A Program of ASTM International

Test Monitoring Center

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6555 Penn Avenue, Pittsburgh, PA 15206, USA

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

MEMORANDUM: 16-041

DATE: November 9, 2016

TO: Matt Umerley, Chairman, L-37 Surveillance Panel

FROM: Scott Parke

SUBJECT: L-37 Testing from April 1, 2016 through September 30, 2016

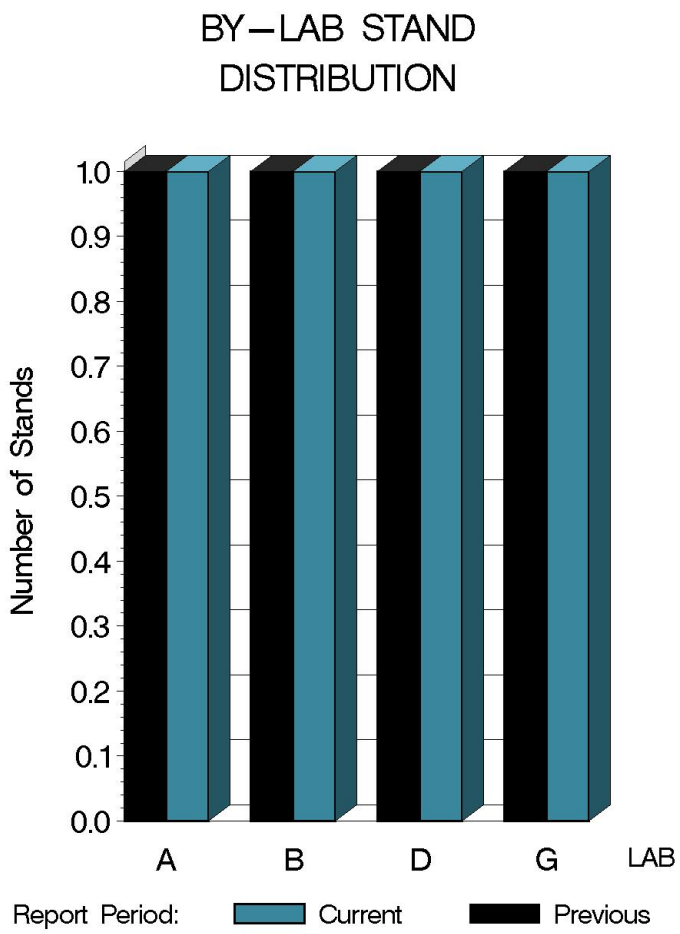
Attached is a summary of reference oil testing activity this period.

SDP/sdp/mem16-041.sdp.doc
cc: Frank Farber
Jeff Clark
L-37 Surveillance Panel
ftp://ftp.astmtmc.cmu.edu/docs/gear/l37/semiannualreports/l37-10-2016.pdf

Distribution: email

L-37 (D6121)

	Reporting Data	Calibrated on 9-30-16
Number of Labs	4	4
Number of Stands	4	4



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Test Distribution by Oil and Validity

		134	134-1	152-2	155	155-1	Totals Last Period	Totals This Period
Accepted for calibration	AC	6	3	4	0	2	8	15
Rejected (Mild)	OC	0	0	0	0	0	0	0
Rejected (Severe)	OC	0	0	0	0	0	0	0
Rejected (Precision)	OC	0	0	0	0	0	1	0
Invalidated calibration	RC	0	0	0	0	0	0	0
Acceptable info run	NI	0	0	3	0	0	11	3
Unacceptable info run	MI	6	0	2	0	0	11	8
Aborted info run	XI	0	0	0	0	0	0	0
Total		12	3	9	0	2	31	26

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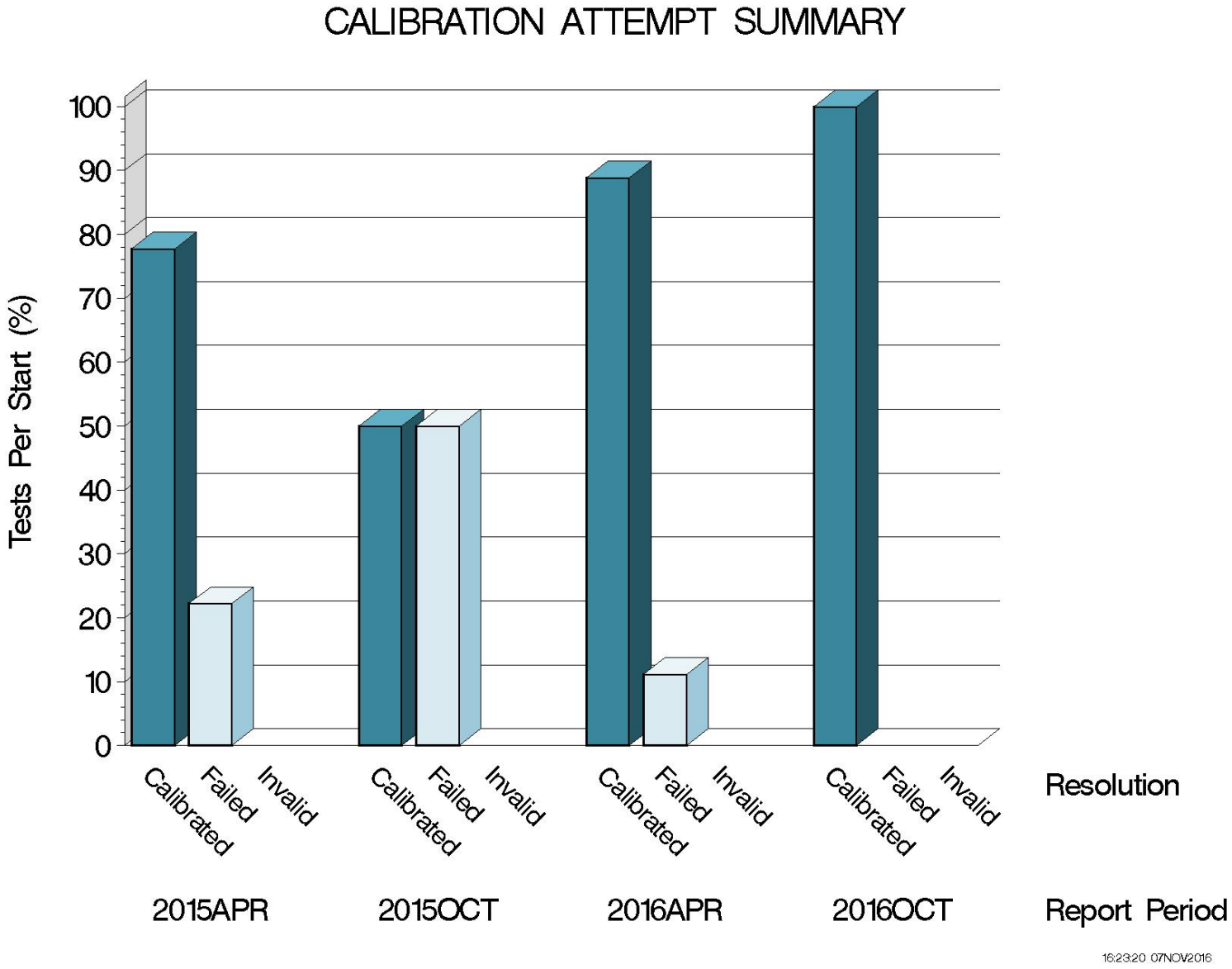
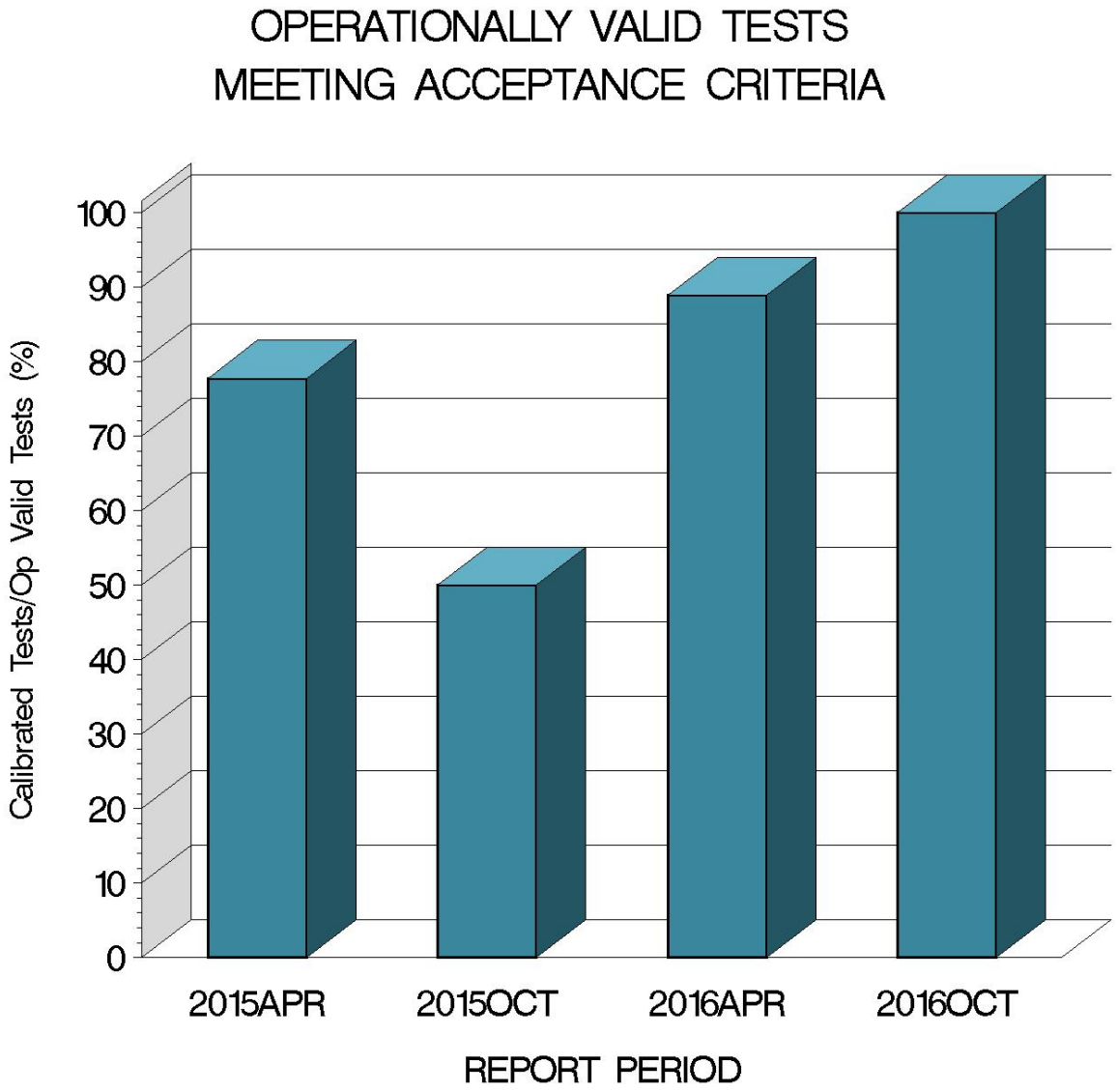
Calibration Attempt Detail

	Gear Batch	Acceptable	Failed	Total
LUBRITED	V1L500/P4T813	0	0	0
	V1L528/P4T883A	11	0	11
	Total	11	0	11
NONLUBRITED	V1L500/P4T813	0	0	0
	V1L528/P4T883A	4	0	4
	Total	4	0	4

L-37 (D6121)


CALIBRATION ATTEMPT SUMMARY
Tests Per Start (%)
100
90
80
70
60
50
40
30
20
10
0
Calibrated
Failed
Invalid
Resolution
2015APR
2015OCT
2016APR
2016OCT
Report Period
16:23:20 07NOV2016

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
2015APR
2015OCT
2016APR
2016OCT
REPORT PERIOD
16:23:20 07NOV2016

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CAUSES FOR LOST TESTS

			Oil					Validity			Loss Rate		
Lab	Cause		134	134-1	152-2	155	155-1	RC	LC	XI	Lost	Starts	%
	No tests were lost.										0	26	0%
		Lost	0	0	0	0	0	0	0	0			
		Starts	12	3	9	0	2	26	26	26			
		%	0%	0%	0%	0%	0%	0%	0%	0%			

Twenty tests were run with the intent to be used for lab-built approval. Eight of them did not meet the acceptance criteria for that purpose and were assigned an “MI” validity code. None of these tests are used in control charting.

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GEAR BATCH SEVERITY

LUBRITED HARDWARE						
Parameter	**Gear Batch**	**N**	**Δ/s**	**s[A]**	**Overall Δ/s**	**Overall Shift (in Merits)[B]**
RIDG	V1L528/P4T883A	11	-0.119	0.704	-0.119	-0.170
RIPP	V1L528/P4T883A	11	-0.350	1.066	-0.350	-0.166
SPIT	V1L528/P4T883A	11	0.177	1.435	0.177	0.102
WEAR	V1L528/P4T883A	11	1.536	2.061	1.536	0.797

[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.

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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	4	0.676	0.638	0.676	0.450
RIPP	V1L528/P4T883A	4	0.542	0.818	0.542	0.302
SPIT	V1L528/P4T883A	4	0.877	2.181	0.877	0.743
WEAR	V1L528/P4T883A	4	0.128	1.510	0.128	0.091

[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.

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LAB SEVERITY

LUBRITED HARDWARE AVERAGE Δ/s						
Gear Batch	Lab	N	RIDG	RIPP	SPIT	WEAR
V1L528/P4T883A	A	4	0.433	-0.452	0.689	2.066
	B	3	-0.527	0.576	0.895	1.377
	D	1	-0.594	-1.246	-0.229	0.370
	G	3	-0.289	-0.839	-1.090	1.377

NON-LUBRITED HARDWARE AVERAGE Δ/s						
Gear Batch	Lab	N	RIDG	RIPP	SPIT	WEAR
V1L528/P4T883A	A	3	0.357	0.209	0.916	0.004
	B	1	1.633	1.538	0.760	0.499

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SUMMARY OF SEVERITY & PRECISION

Severity
Nonlubrited – SPIT continues to exhibit occasional spikes in performance either mild or severe (though usually mild). When used with oil 134, the current hardware often produces either spalling (an extremely low merit result) or only mild pitting (a high merit result). This phenomena does not affect all labs equally and is suspected to be build-related. Such results occasionally adversely impact the SPIT precision chart. The other test parameters are currently within control chart alarm limits. Lubrited – A succession of 5 severe tests from lab B in April and October of 2015 resulted in WEAR, RIDG, and SPIT charts exceeding the severe EWMA action limit. More recent activity has begun to return the SPIT chart to target levels while WEAR has recovered and even gone mild over the last three tests.

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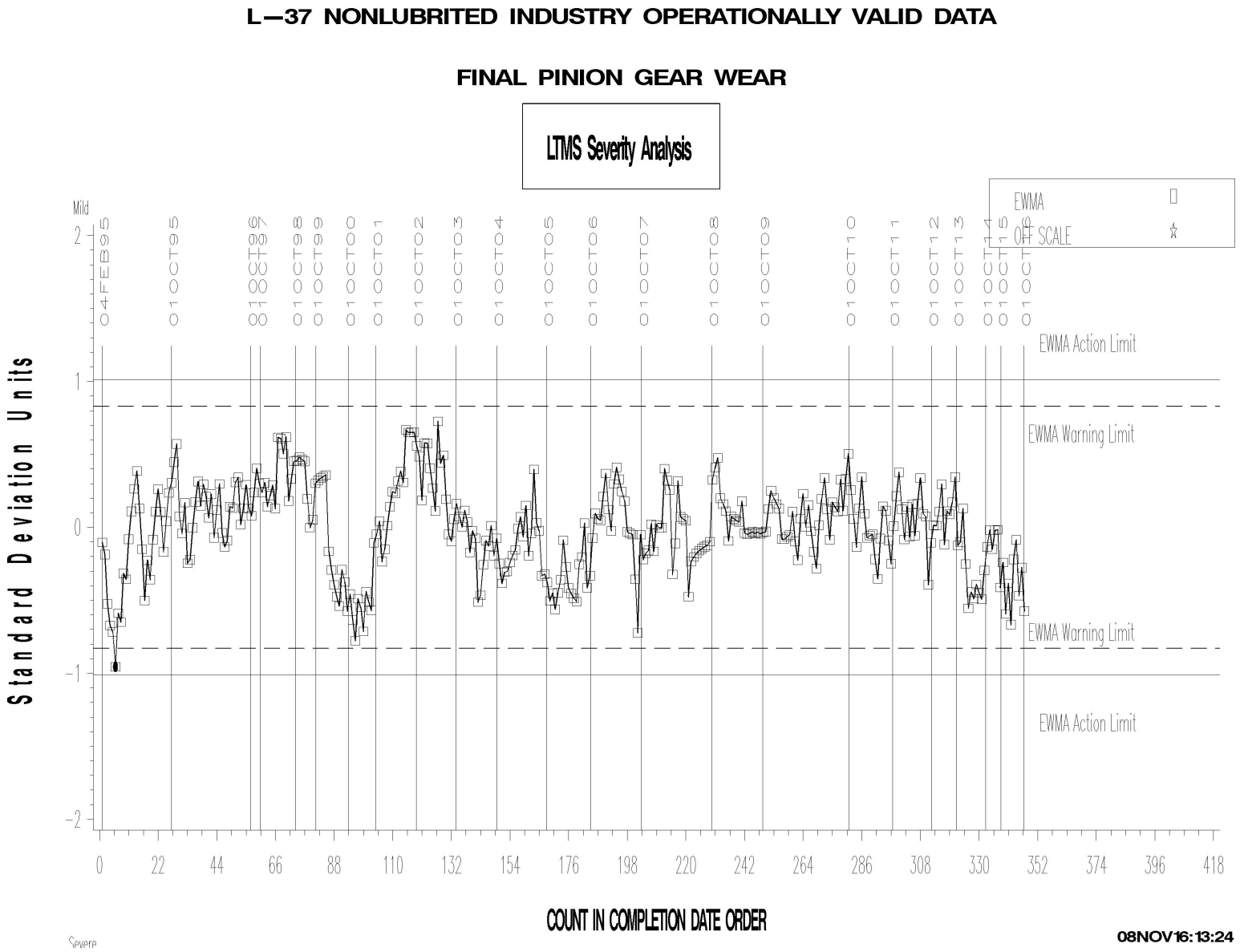
SUMMARY OF SEVERITY & PRECISION (cont.)

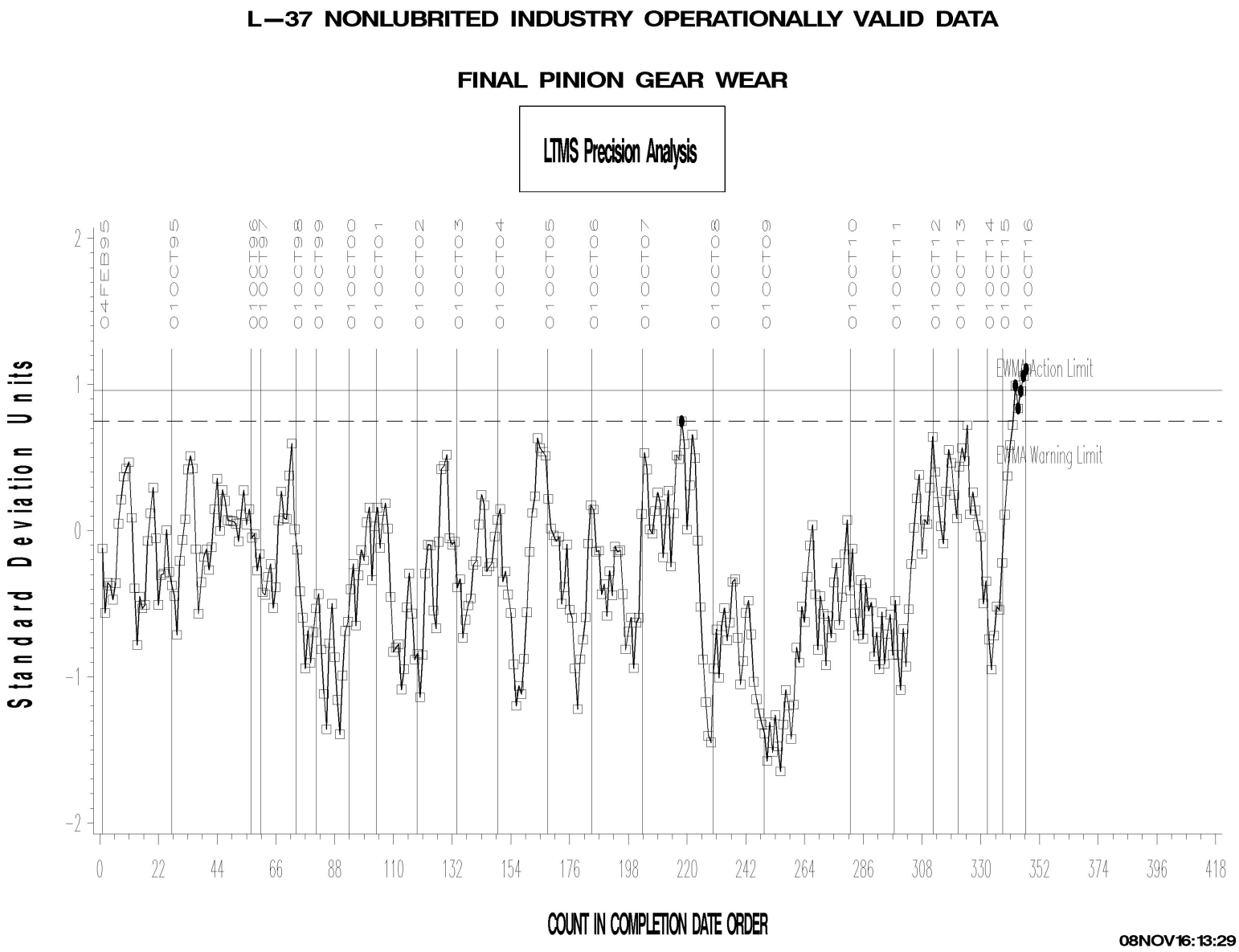
Precision
Nonlubrited – As mentioned previously, SPIT precision has been exceeding limits due to alternately mild and severe results with the V1L528 hardware and oil 134. WEAR precision has also suffered from alternately mild and severe results (unrelated to oil type) and is currently showing an EWMA action alarm. Lubrited – SPIT precision has recovered from the five tests already discussed and is now within limits. As with the nonlubrited hardware, WEAR currently exceeds the EWMA action limit.

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
01OCT95
01OCT96
01OCT97
01OCT98
01OCT99
01OCT00
01OCT01
01OCT02
01OCT03
01OCT04
01OCT05
01OCT06
01OCT07
01OCT08
01OCT09
01OCT10
01OCT11
01OCT12
01OCT13
01OCT14
01OCT15
01OCT
0
22
44
66
88
110
132
154
176
198
220
242
264
286
308
330
352
374
396
418
COUNT IN COMPLETION DATE ORDER
Severp
08NOV16:13:24

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
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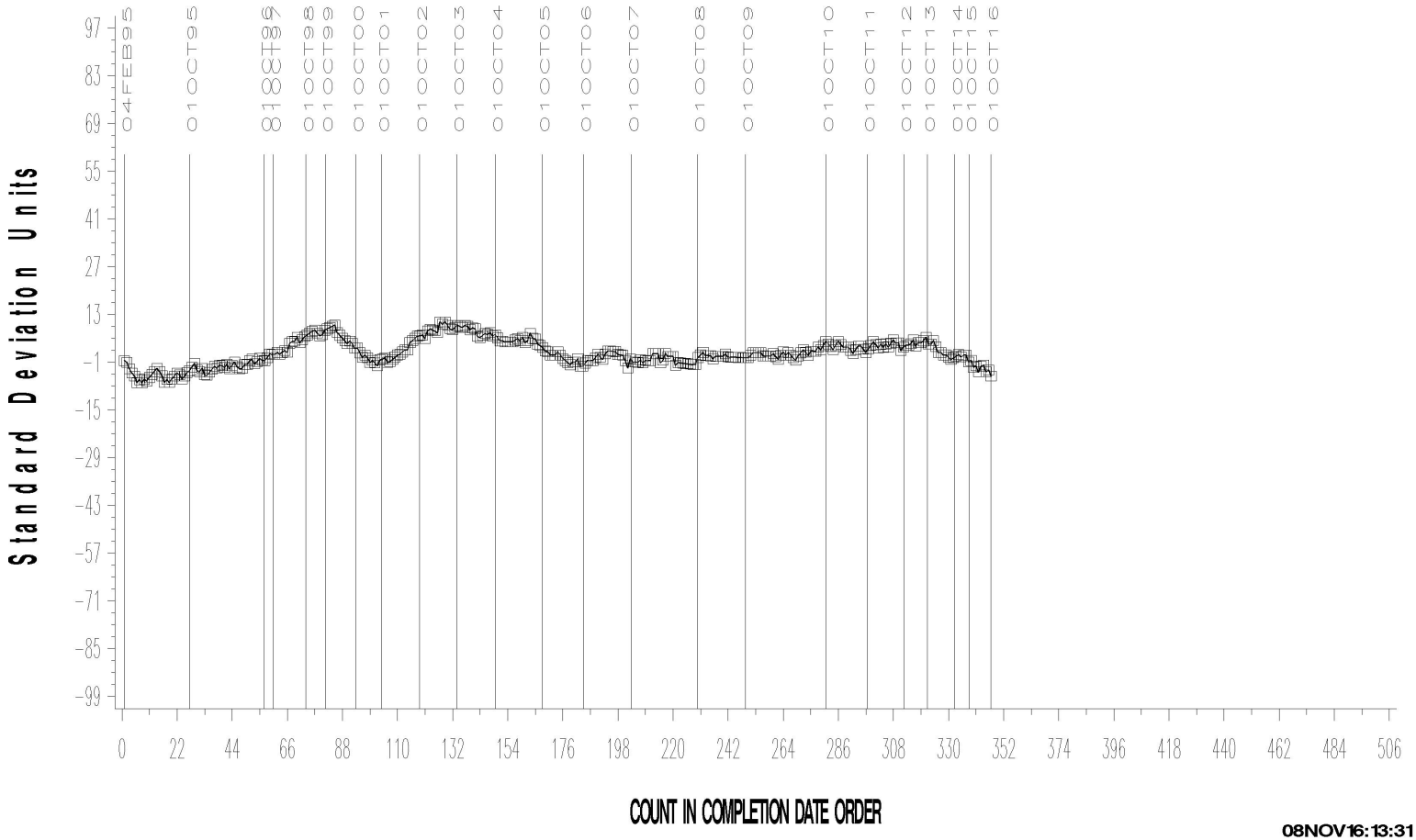
L-37 (D6121)

L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR WEAR

CUSUM Severity Analysis



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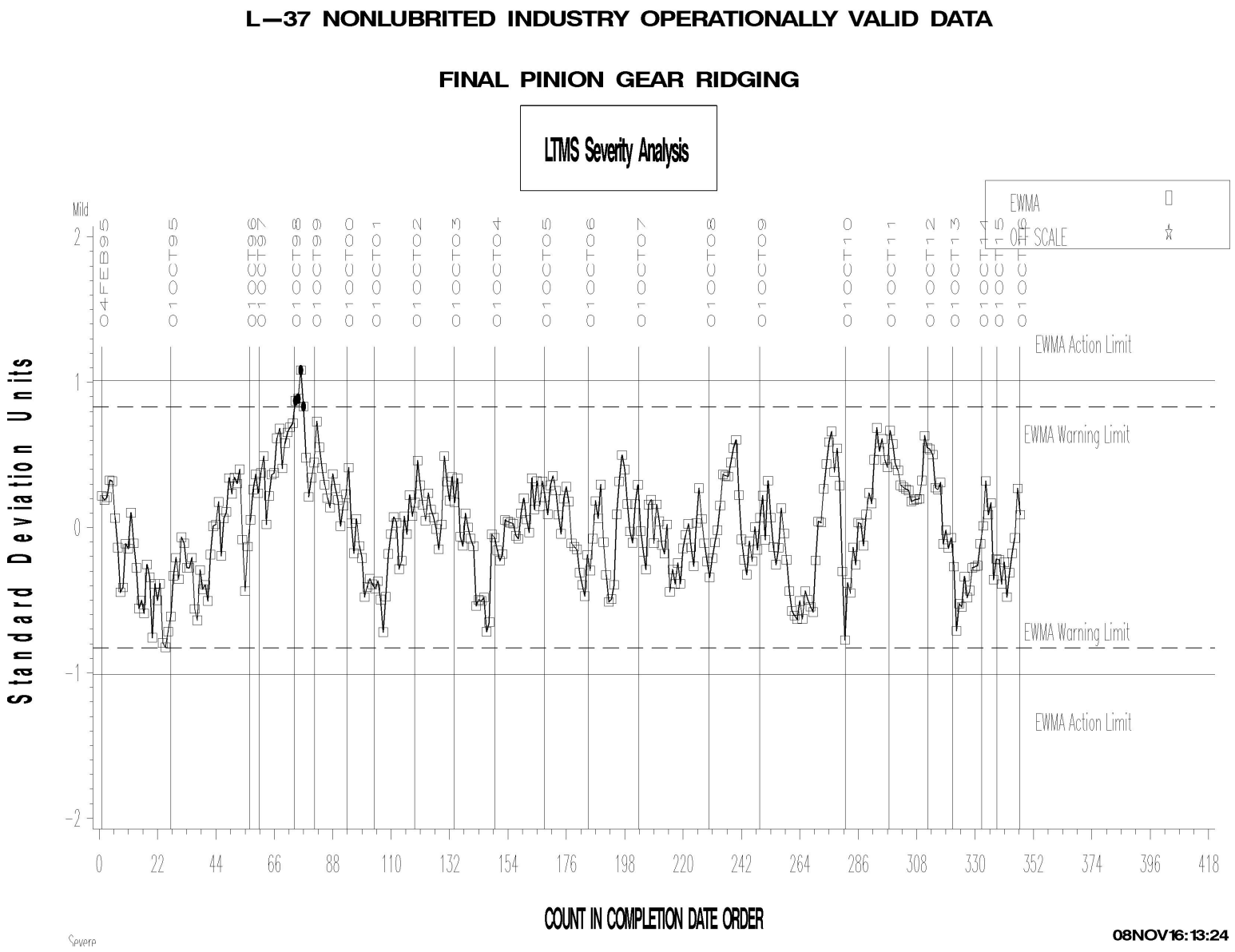
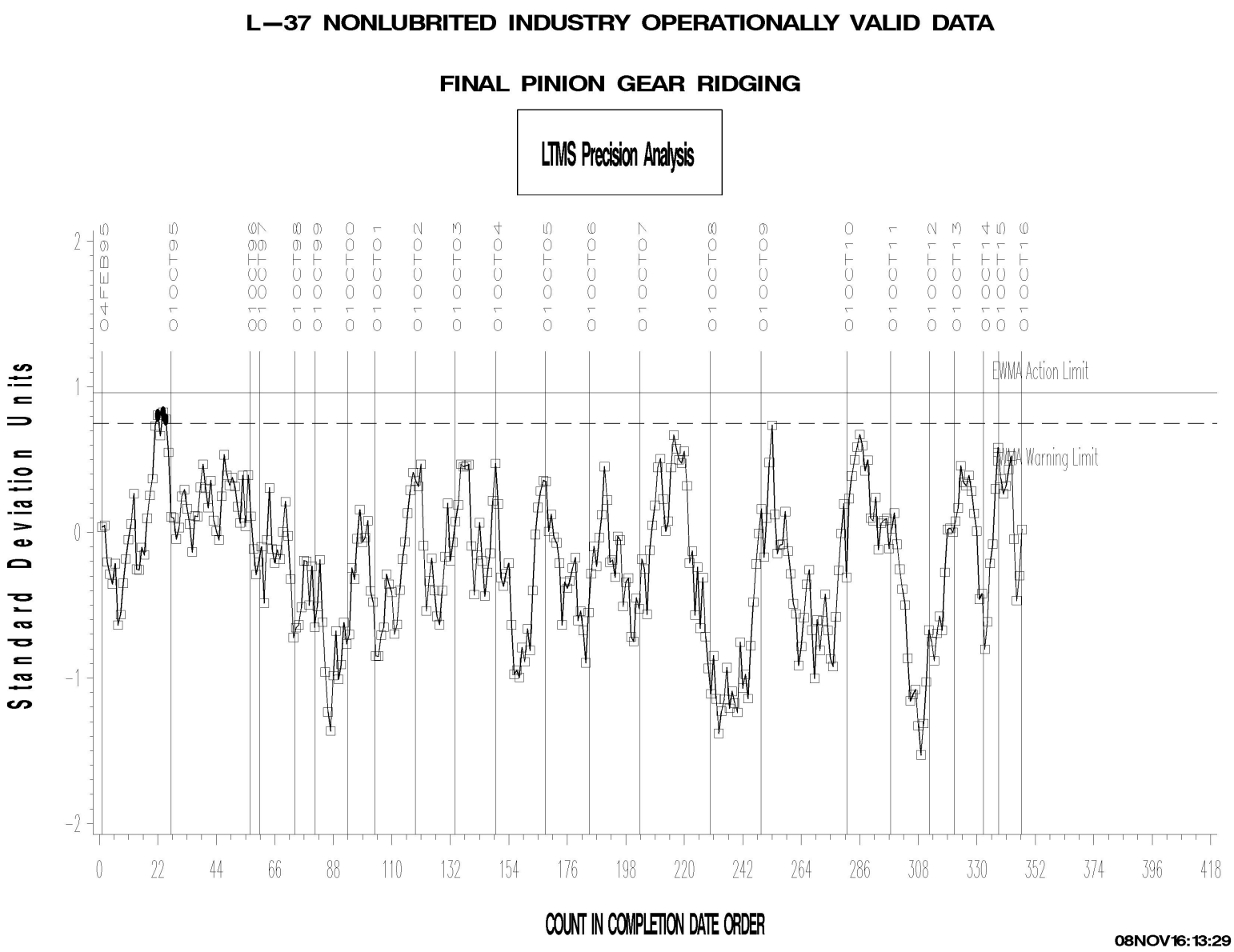
L-37 (D6121)


L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIDGING
LTMS Severity Analysis
EWMA
OFF SCALE
Mild
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
08NOV16:13:24

L-37 (D6121)

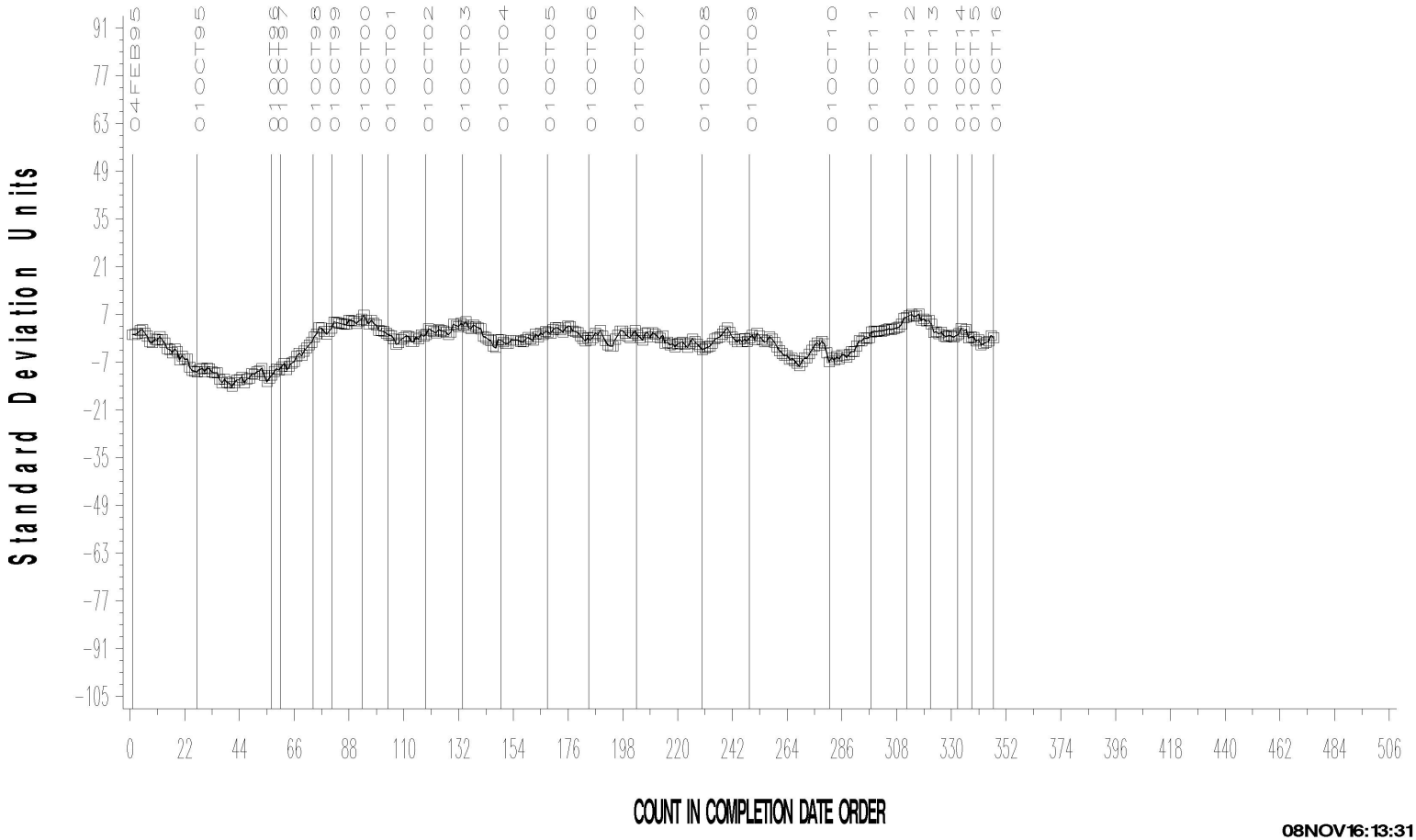

L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIDGING
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
04FEB95
01OCT95
01OCT96
01OCT97
01OCT98
01OCT99
01OCT00
01OCT01
01OCT02
01OCT03
01OCT04
01OCT05
01OCT06
01OCT07
01OCT08
01OCT09
01OCT10
01OCT11
01OCT12
01OCT13
01OCT14
01OCT15
01OCT16
2
1
0
-1
-2
0
22
44
66
88
110
132
154
176
198
220
242
264
286
308
330
352
374
396
418
COUNT IN COMPLETION DATE ORDER
08NOV16:13:29

L-37 (D6121)

L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR RIDGING

CUSUM Severity Analysis



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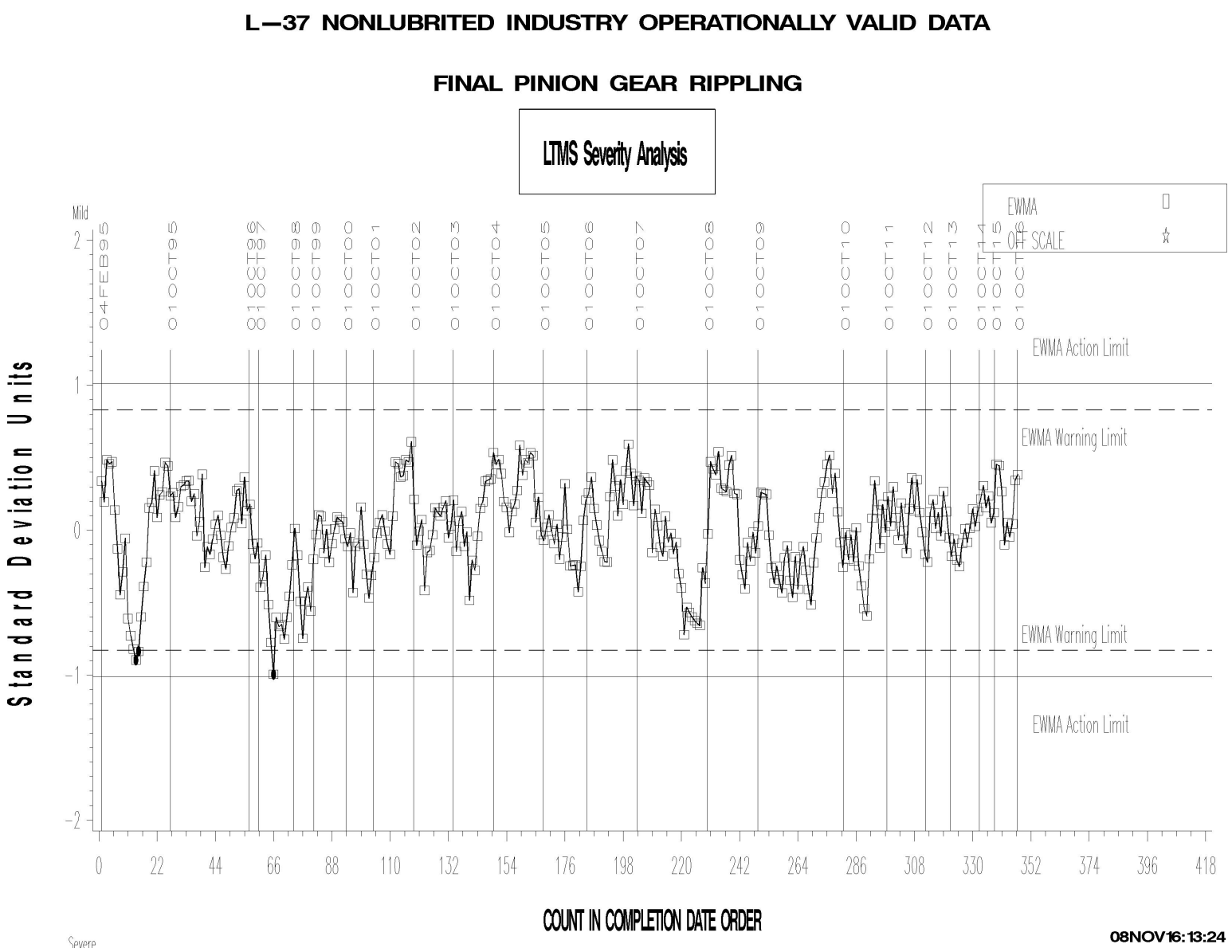
L-37 (D6121)


L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIPPLING
LTMS Severity Analysis
Mild
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
2
1
0
-1
-2
04FEB95
01OCT95
01OCT96
01OCT97
01OCT98
01OCT99
01OCT00
01OCT01
01OCT02
01OCT03
01OCT04
01OCT05
01OCT06
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01OCT15
01OCT
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132
154
176
198
220
242
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418
COUNT IN COMPLETION DATE ORDER
Sqverp
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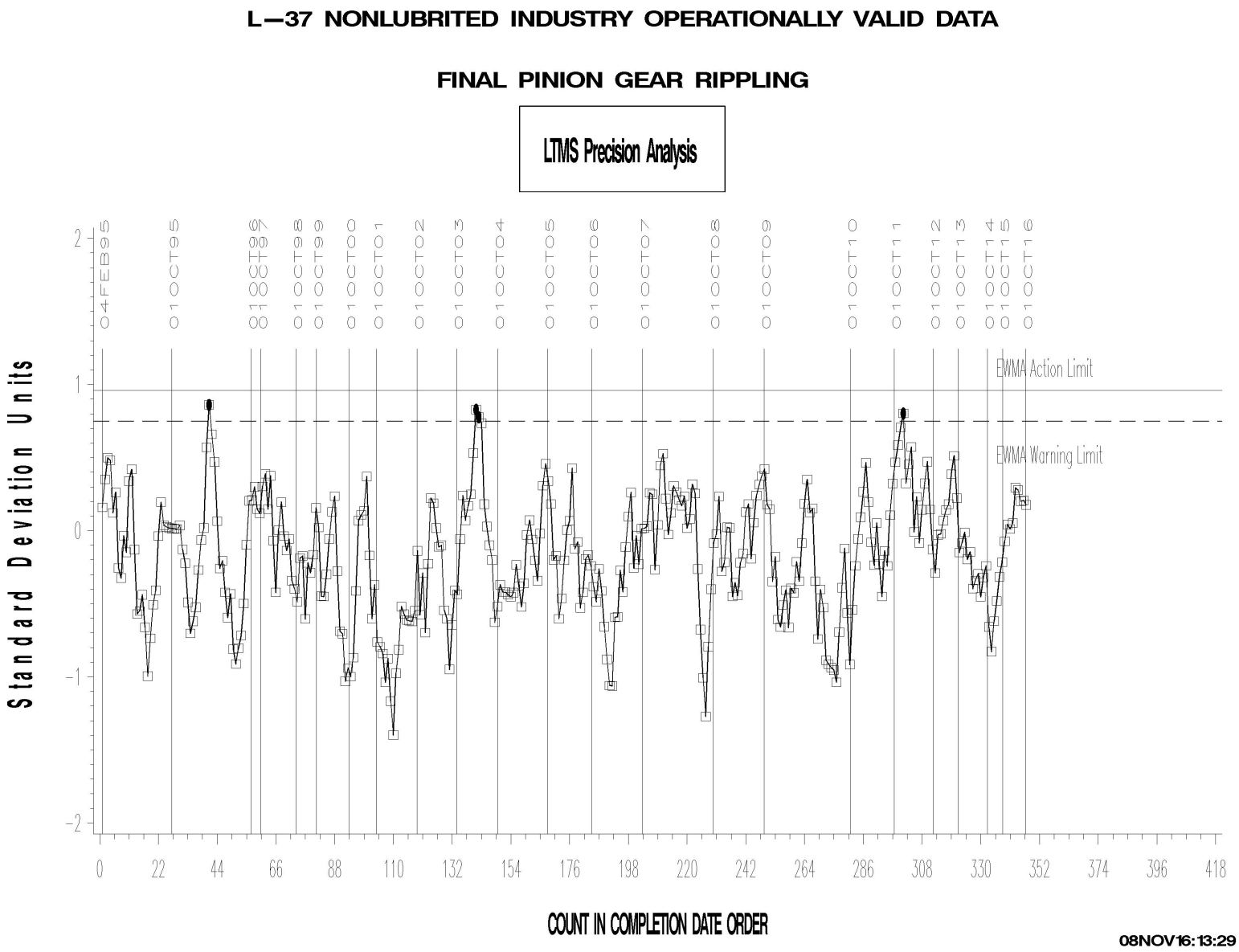
L-37 (D6121)

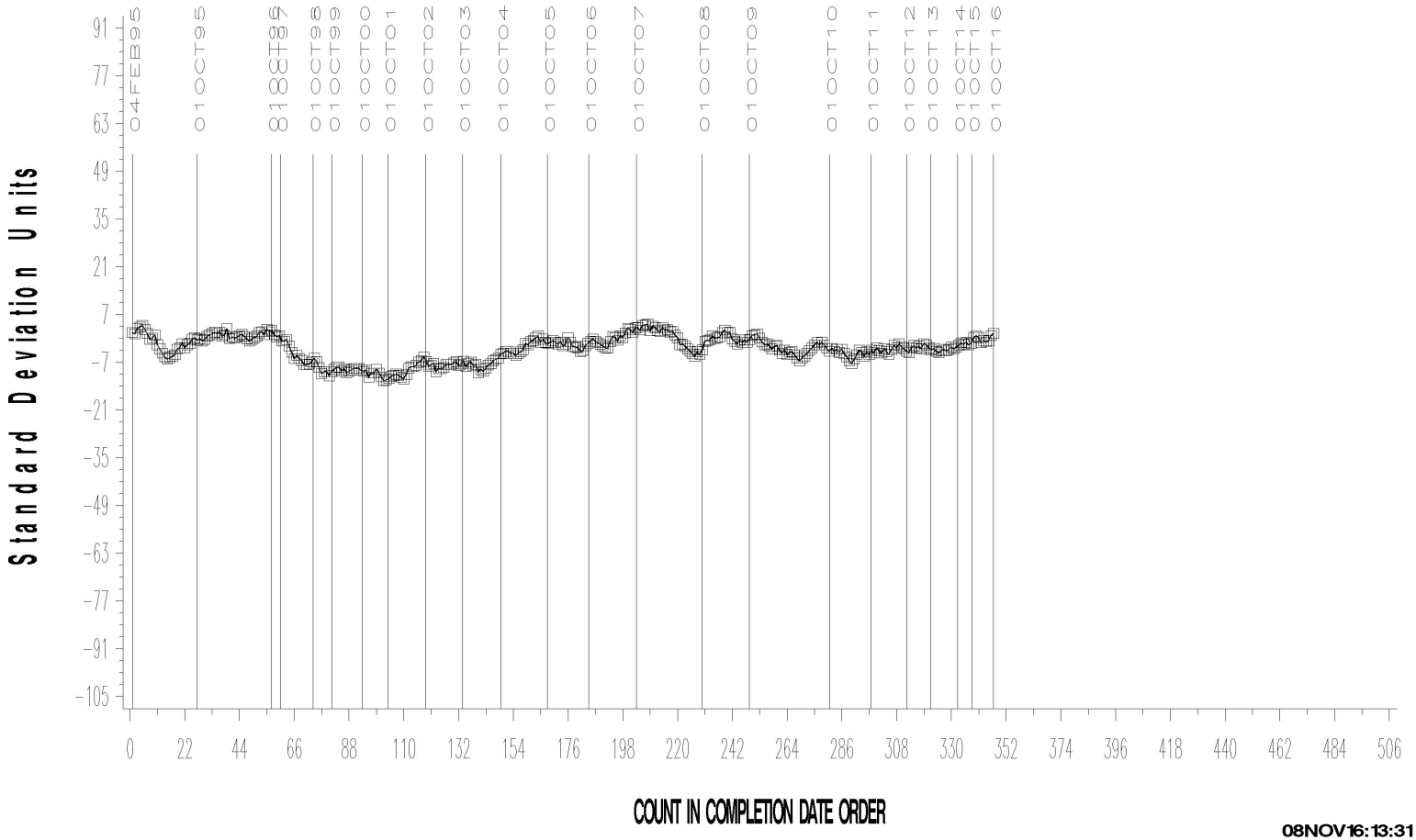

L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIPPLING
LTMS Precision Analysis
Standard Deviation Units
2
1
0
-1
-2
04FEB95
01OCT95
01OCT96
01OCT97
01OCT98
01OCT99
01OCT00
01OCT01
01OCT02
01OCT03
01OCT04
01OCT05
01OCT06
01OCT07
01OCT08
01OCT09
01OCT10
01OCT11
01OCT12
01OCT13
01OCT14
01OCT15
01OCT16
EWMA Action Limit
EWMA Warning Limit
0
22
44
66
88
110
132
154
176
198
220
242
264
286
308
330
352
374
396
418
COUNT IN COMPLETION DATE ORDER
08NOV16:13:29

L-37 (D6121)

L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR RIPPLING

CUSUM Severity Analysis



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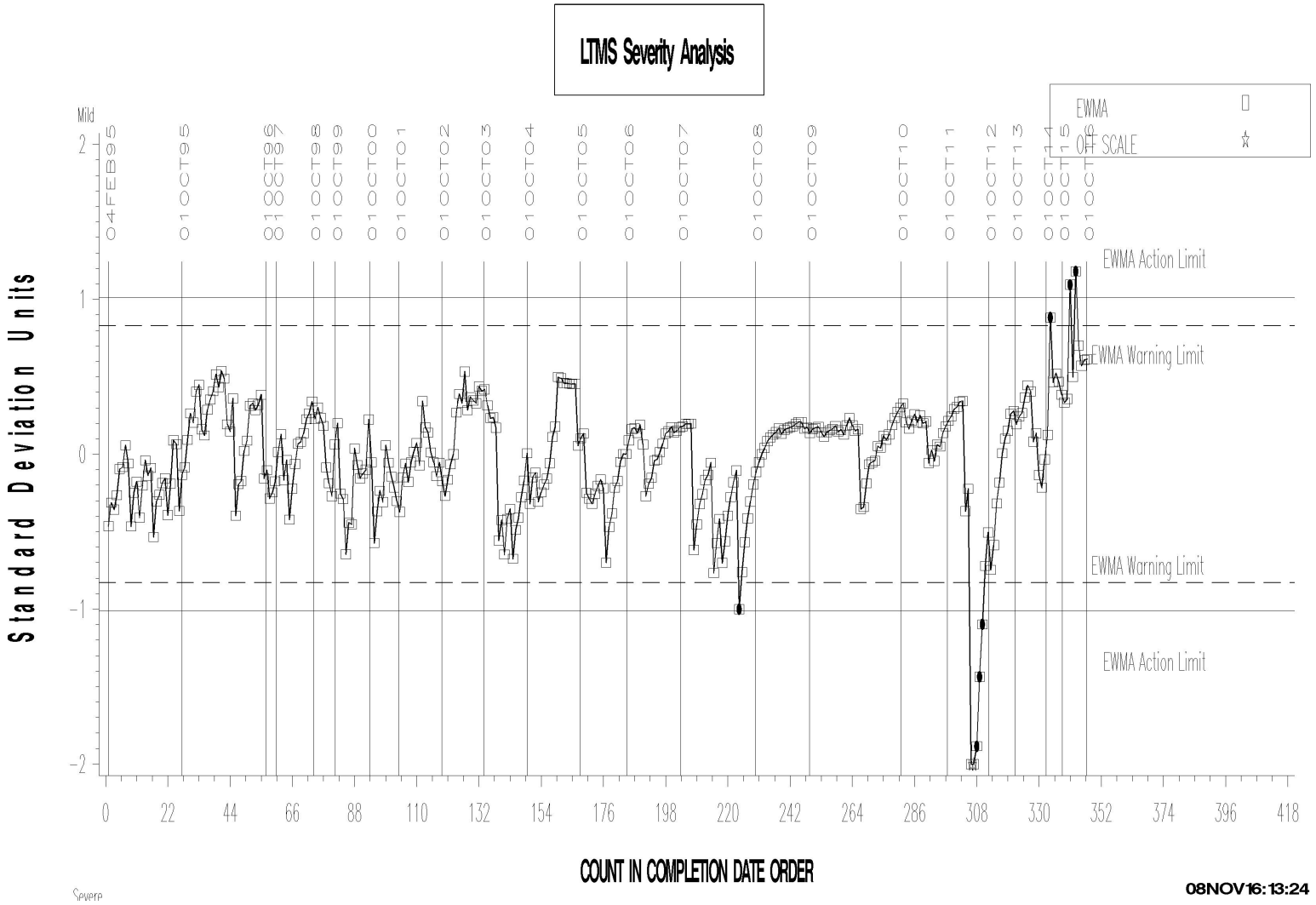
L-37 (D6121)

L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR PITTING/SPALLING



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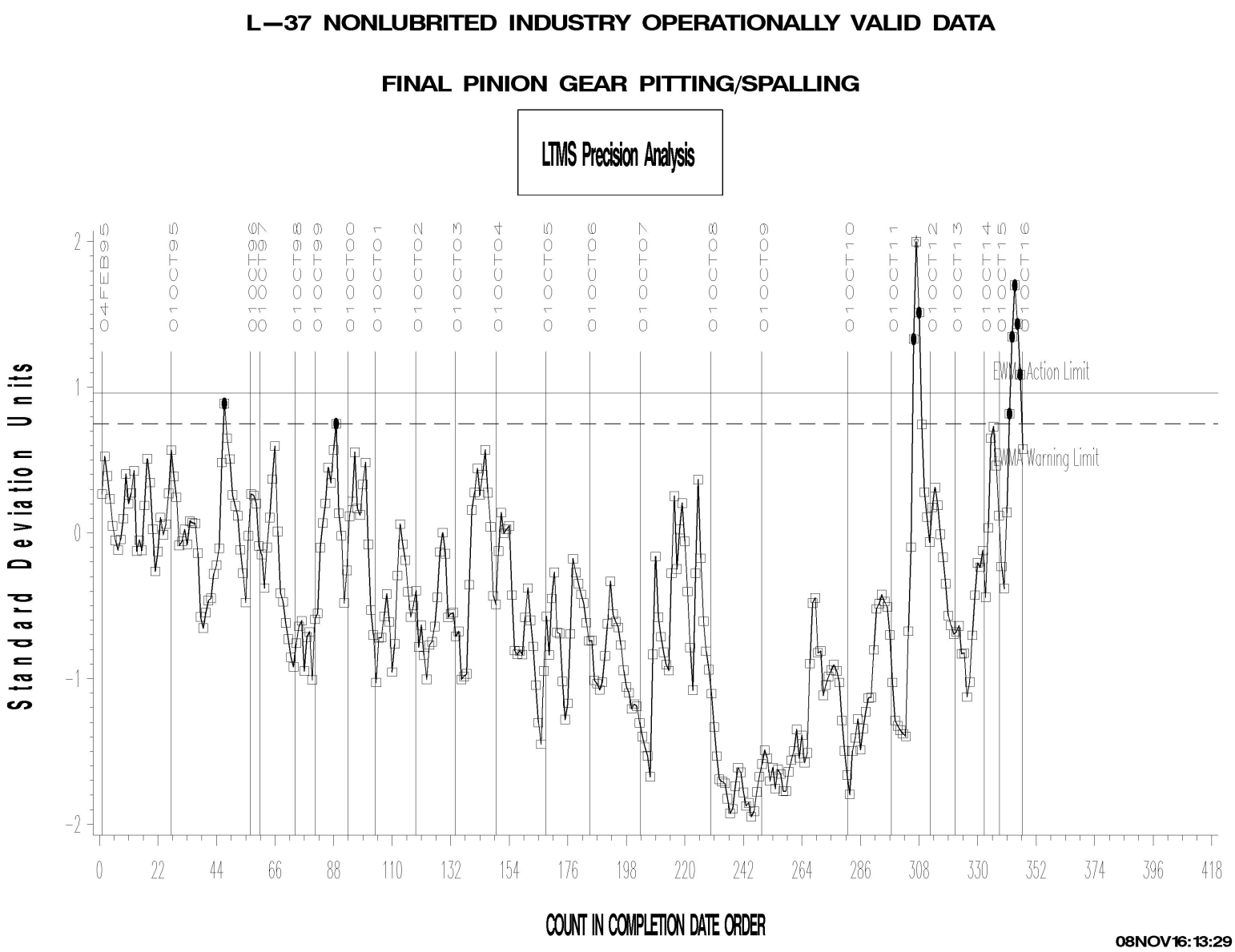
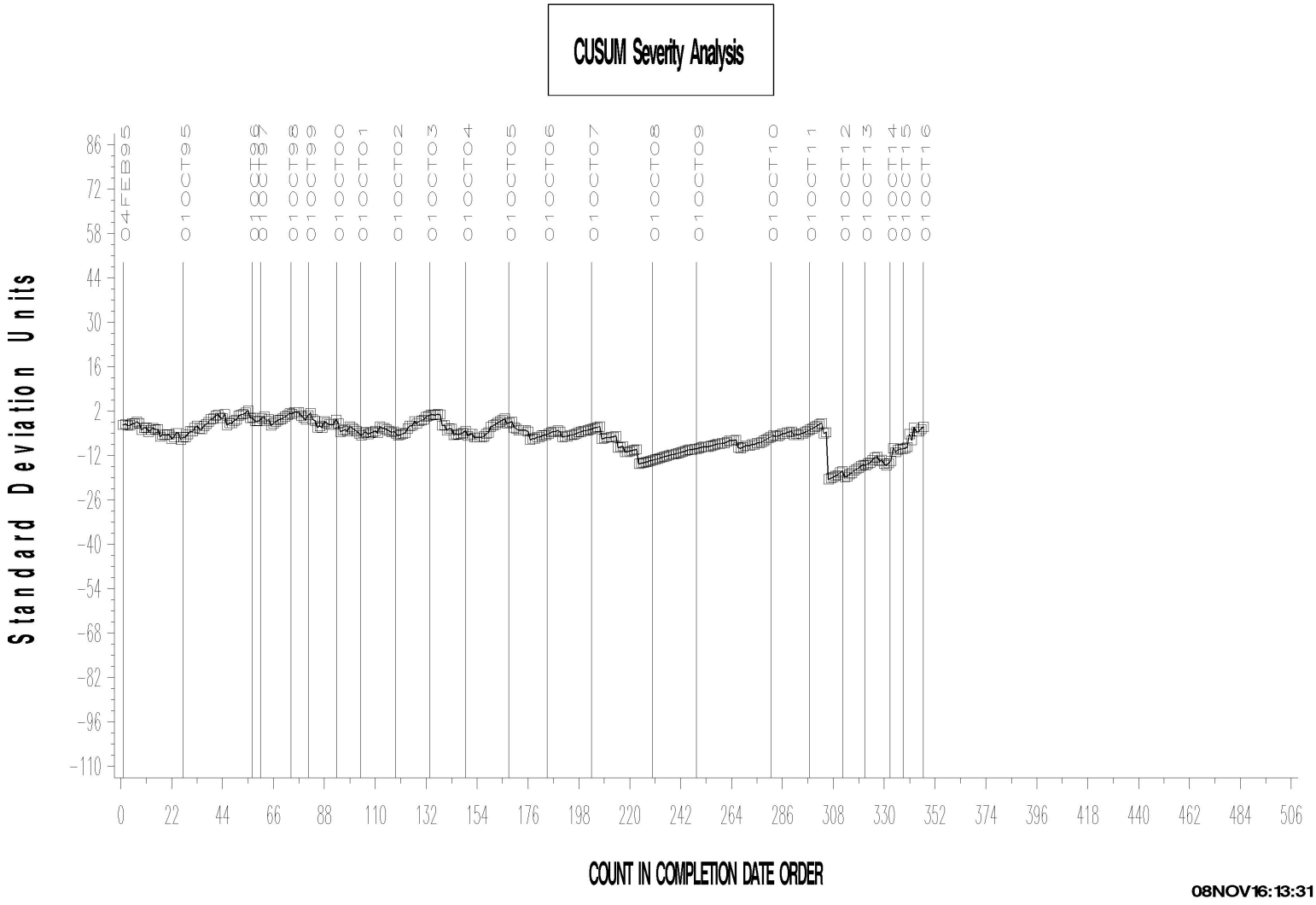

L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR PITTING/SPALLING
LTMS Precision Analysis
Standard Deviation Units
2
1
0
-1
-2
04FEB95
01OCT95
01OCT96
01OCT97
01OCT98
01OCT99
01OCT00
01OCT01
01OCT02
01OCT03
01OCT04
01OCT05
01OCT06
01OCT07
01OCT08
01OCT09
01OCT10
01OCT11
01OCT12
01OCT13
01OCT14
01OCT15
01OCT16
EWMA Action Limit
EWMA Warning Limit
0
22
44
66
88
110
132
154
176
198
220
242
264
286
308
330
352
374
396
418
COUNT IN COMPLETION DATE ORDER
08NOV16:13:29

L-37 (D6121)

L—37 NONLUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR PITTING/SPALLING



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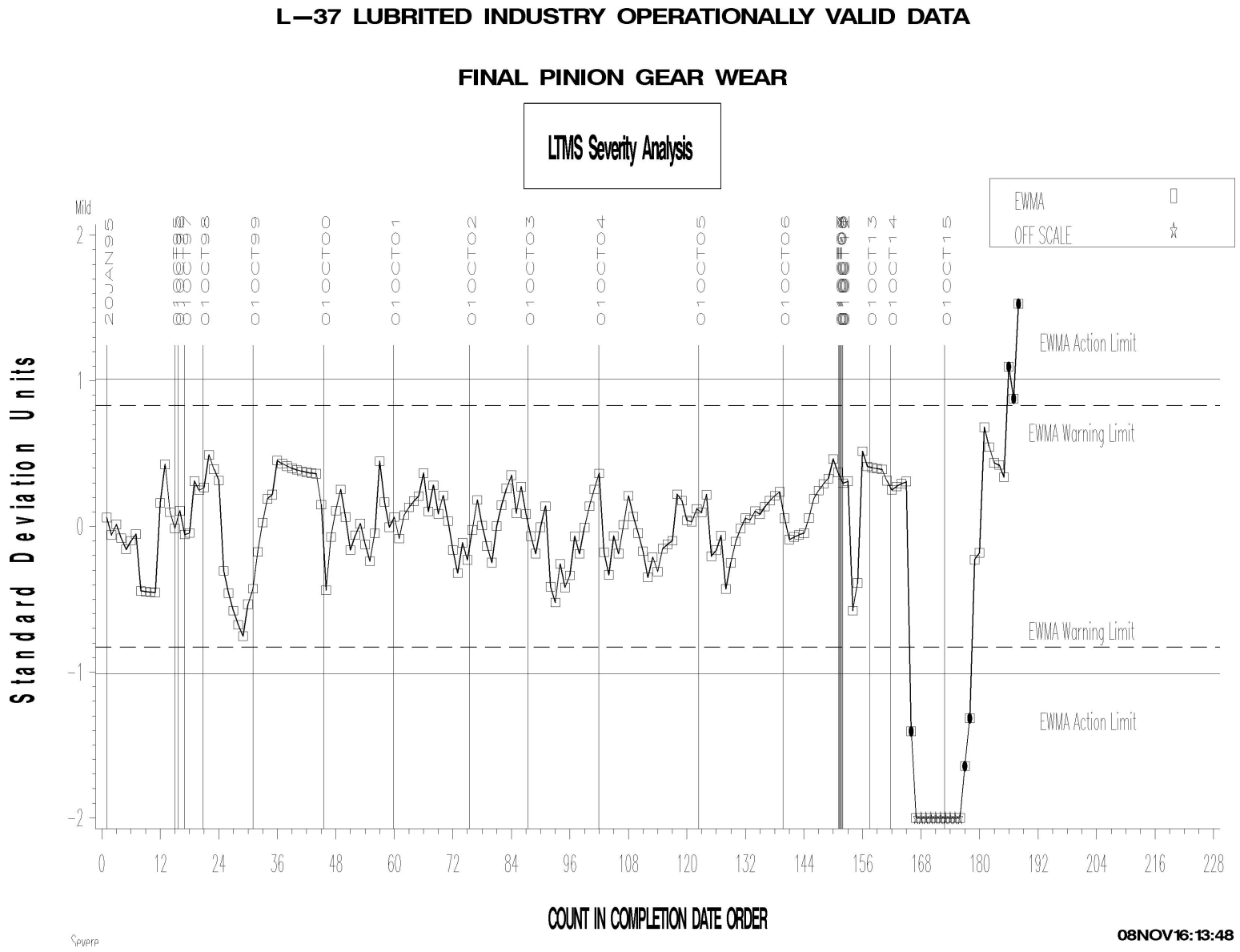
L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR WEAR
LTMS Severity Analysis
EWMA
OFF SCALE
Mild
2
1
0
-1
-2
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
0
12
24
36
48
60
72
84
96
108
120
132
144
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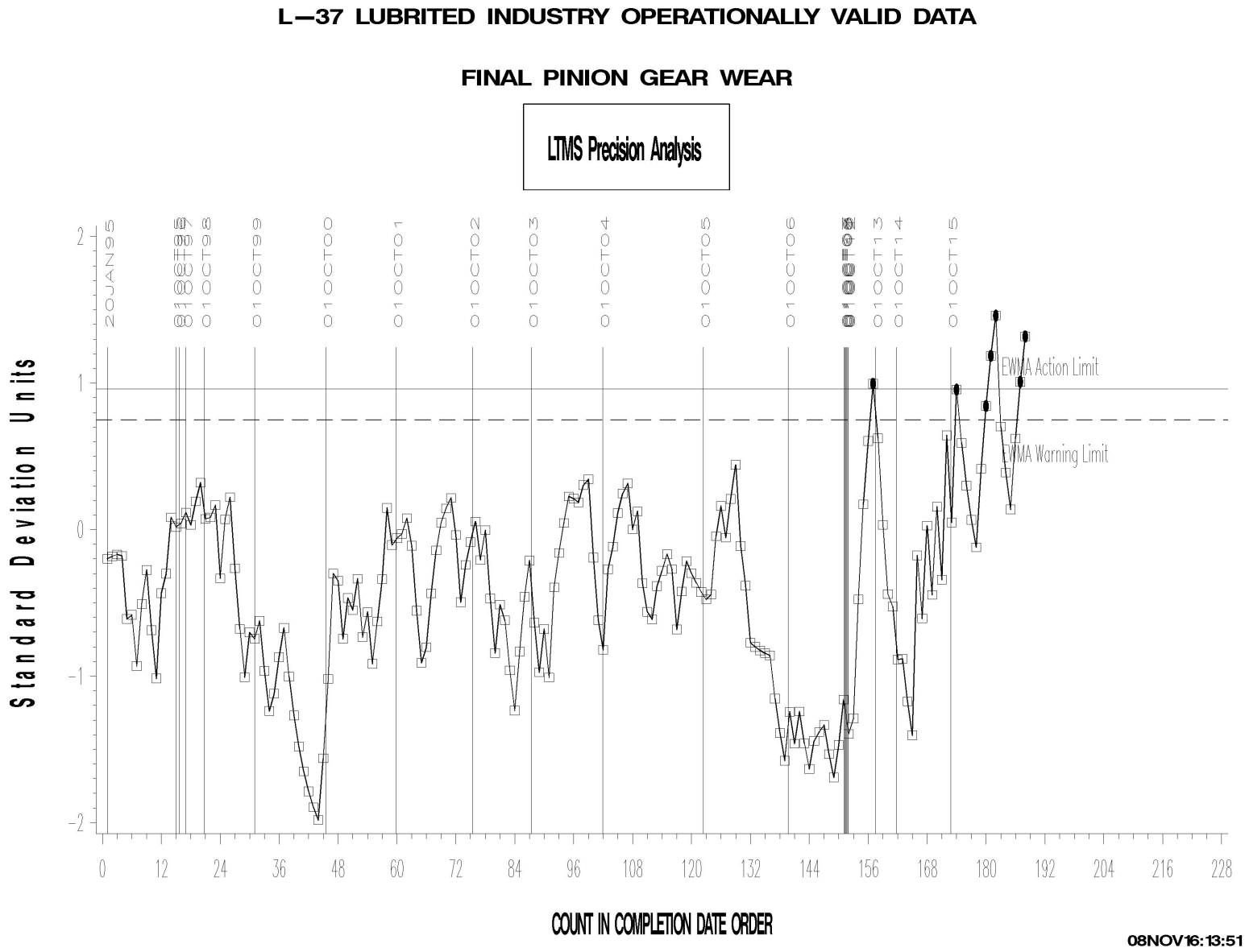
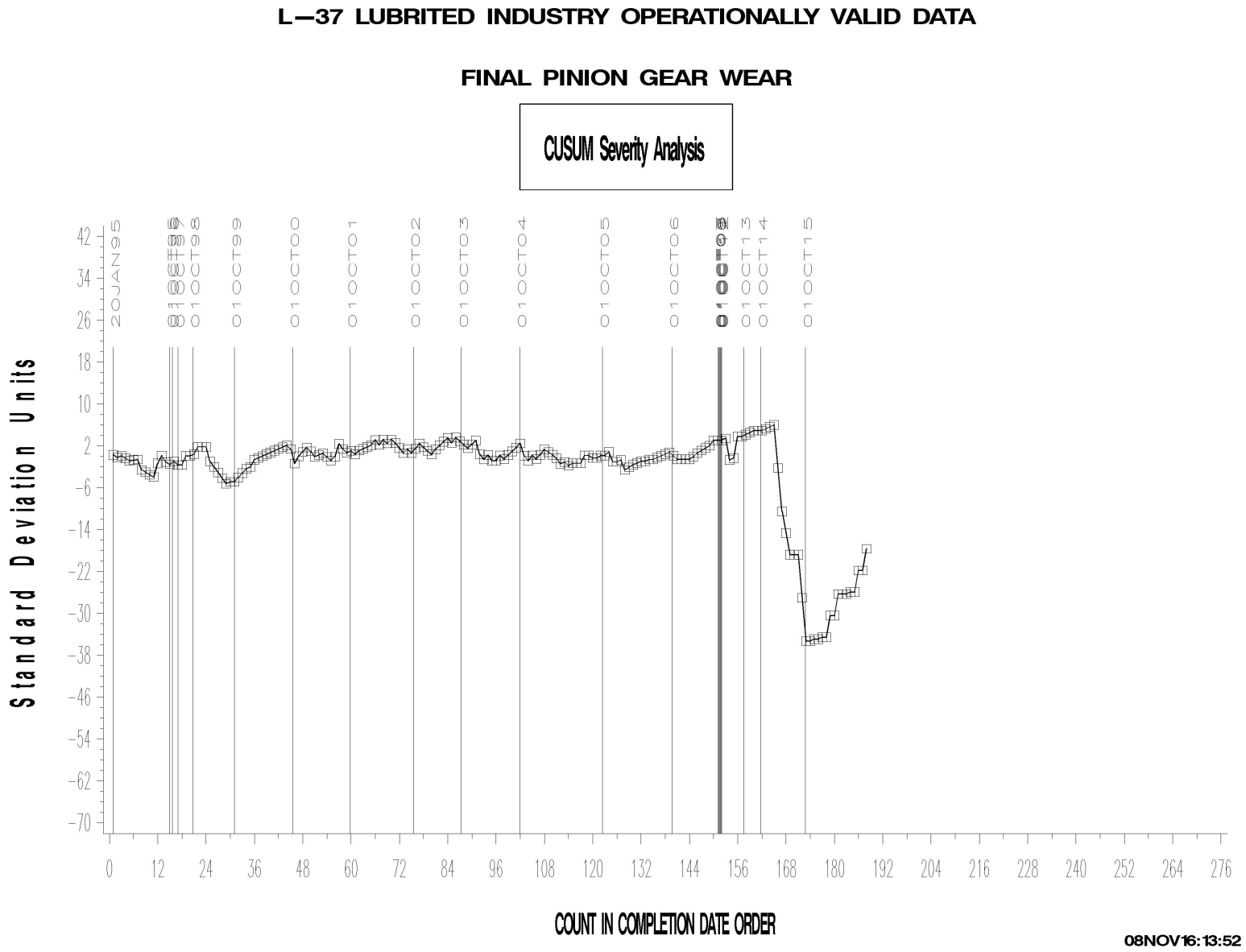
168
180
192
204
216
228
COUNT IN COMPLETION DATE ORDER
08NOV16:13:48

L-37 (D6121)


L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR WEAR
LTMS Precision Analysis
Standard Deviation Units
2
1
0
-1
-2
2JAN95
01OCT98
01OCT99
01OCT00
01OCT01
01OCT02
01OCT03
01OCT04
01OCT05
01OCT06
01OCT13
01OCT14
01OCT15
EWMA Action Limit
EWMA Warning Limit
0
12
24
36
48
60
72
84
96
108
120
132
144
156
168
180
192
204
216
228
COUNT IN COMPLETION DATE ORDER
08NOV16:13:51

L-37 (D6121)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FINAL PINION GEAR WEAR
CUSUM Severity Analysis
Standard Deviation Units
42
34
26
18
10
2
-6
-14
-22
-30
-38
-46
-54
-62
-70
0
12
24
36
48
60
72
84
96
108
120
132
144
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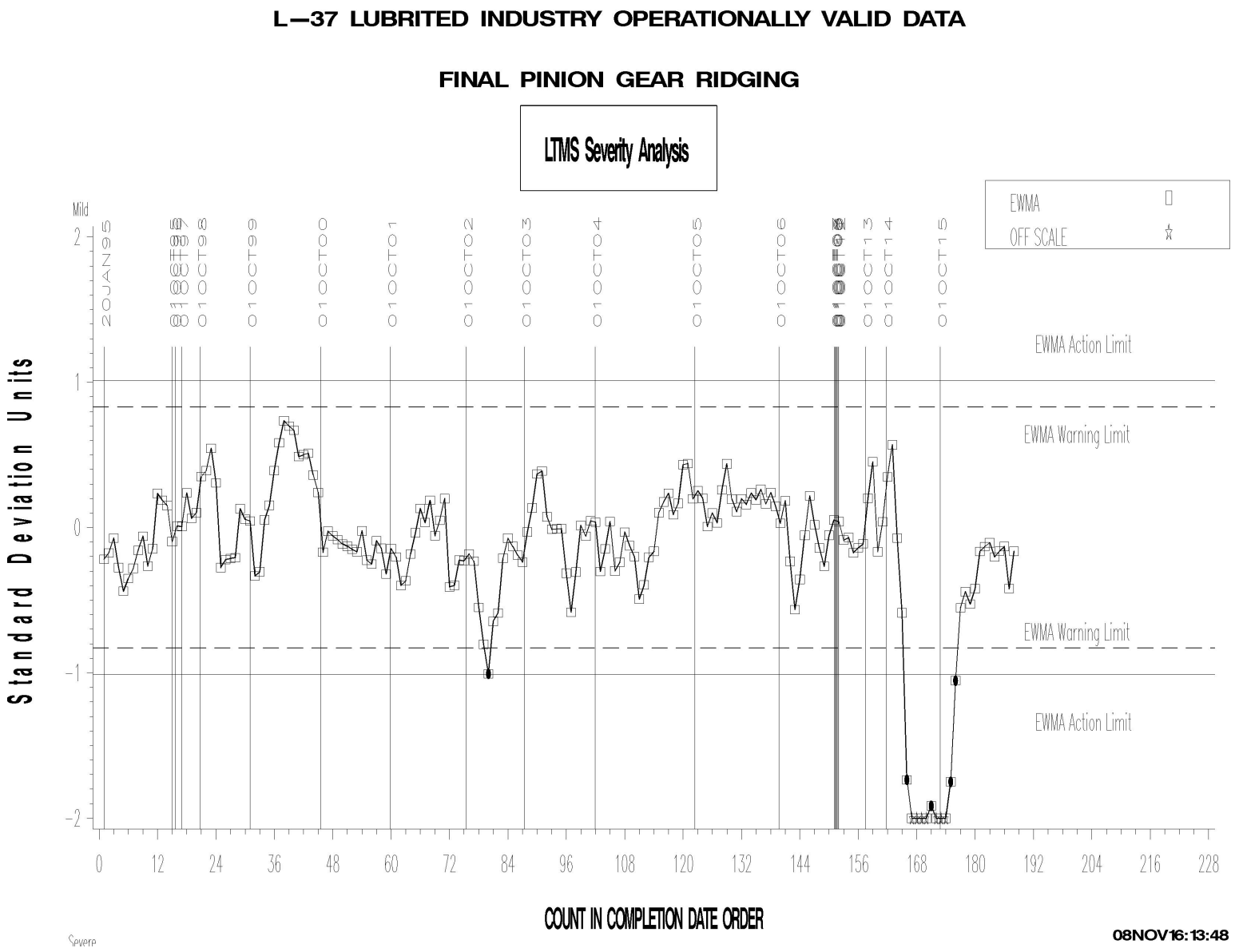
228
240
252
264
276
COUNT IN COMPLETION DATE ORDER
08NOV16:13:52

L-37 (D6121)


L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIDGING
LTMS Severity Analysis
Mild
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
2
1
0
-1
-2
0
12
24
36
48
60
72
84
96
108
120
132
144
156
168
180
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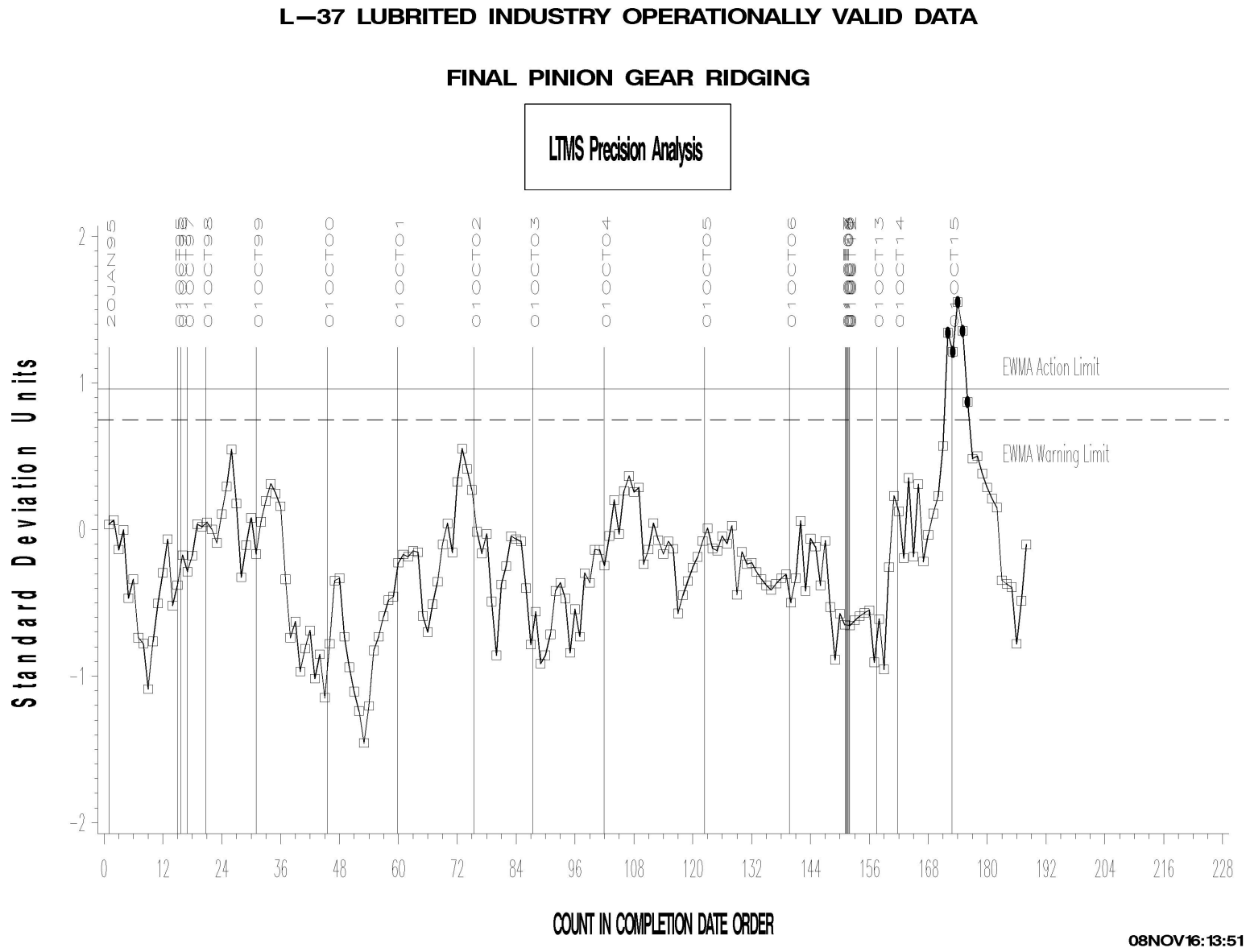
204
216
228
COUNT IN COMPLETION DATE ORDER
08NOV16:13:48

L-37 (D6121)


L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIDGING
LTMS Precision Analysis
Standard Deviation Units
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01OCT00
01OCT01
01OCT02
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EWMA Action Limit
EWMA Warning Limit
0
12
24
36
48
60
72
84
96
108
120
132
144
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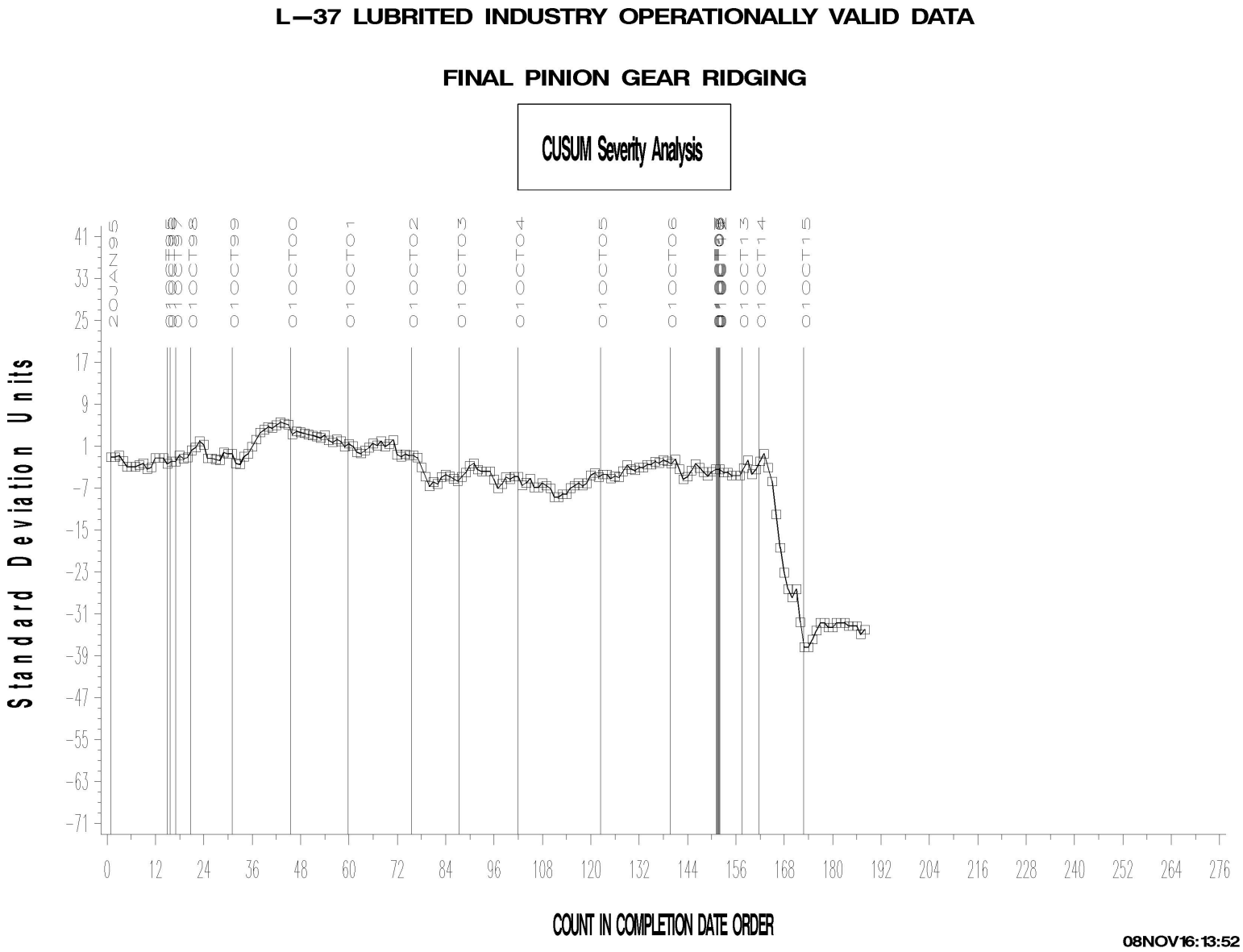
180
192
204
216
228
COUNT IN COMPLETION DATE ORDER
08NOV16:13:51

L-37 (D6121)


L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIDGING
CUSUM Severity Analysis
Standard Deviation Units
41
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17
9
1
-7
-15
-23
-31
-39
-47
-55
-63
-71
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36
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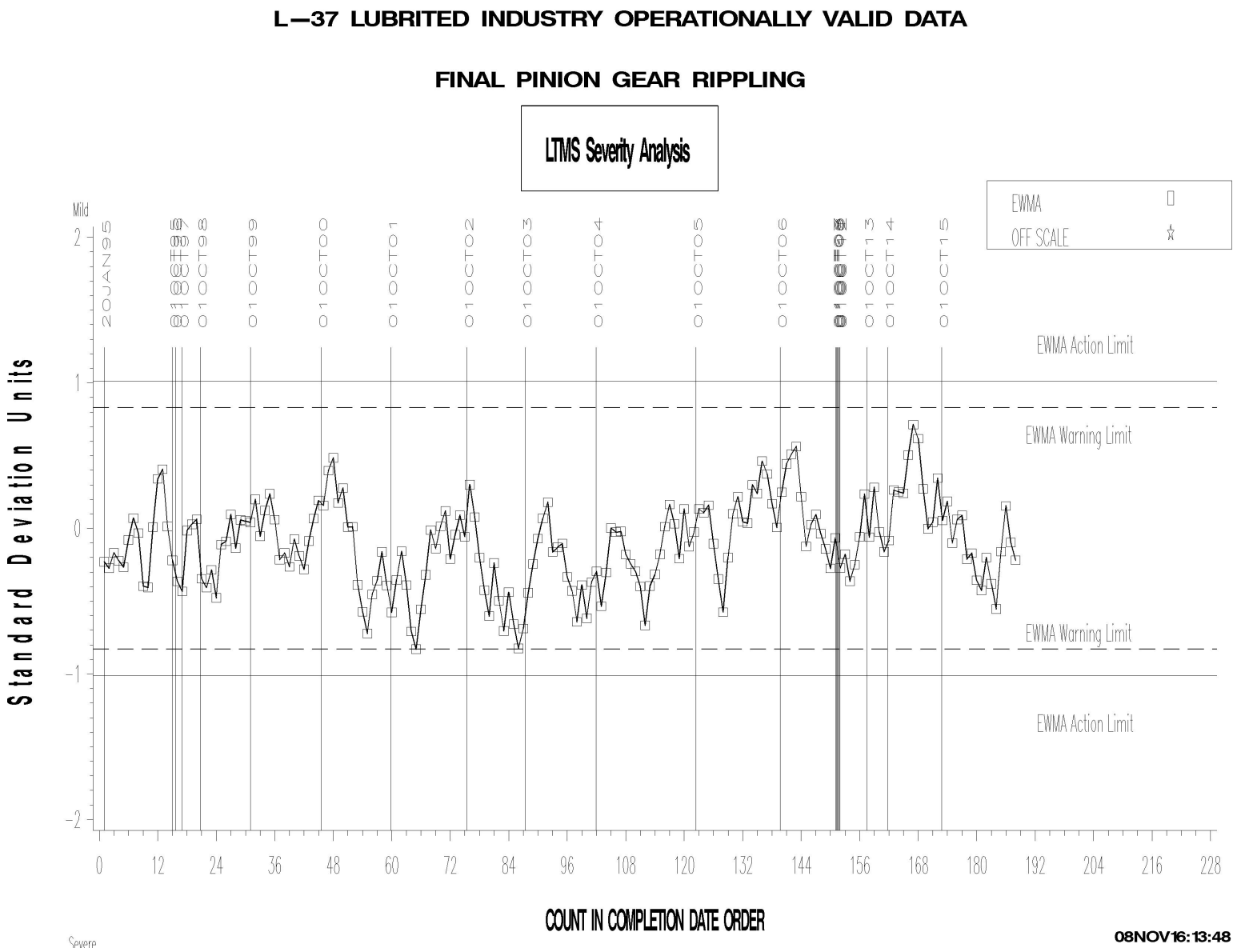
60
72
84
96
108
120
132
144
156
168
180
192
204
216
228
240
252
264
276
COUNT IN COMPLETION DATE ORDER
08NOV16:13:52

L-37 (D6121)


L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR RIPPLING
LTMS Severity Analysis
EWMA
OFF SCALE
Mild
2
1
0
-1
-2
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
20JAN95
01OCT98
01OCT99
01OCT00
01OCT01
01OCT02
01OCT03
01OCT04
01OCT05
01OCT06
01OCT13
01OCT14
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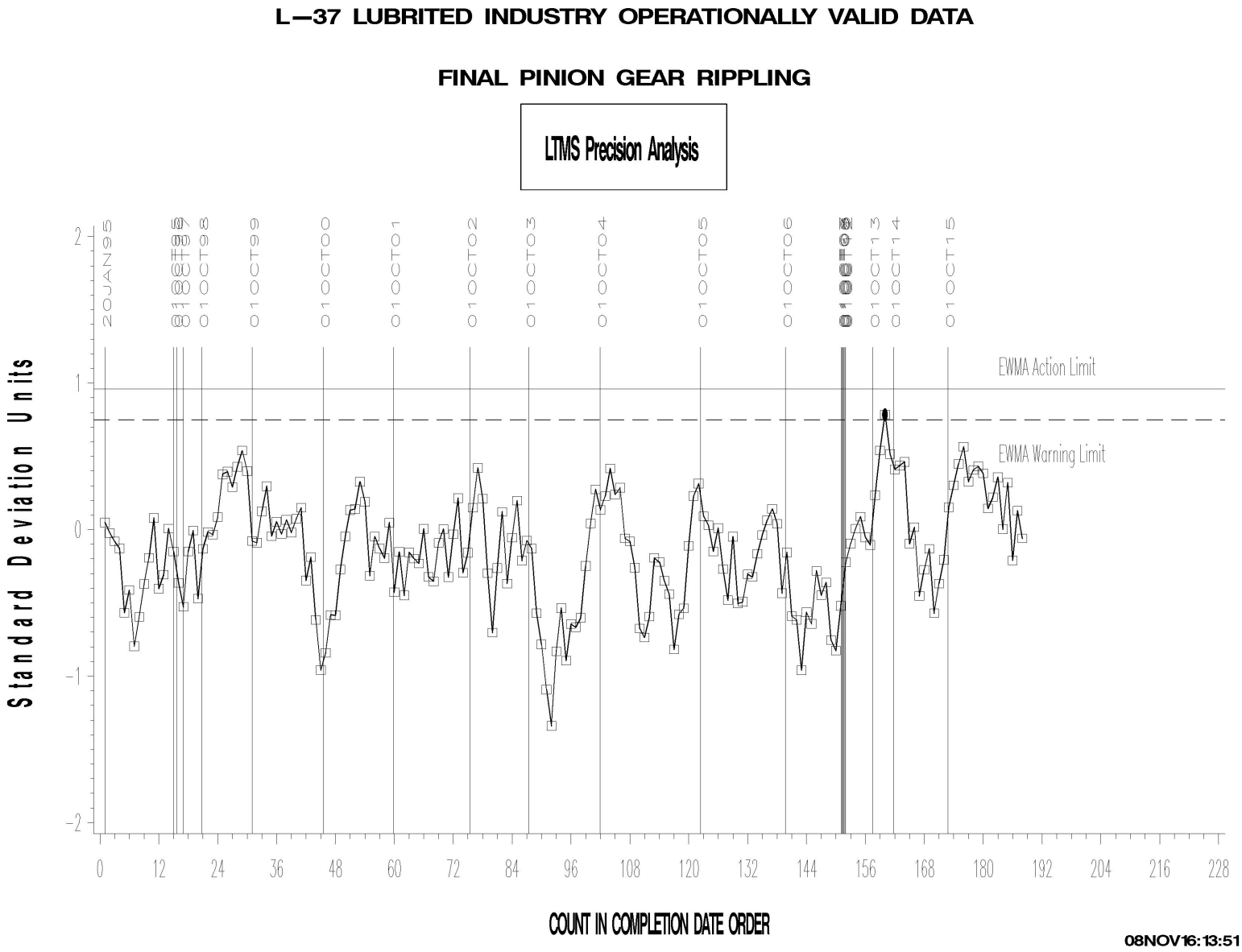
0 12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204 216 228
COUNT IN COMPLETION DATE ORDER
08NOV16:13:48

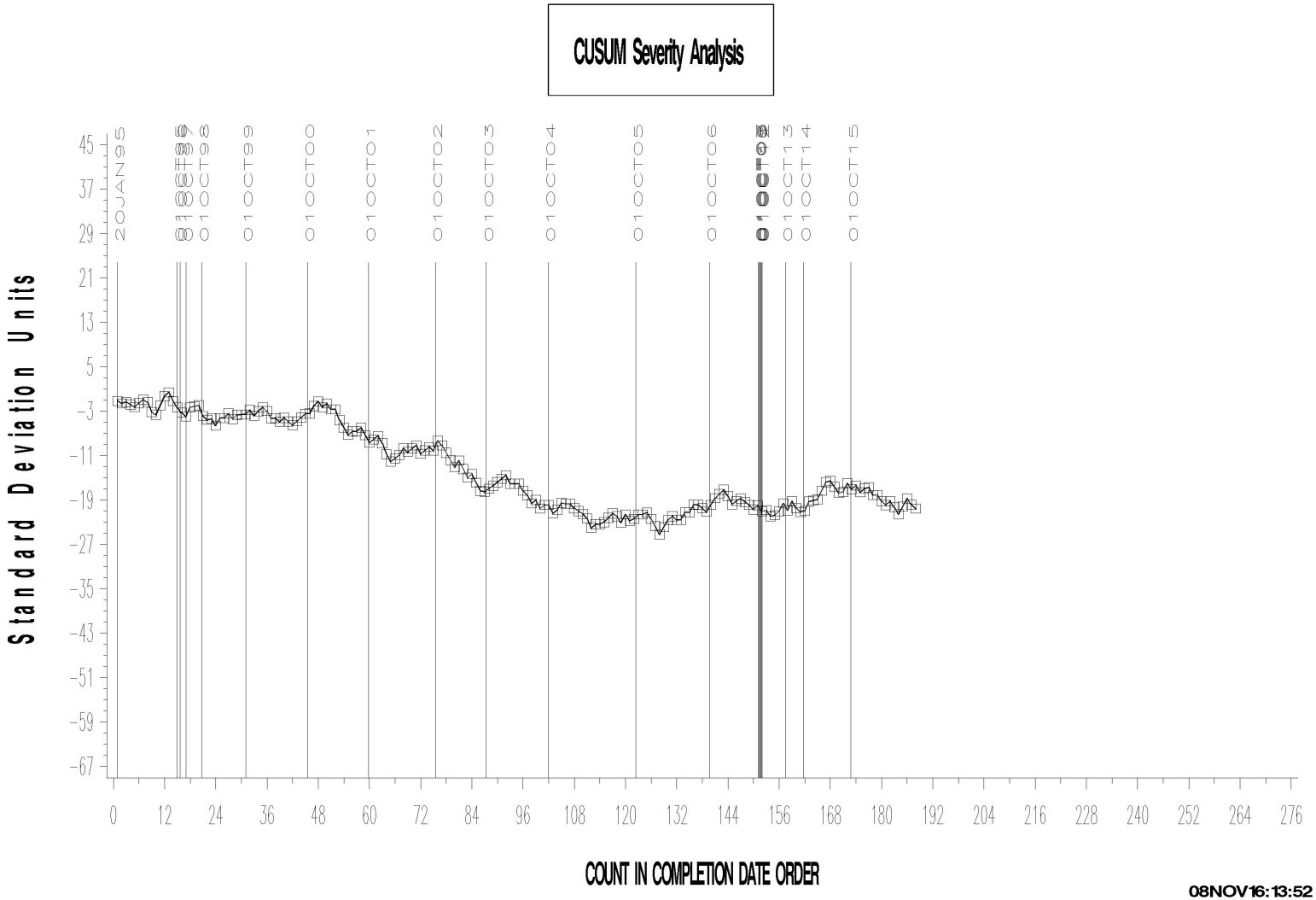
L-37 (D6121)


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
08NOV16:13:51

L-37 (D6121)

L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA

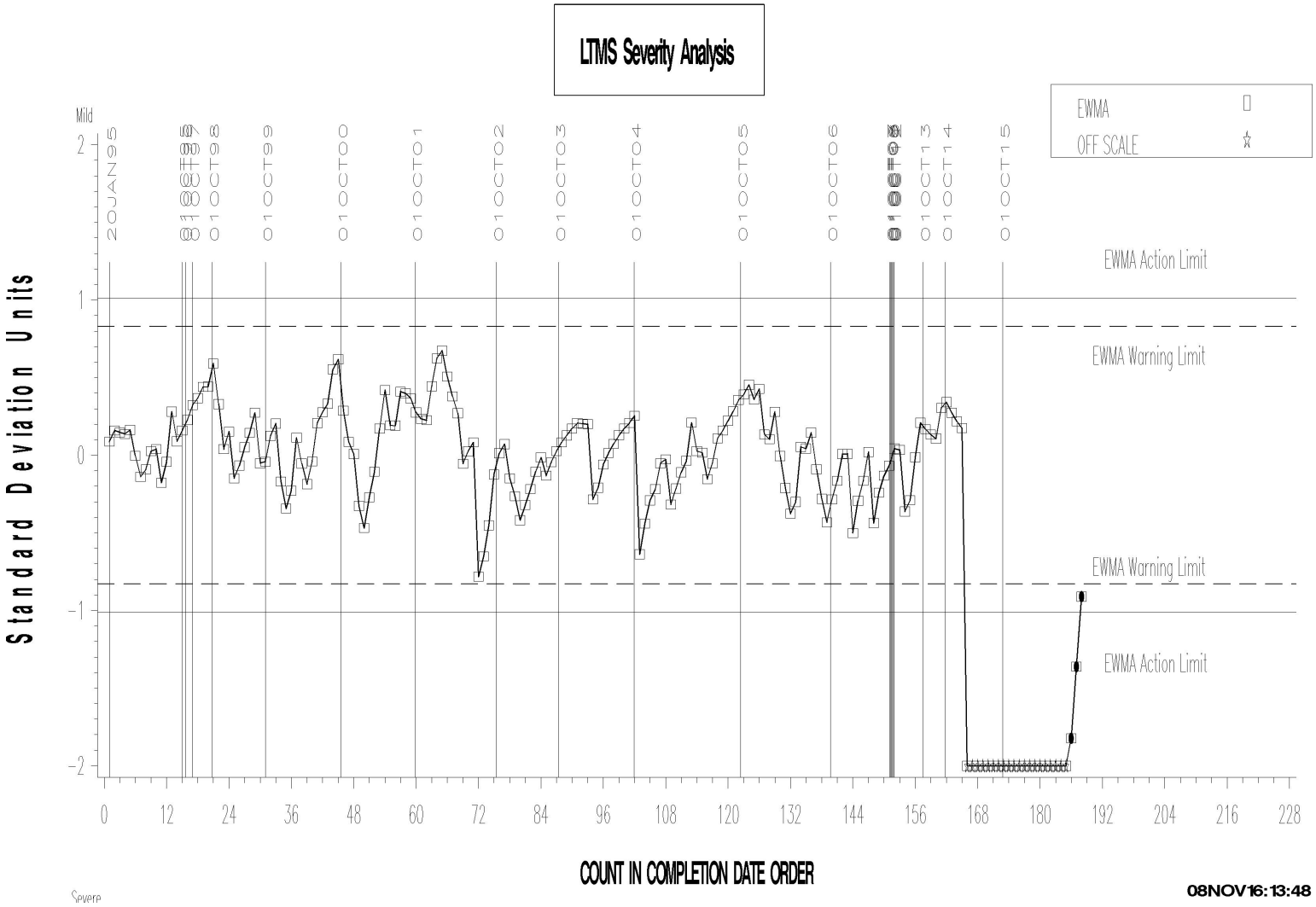
FINAL PINION GEAR RIPPLING



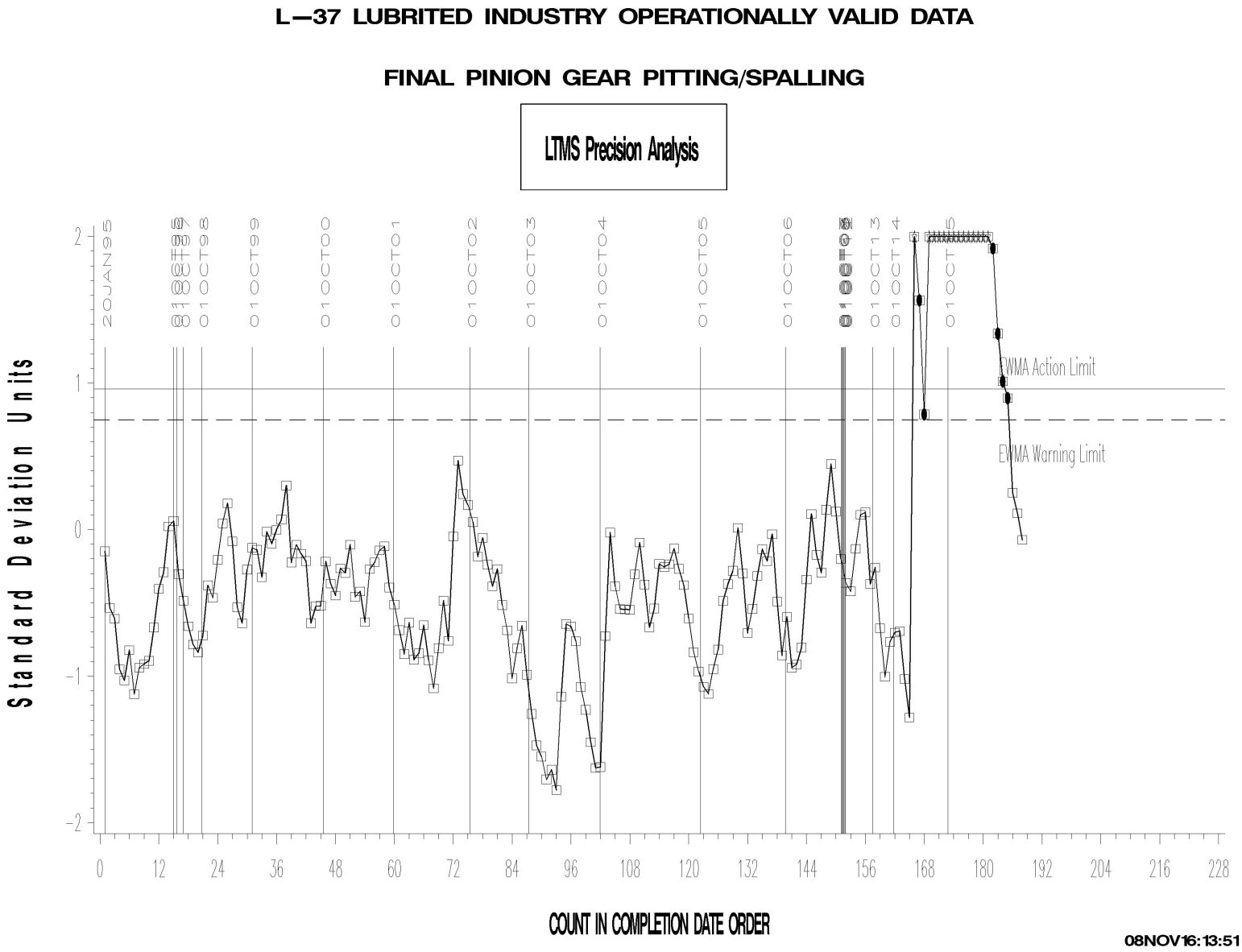
L-37 (D6121)

L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR PITTING/SPALLING



L-37 (D6121)

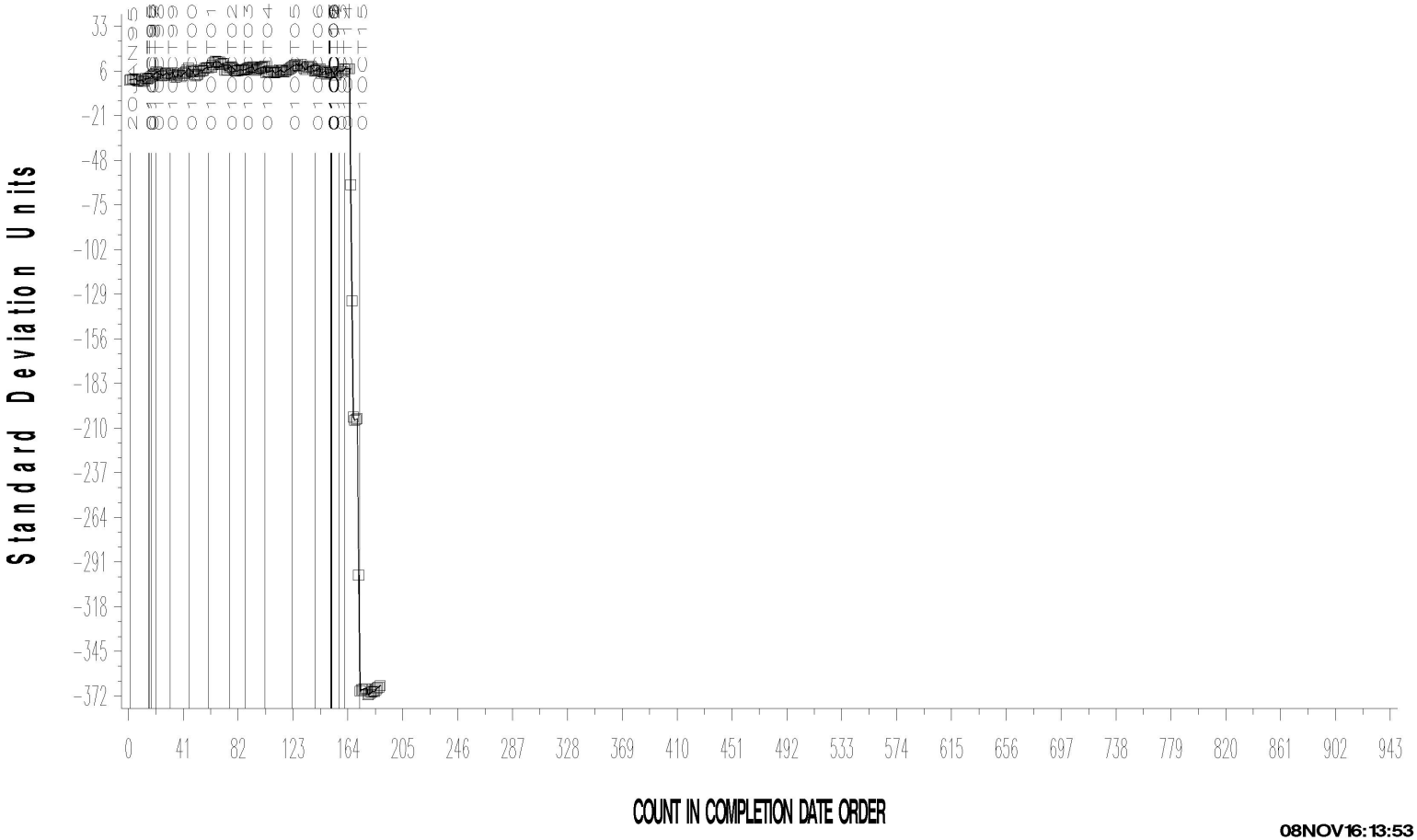

L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA
FINAL PINION GEAR PITTING/SPALLING
LTMS Precision Analysis
Standard Deviation Units
2
1
0
-1
-2
2JAN95
01OCT98
01OCT99
01OCT00
01OCT01
01OCT02
01OCT03
01OCT04
01OCT05
01OCT06
01OCT13
01OCT14
01OCT
EWMA Action Limit
EWMA Warning Limit
0
12
24
36
48
60
72
84
96
108
120
132
144
156
168
180
192
204
216
228
COUNT IN COMPLETION DATE ORDER
08NOV16:13:51

L-37 (D6121)

L—37 LUBRITED INDUSTRY OPERATIONALLY VALID DATA

FINAL PINION GEAR PITTING/SPALLING

CUSUM Severity Analysis



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L-37 (D6121)

TIMELINE ADDITIONS

Effective Date	Information Letter	Event
20160624	16-2	Intro of 134-1 for use in lab-built approval process.

L-37 (D6121)

LAB VISITS
No L-37 lab visits were conducted this report period.

L-37 (D6121)

INFORMATION LETTERS

Information Letter 16-2 was issued 20160624 to permit the use of approved reblends of the oils used for the lab-built approval process.

L-37 (D6121)

LTMS DEVIATIONS

LTMS deviation dev.l37.01.2016 was written in September to calibrate a stand exceeding Shewhart and EWMA precision limits for WEAR. As a result of L-37's use of acceptance bands for severity limits while retaining standard LTMS limits on precision, this has been a common occurrence. At the most recent surveillance panel meeting, the group voted to address this issue by removing the required actions for exceeding stand Shewhart and EWMA precision alarms.

L-37 (D6121)

STATUS OF REFERENCE OIL SUPPLY

		@ TMC	
Oil	Cans @ Labs	Cans	Gallons
117	0	423	423.0
134	4	0	0.0
134-1	7	210	210.0
152-2	12	165	165.9
152-3	0	54	54.8
155	7	15	15.0
155-1	10	197	197.0
Total	40	1064	1065.6

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, L-60-1, 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 39.0 gal) for use in that test.

TMC stocks of oil 134 have been depleted. The 134-1 reblend has been introduced to testing.