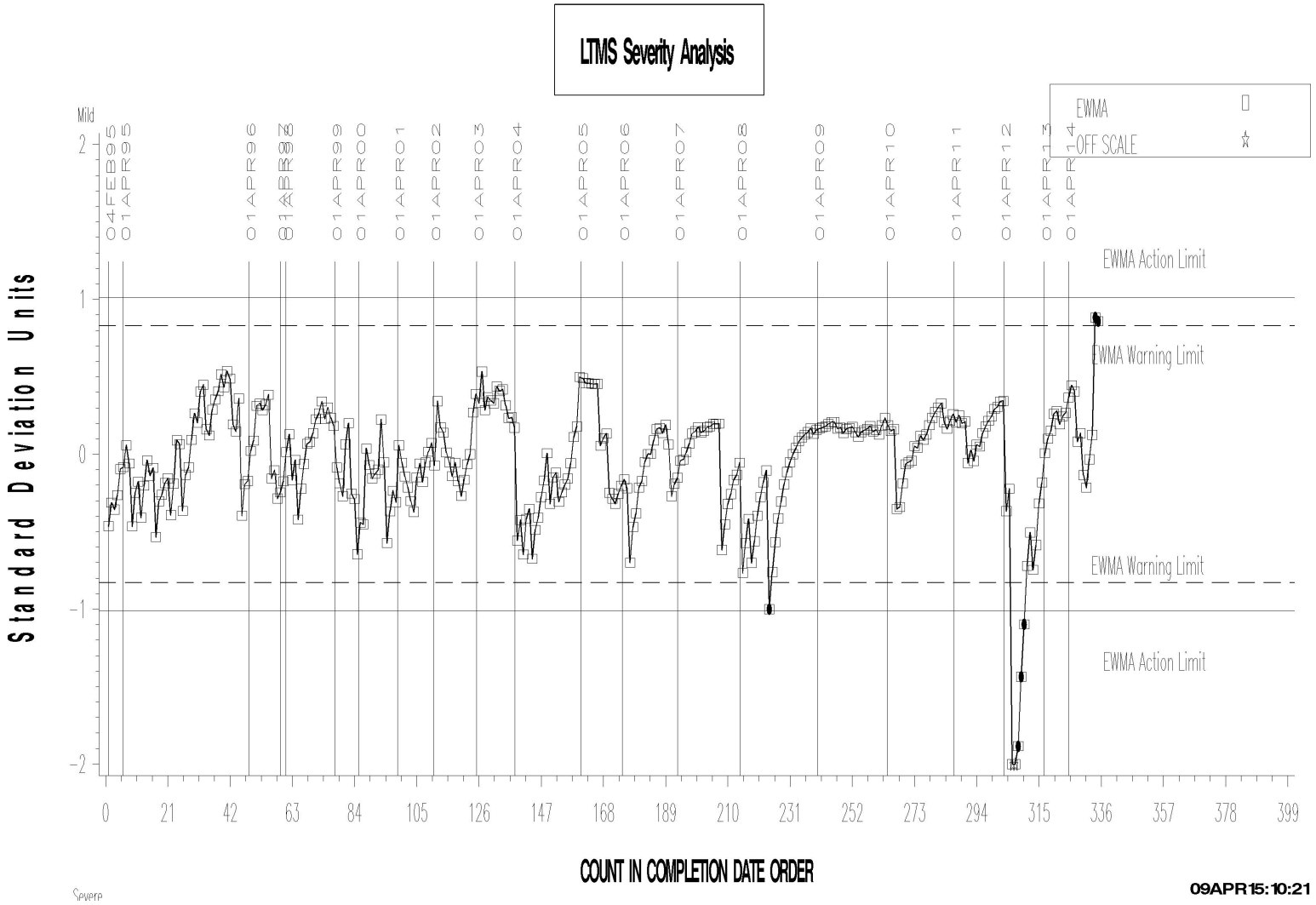


09APR15:10:26

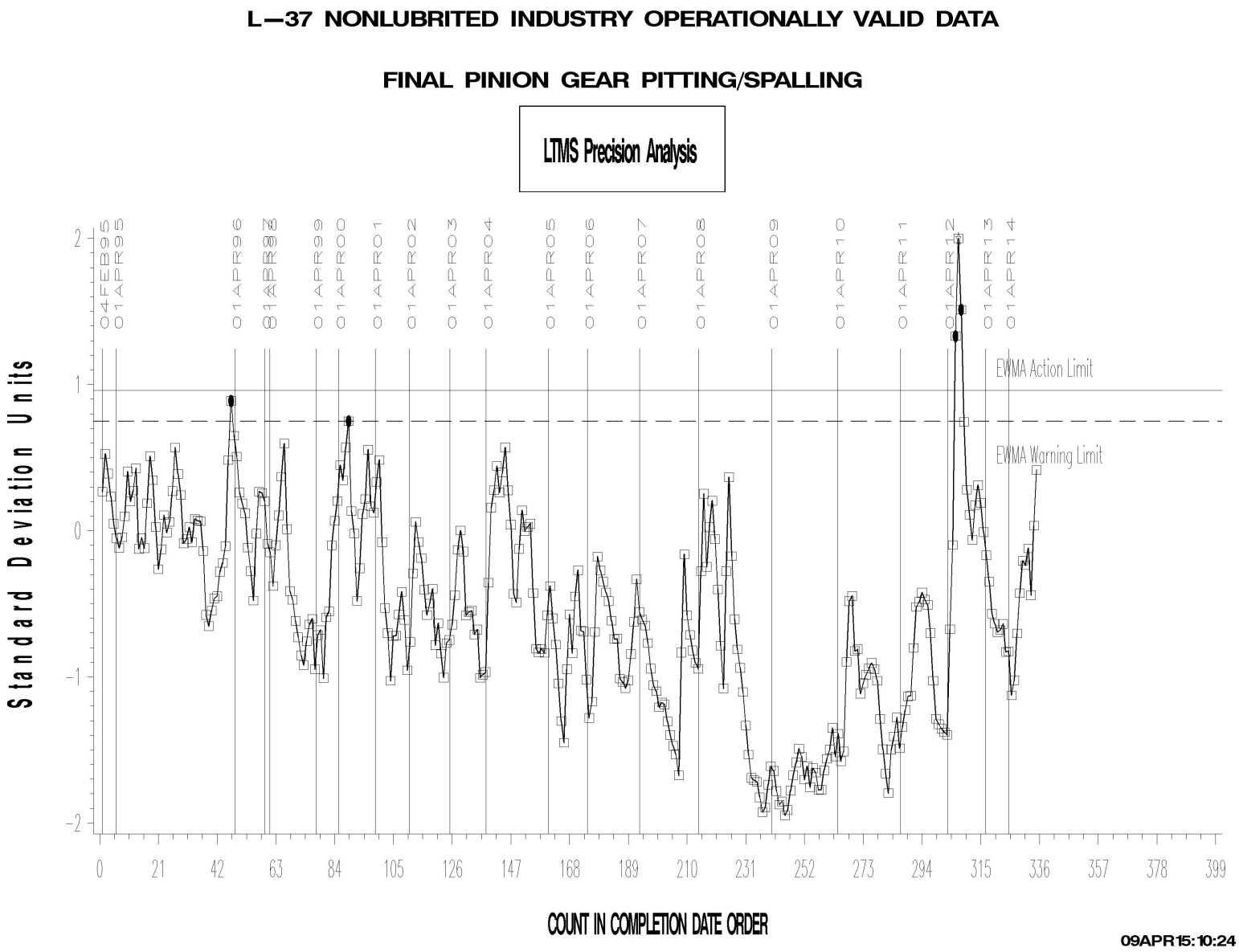
L-37 (D6121)

L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR PITTING/SPALLING



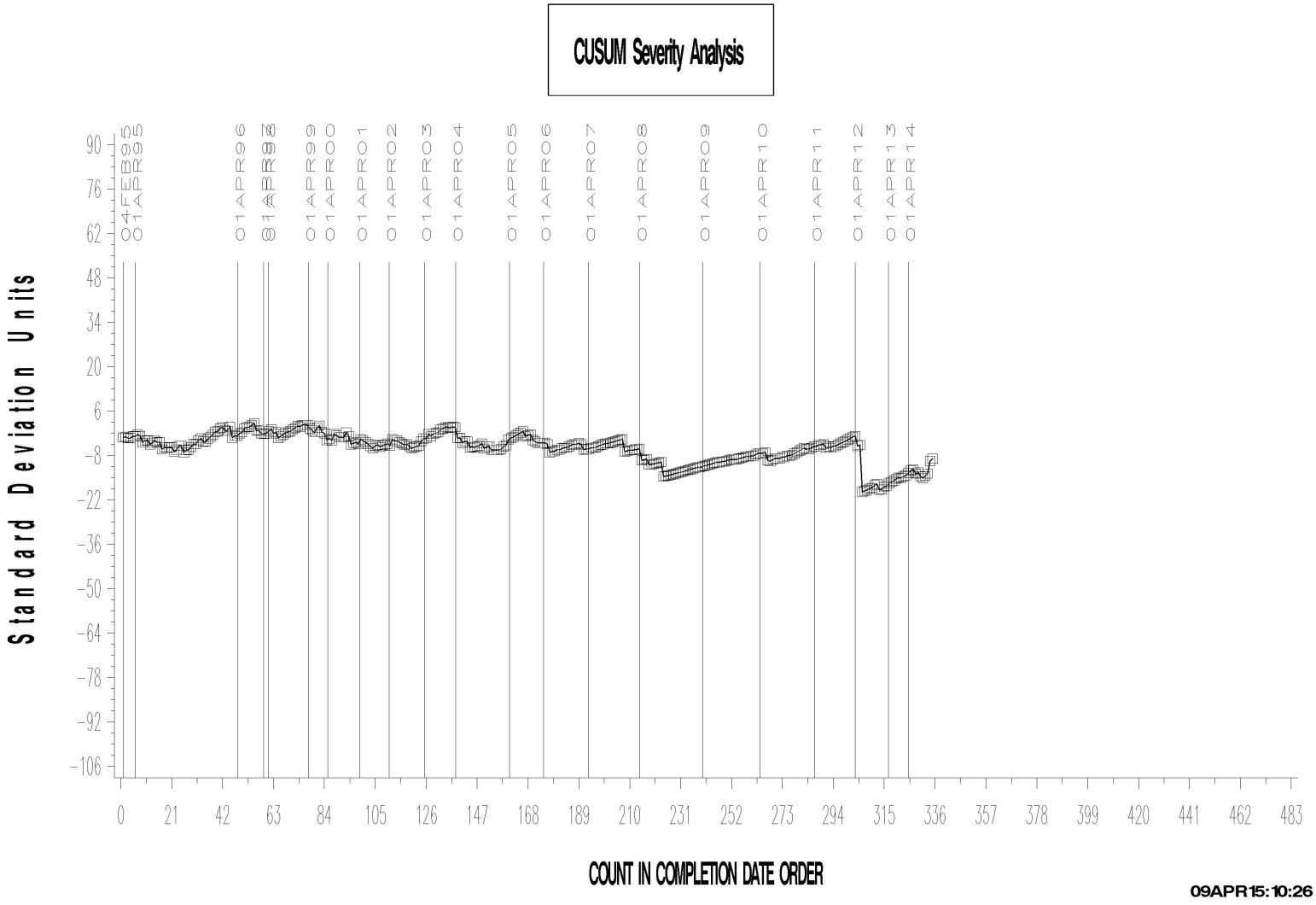
L-37 (D6121)



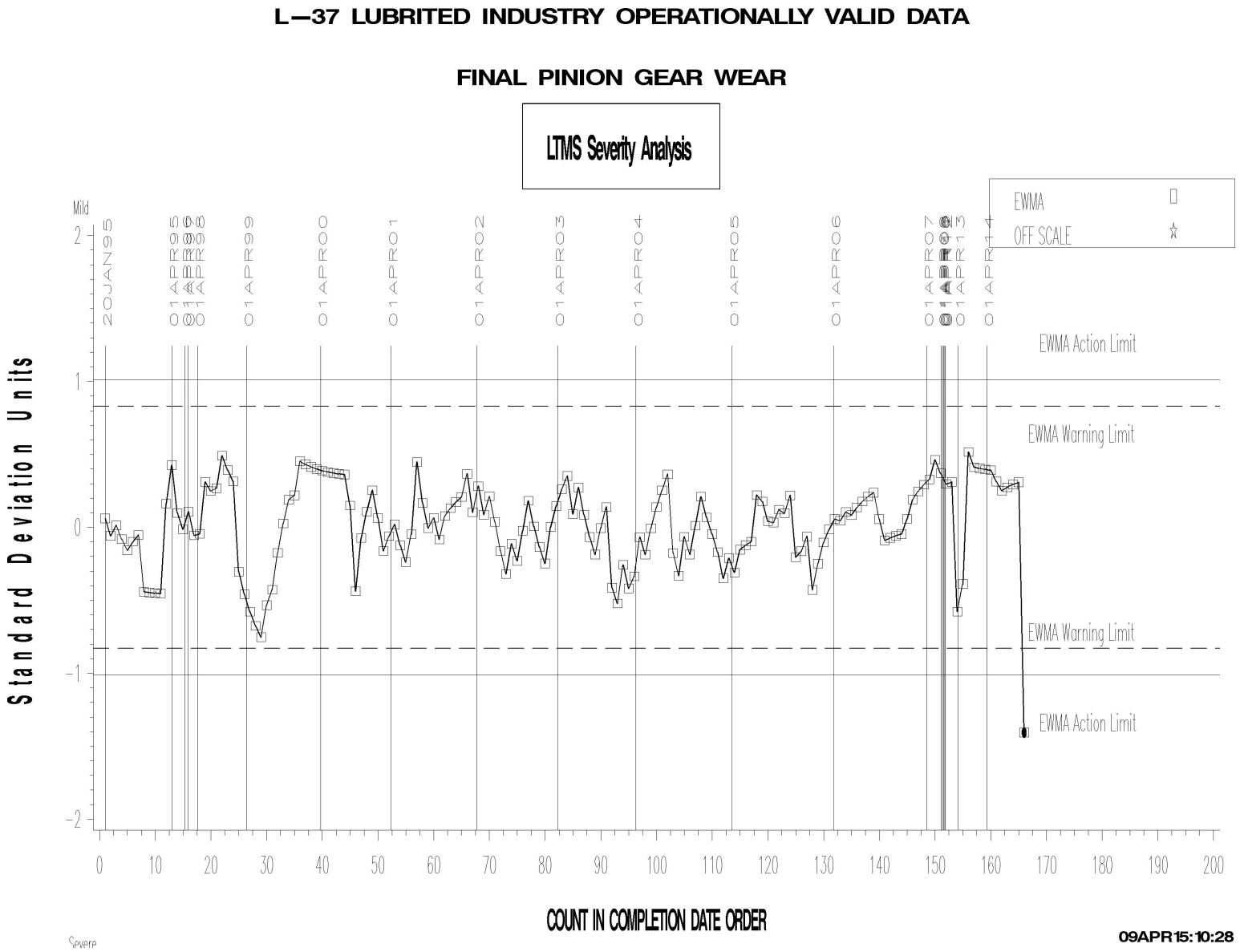
L-37 (D6121)

L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA

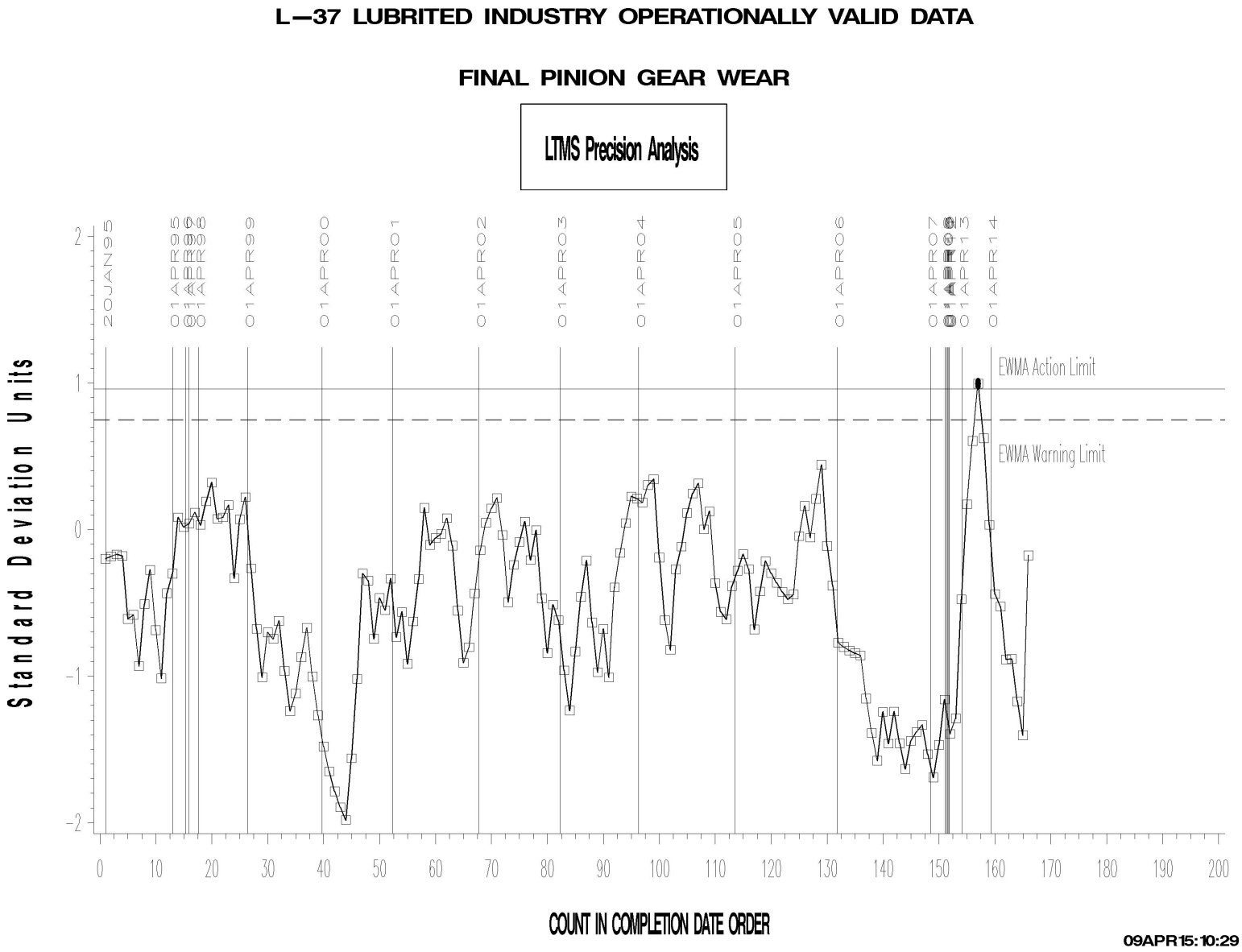
FINAL PINION GEAR PITTING/SPALLING



L-37 (D6121)


L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR WEAR
LTMS Severity Analysis
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
09APR15:10:28

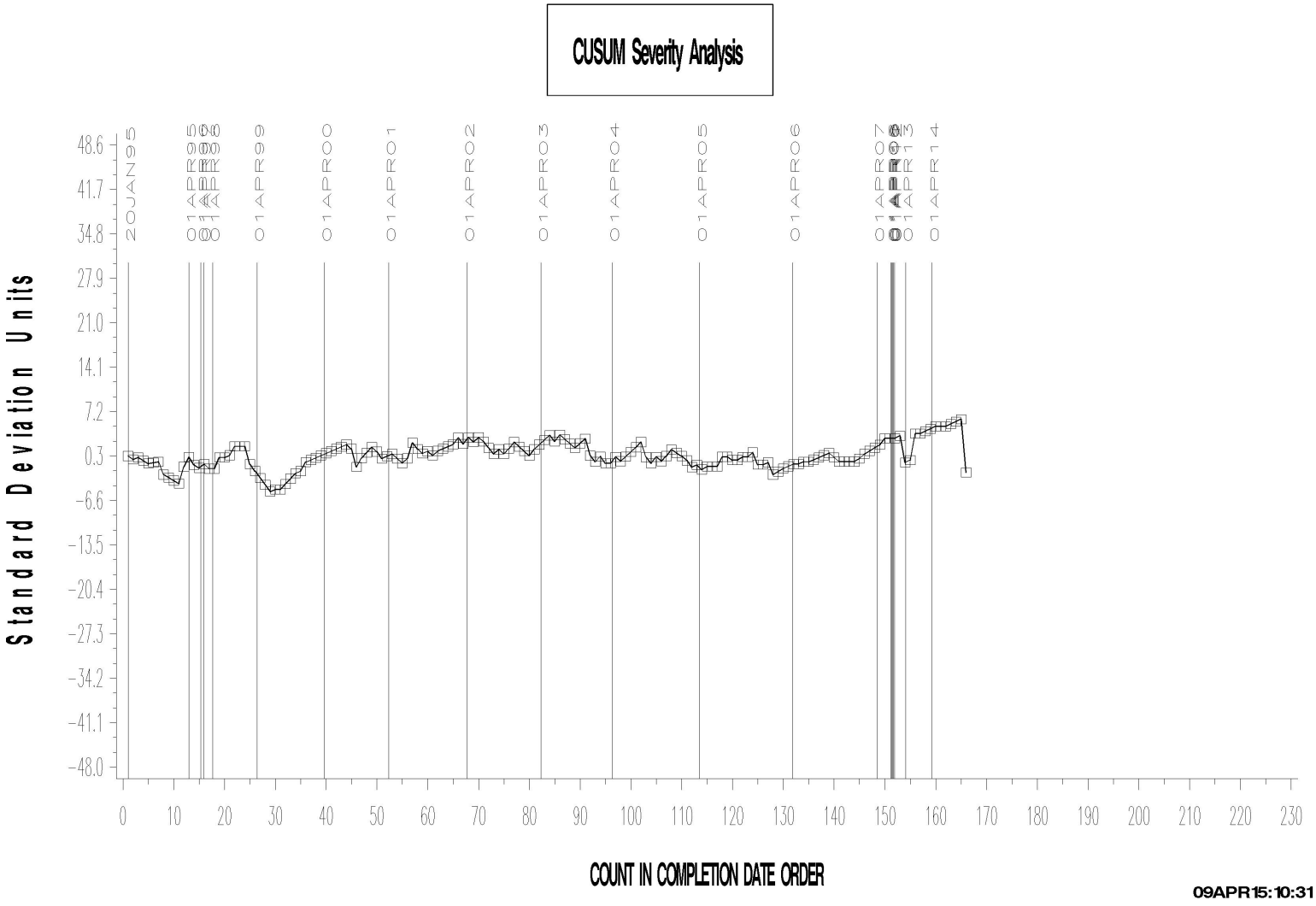
L-37 (D6121)


L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR WEAR
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
09APR15:10:29

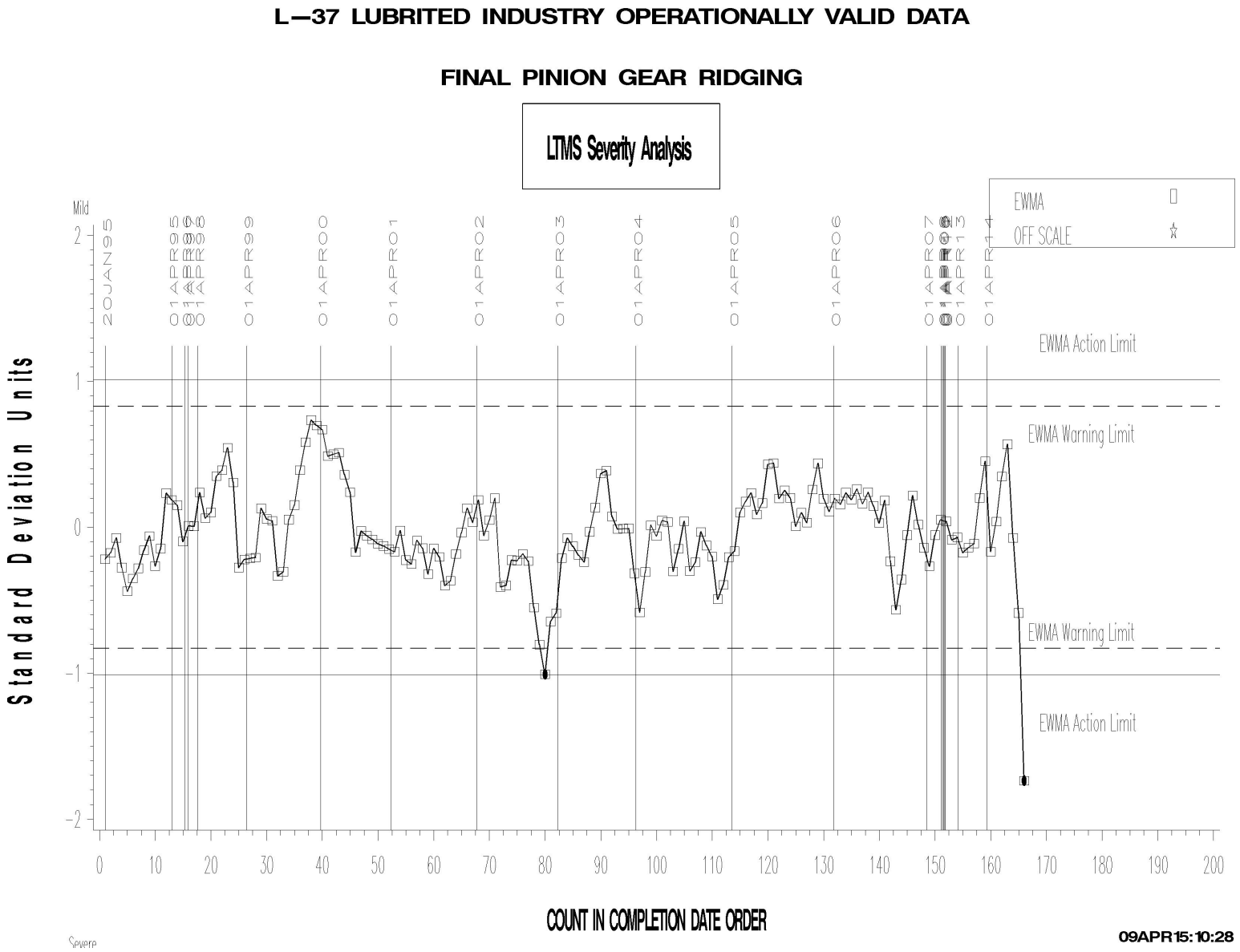
L-37 (D6121)

L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA

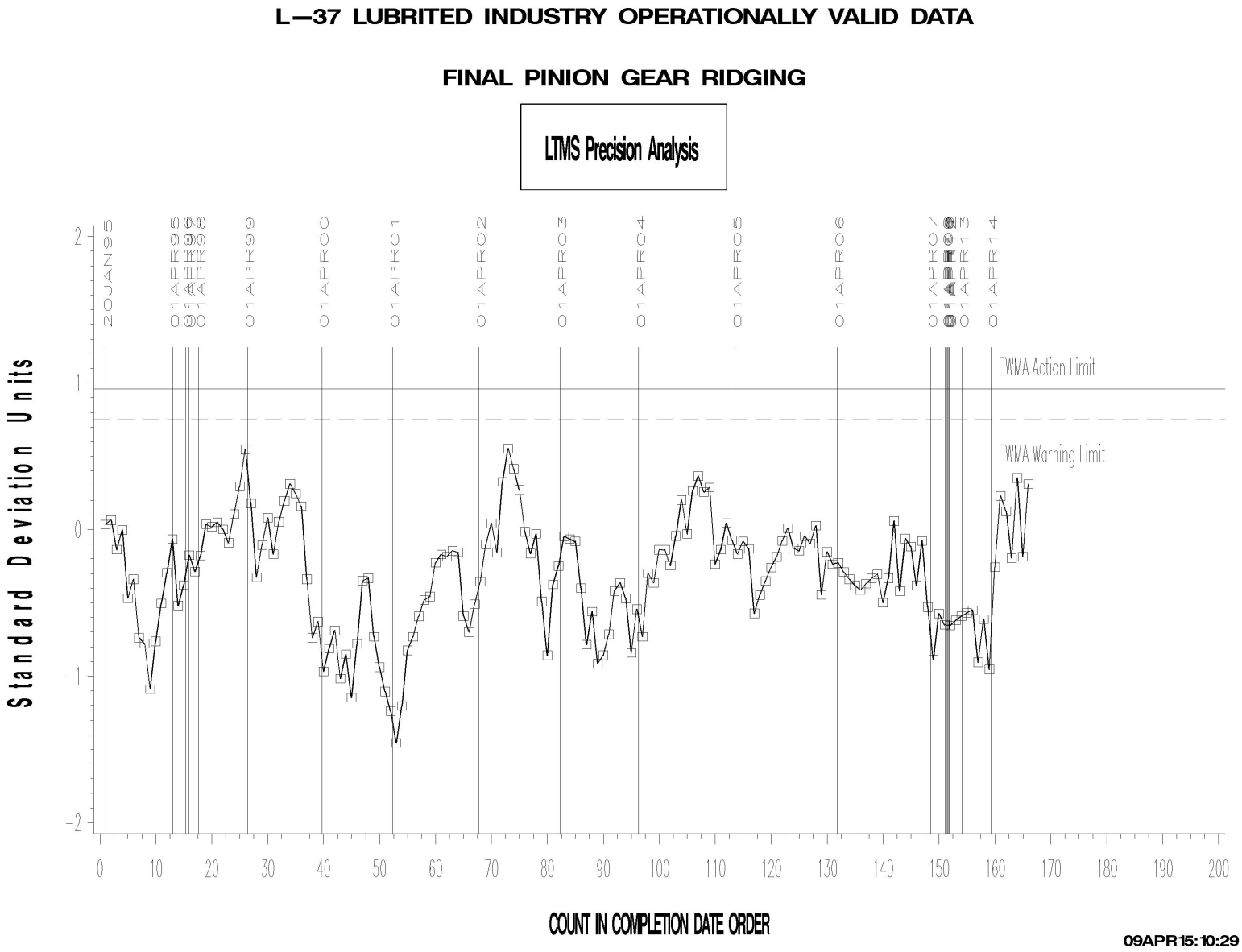
FINAL PINION GEAR WEAR



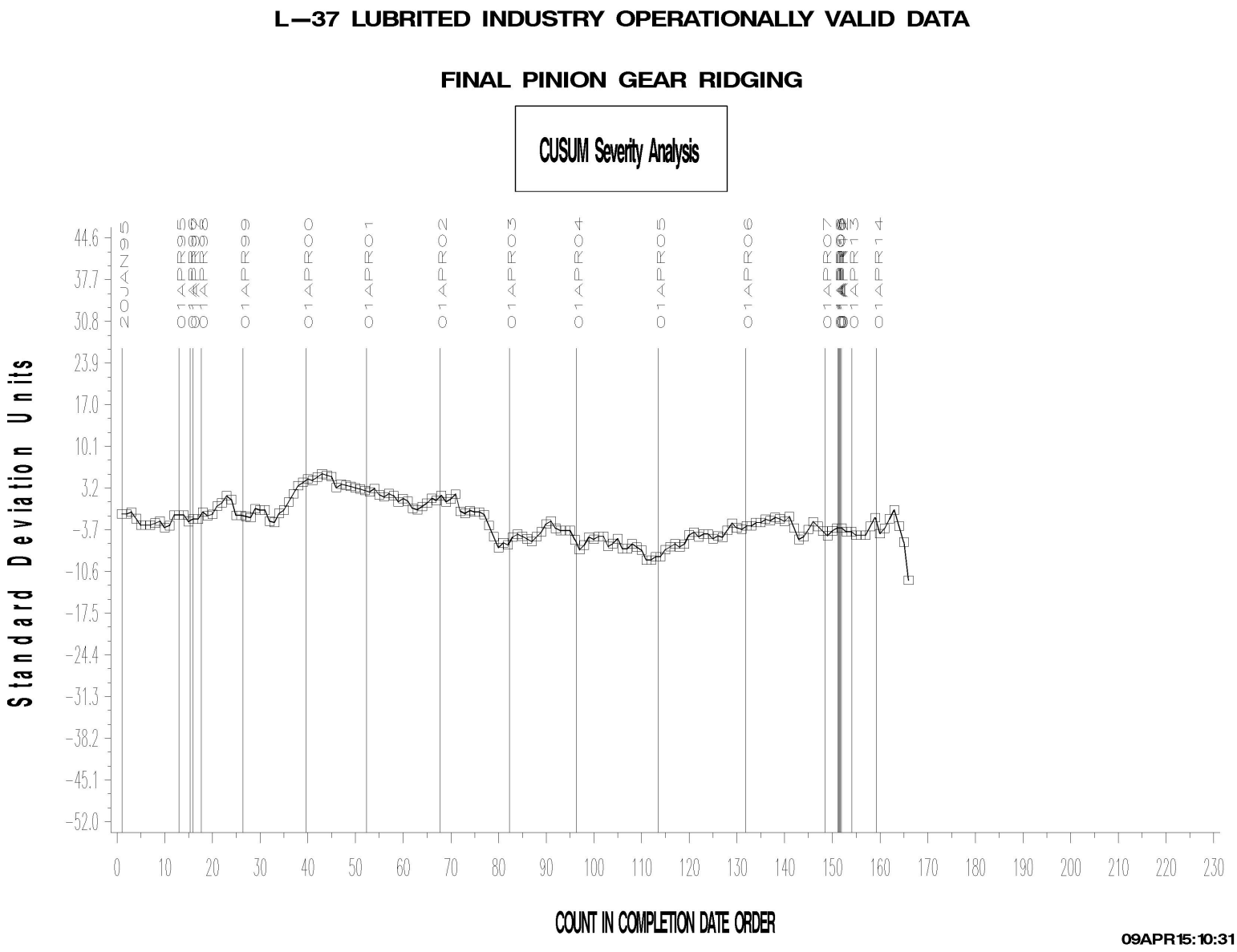
L-37 (D6121)


L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIDGING
LTMS Severity Analysis
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
09APR15:10:28

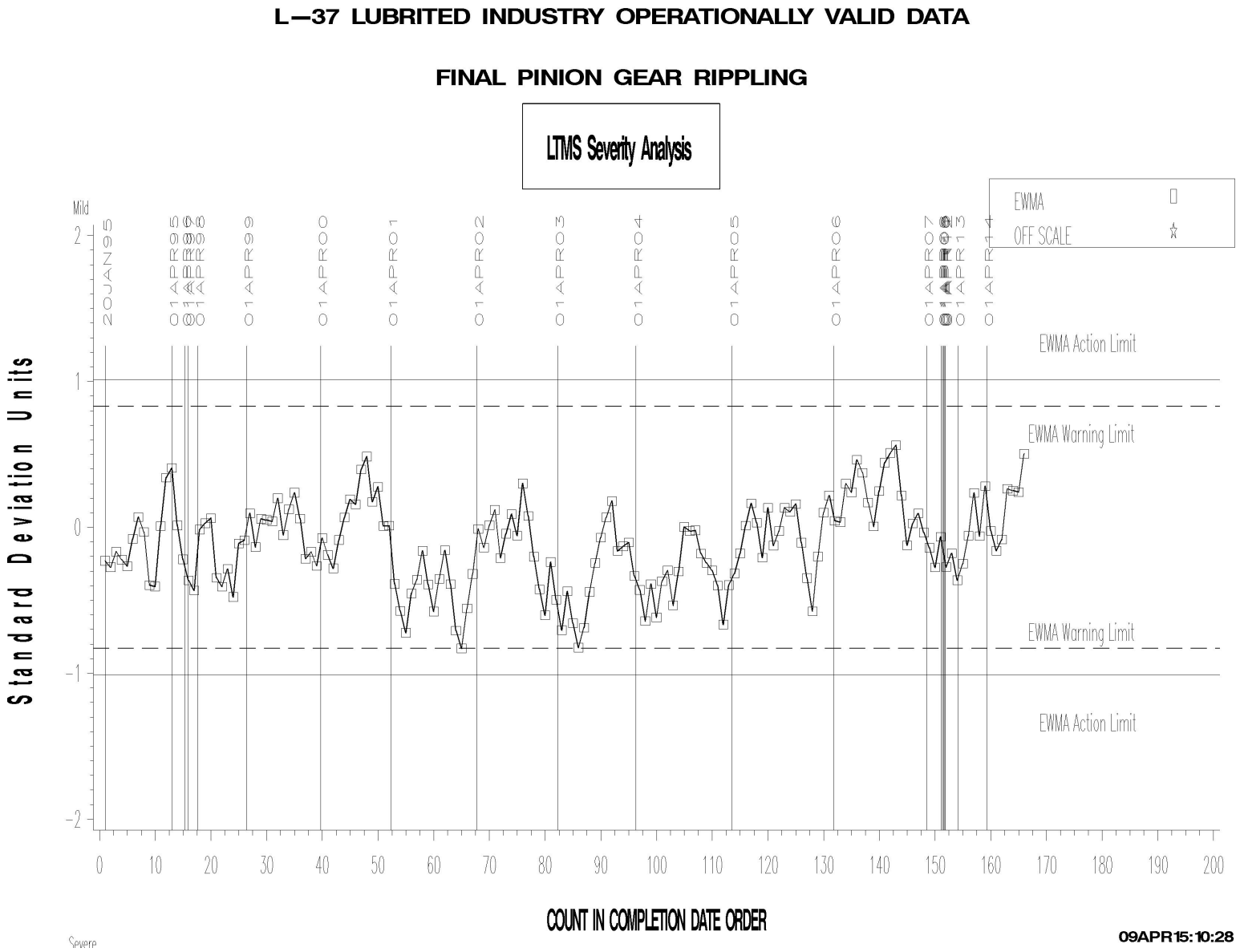
L-37 (D6121)


L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIDGING
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
09APR15:10:29

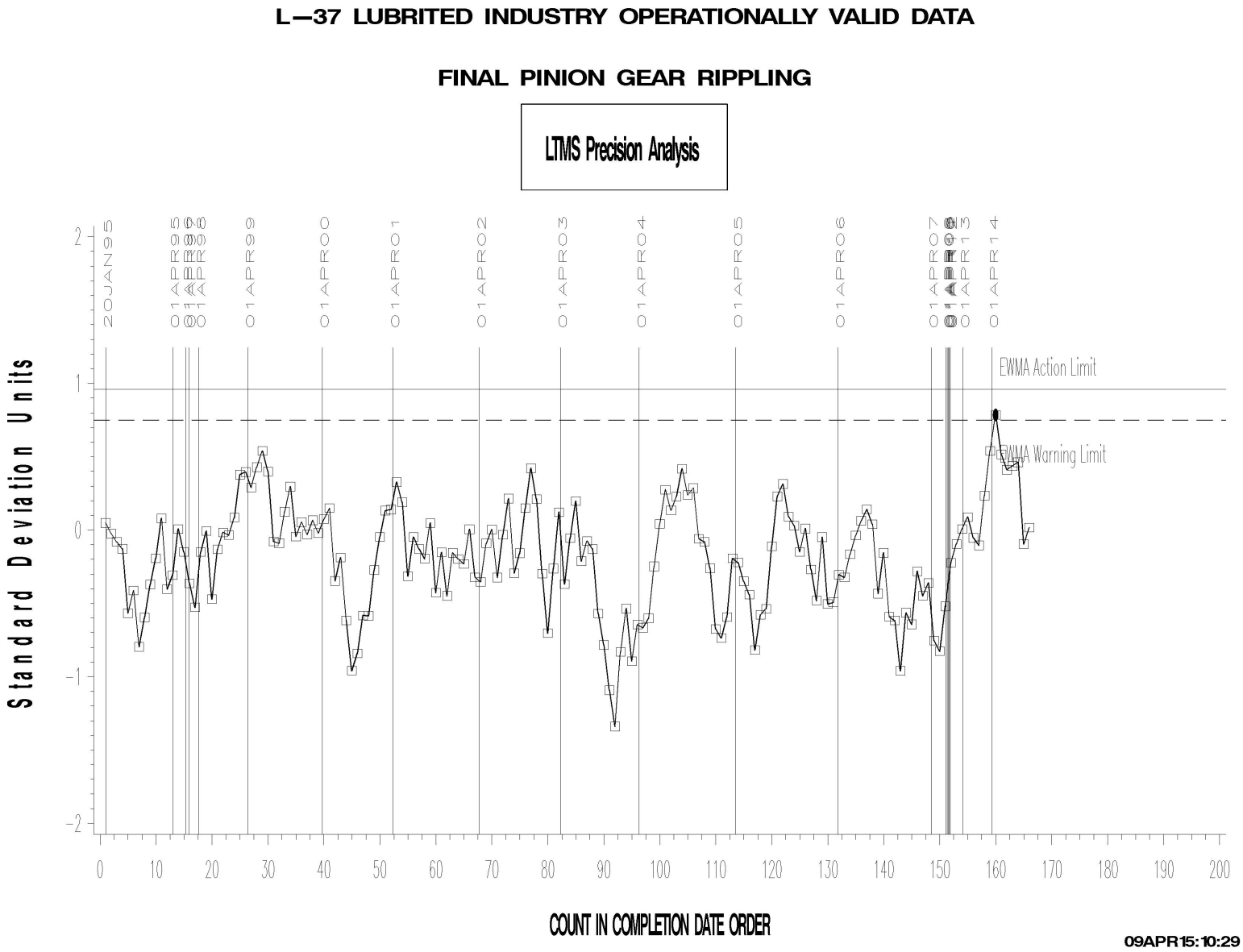
L-37 (D6121)



L-37 (D6121)


L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIPPLING
LTMS Severity Analysis
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
09APR15:10:28

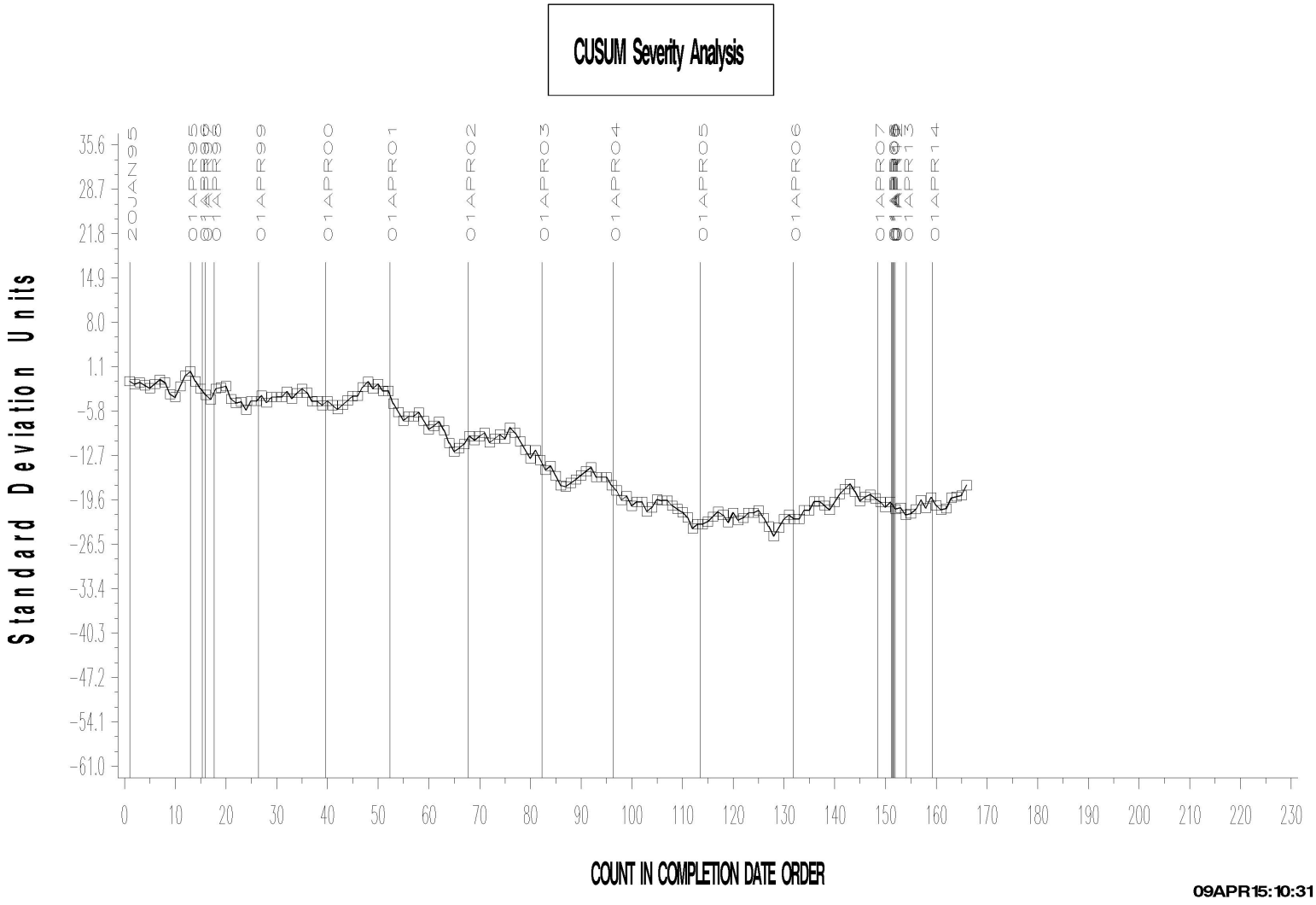
L-37 (D6121)


L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIPPLING
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
09APR15:10:29

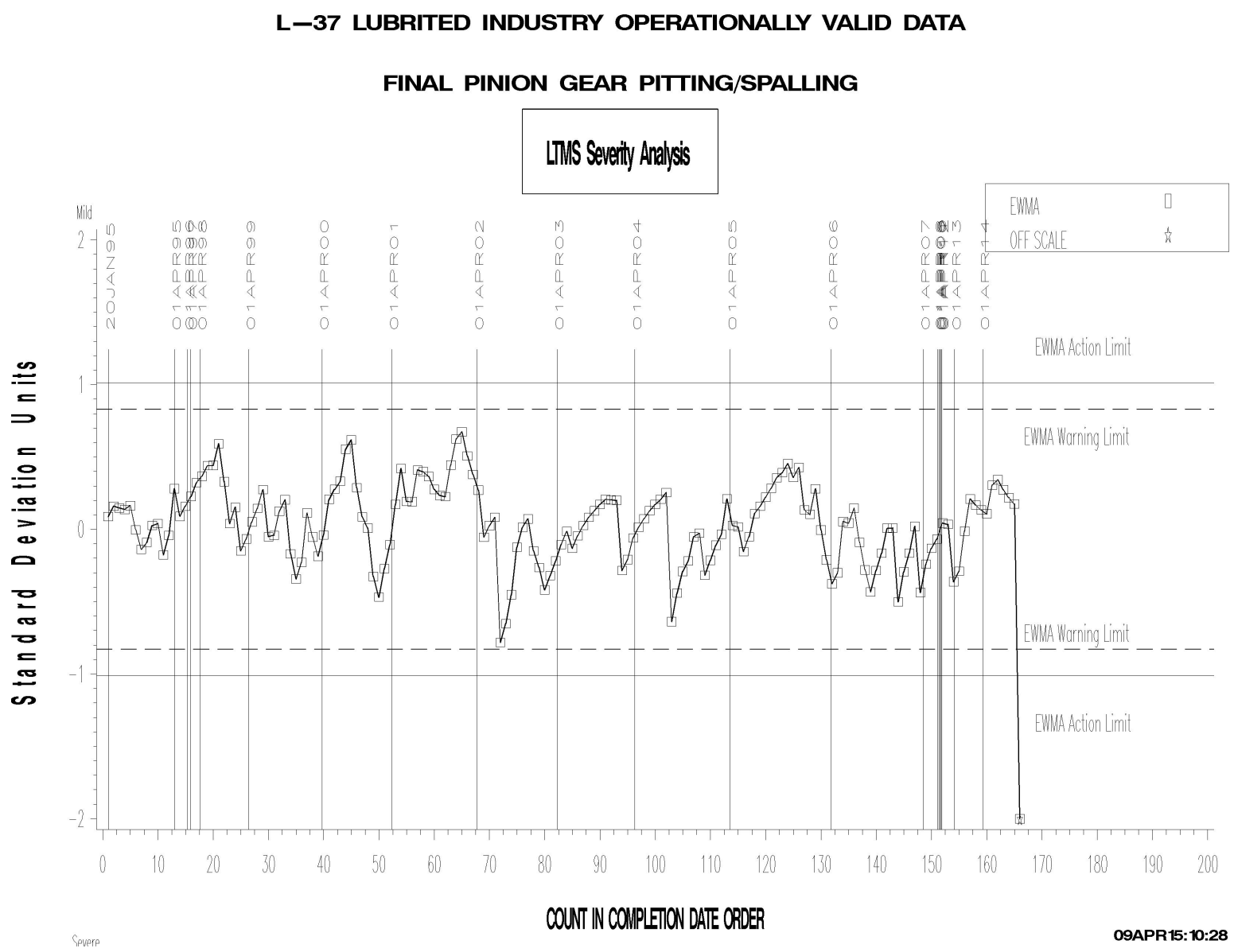
L-37 (D6121)

L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA

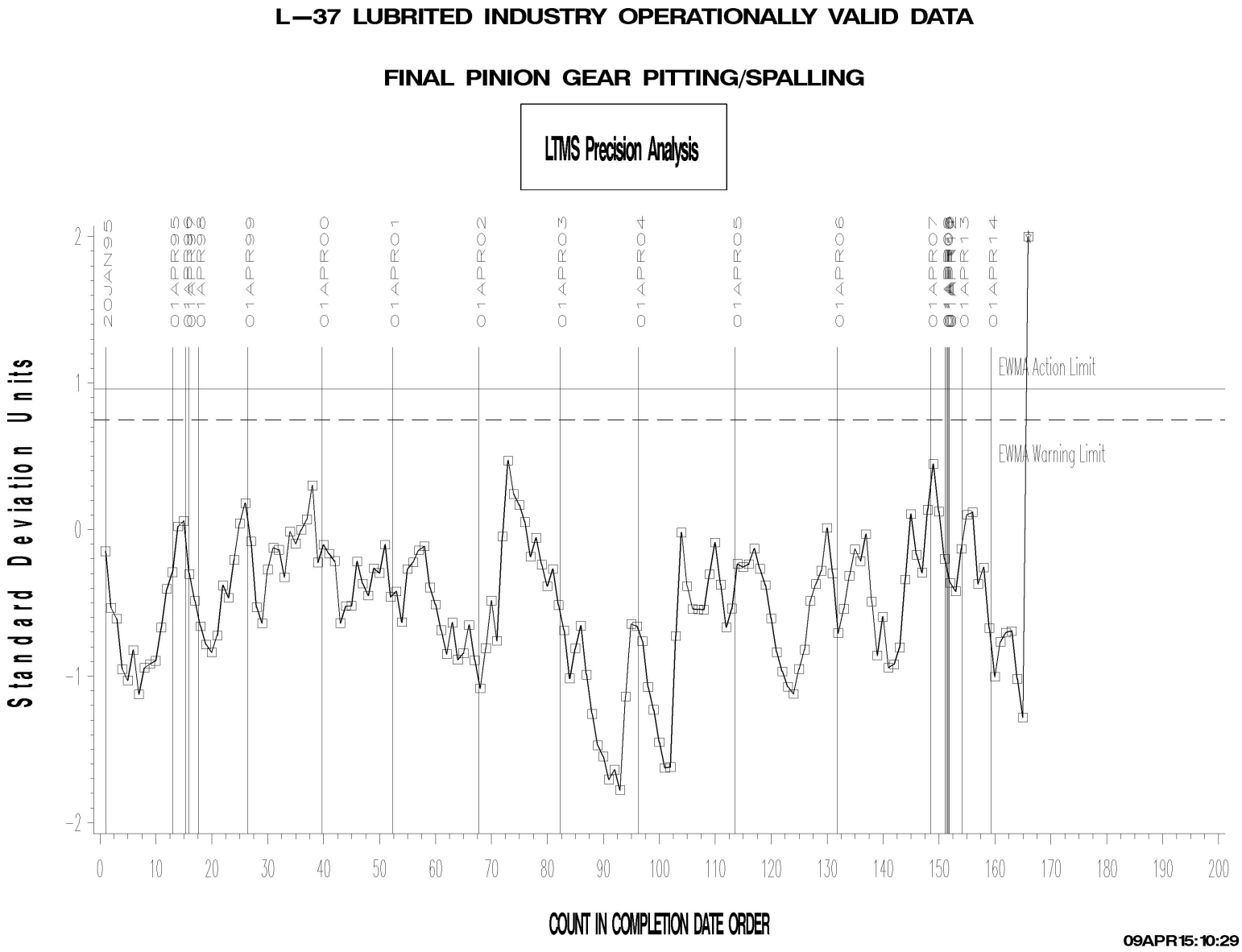
FINAL PINION GEAR RIPPLING



L-37 (D6121)


L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR PITTING/SPALLING
LTMS Severity Analysis
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
09APR15:10:28

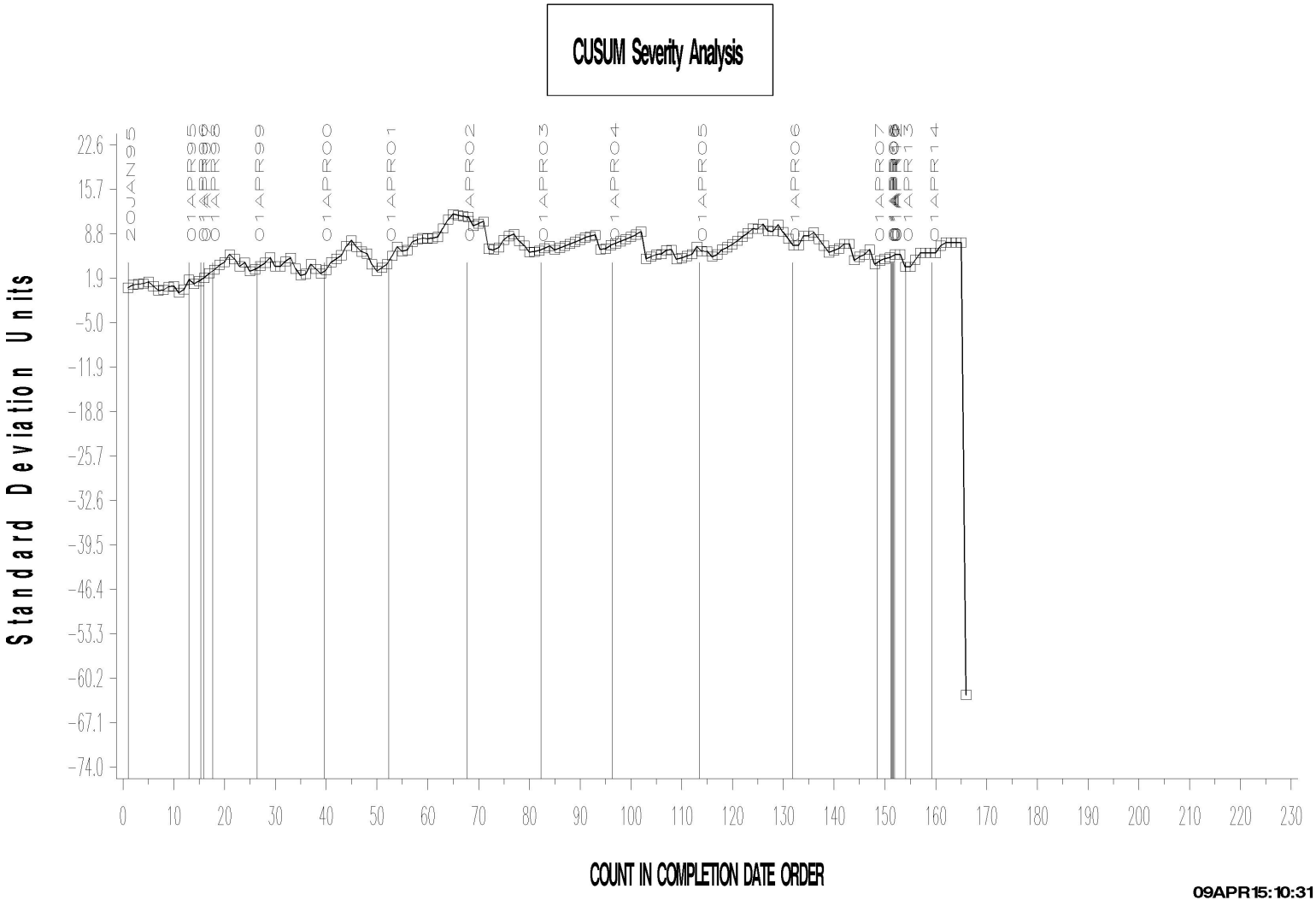
L-37 (D6121)


L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR PITTING/SPALLING
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
09APR15:10:29

L-37 (D6121)

L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR PITTING/SPALLING



L-37 (D6121)

TIMELINE ADDITIONS

Effective Date	Information Letter	Event
20141112	15-1	Cracked tooth definition.

L-37 (D6121)

LAB VISITS

One L-37 lab visit was conducted during this period with particular attention to procedures implemented to assure that the appropriate torque is applied for the given gear batch and hardware type. No procedural non-conformances were found.

Discussion: Last year, TMC review discovered that a non-lubrited V1L528 test that was reported as valid had used the reduced torque setting of 1213 lb·ft; this hardware combination is required to apply 1740 lb·ft of torque. Given the multiplicity of torque/hardware type combinations used in this test, the TMC felt it necessary to verify that labs are configured to correctly match torque and hardware type to ensure that the validity of future testing is not jeopardized.

L-37 (D6121)

INFORMATION LETTERS

Information Letter 15-1 was issued 20150317 to add a “cracked gear tooth” definition to the procedure. This definition has also been added to ASTM Distress Rating Manual No. 21.

L-37 (D6121)

LTMS DEVIATIONS

One LTMS deviation was written this period to calibrate a test stand generating RIDG EWMA and Shewhart precision alarms using lubrited hardware.

For test acceptance, the L-37 surveillance panel has approved the use of acceptance bands that are not derived from calculations using the target mean, standard deviation, and k-value. This can produce widely divergent Shewhart severity values on successive tests and thereby result in precision alarms.

This has become a continuing problem and will need to be addressed by the surveillance panel.

L-37 (D6121)

STATUS OF REFERENCE OIL SUPPLY

		@ TMC	
Oil	Cans @ Labs	Cans	Gallons
117	0	471	471.0
134	12	30	30.8
152-1	0	0	0.0
152-2	12	206	206.9
152-3	0	54	54.8
155	9	15	15.0
155-1	13	263	263.0
Total	46	1039	1041.4

The TMC quantity remaining presumes usage only for L-37 testing. Oil 155/155-1 is also used in other test areas (L-33-1 and HTCT). The 155-1 total also reflects that the L-60-1 surveillance panel has requested that TMC reserve a quantity of that oil (currently 40.4 gal) for use in that test.