



# Test Monitoring Center

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MEMORANDUM: 09-022

DATE: April 16, 2009

TO: Mark Cooper, Chairman, Mack Test Surveillance Panel

FROM: Jeff Clark

SUBJECT: T-8/T-8E, T-10A, T-11, and T-12 Calibration Testing for the April 2009 ASTM Report Period

The following is a summary of T-8/T-8E, T-10A, T-11, and T-12 reference oil tests completed during the April 2009 ASTM report period, which began on October 1, 2008 and ended on March 31, 2009.

Test Status	TMC Validity Code	Number of Tests			
		T-8/T-8E	T-10A	T-11	T-12
Acceptable Calibration Test	AC	3	0	9	1
Failed Calibration Test (LTMS Criteria)	OC	0	0	0	0
Operationally Invalid Test	RC or LC	2	0	1	0
Aborted	XC	1	0	0	0
Total		6	0	10	1

One T-8 test was invalid due to missing a soot window and one was invalid due to the inlet air restriction being out of specification. One T-8 test was aborted due to missing a soot window. One T-11 was invalid due to exceptionally low viscosity increase which prevented the test pass/fail parameters from being calculated.

### **T-8 Severity:**

Viscosity Increase at 3.8% Soot (VI38), Relative Viscosity at 4.8% Soot, 50% Loss (RV48), and Relative Viscosity at 4.8% Soot, 100% Loss (RV2) are all currently within control chart limits and are not exhibiting any pronounced severity trends. Figures 1, 2, and 3 (attached) show the current industry EWMA severity, EWMA precision, and cusum charts for VI38, RV48, and RV2, respectively.

### **T-10A Severity:**

MRV Viscosity (MRV) is currently within control chart limits. Since January 2006, MRV has been trending an average of 0.35  $\Delta$ /s severe, which is approximately 170 cP. Figure 4 (attached) shows the current industry EWMA severity and cusum charts for MRV.

**T-11 Severity:**

Soot at 12 cSt Viscosity Increase (SOOT), MRV Viscosity (MRV), Soot at 4 cSt Viscosity Increase (SOOT4), and Soot at 15 cSt Viscosity Increase (SOOT5) are all currently within control chart limits. SOOT and SOOT5 are showing some evidence of a mild trend. MRV and SOOT4 are not currently exhibiting any pronounced severity trends. Figures 5 through 8 (attached) show the current industry EWMA severity, EWMA precision, and cusum charts for SOOT, MRV, SOOT4, and SOOT5, respectively.

**T-12 Severity:**

Delta PB @ EOT (PB), Cylinder Liner Wear (CLW), Top Ring Weight Loss (TRWL), Oil Consumption (OC), and Delta PB 250 – 300 Hours (PB2) are all currently within control chart limits. PB, CLW, OC, and PB2 are not exhibiting any pronounced severity trends, while TRWL may be showing some evidence of a severe trend. Figures 9 through 13 (attached) show the current industry EWMA severity, EWMA precision, and cusum charts for PB, CLW, TRWL, OC, and PB2, respectively.

**Reference Test Precision Estimates:**

Precision estimates, and any relevant commentary, will be provided on an annual basis in the sections below. Please note that due to low testing frequency, precision estimates are not available for the T-8 and T-10A.

The T-11 precision estimates for 2008 show MRV precision to be within historical levels. Precision for SOOT and SOOT 5 shows some improvement compared to recent years, while SOOT4 continues to show some degradation.

**T-11 Precision Estimates**

<b>Parameter</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
df	21	17	9	16	
SOOT	0.23	0.22	0.18	0.18	
MRV	1410	1251	820	967	
SOOT4	0.22	0.22	0.32	0.33	
SOOT5	0.26	0.23	0.18	0.18	

The T-12 2008 precision estimates show some improvement for PB, CLW, TRWL, and PB2, with the OC precision estimate remaining relatively steady.

**T-12 Precision Estimates**

<b>Parameter</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
df	21	11	6	7	
PB (ln units)	0.252	0.2030	0.274	0.164	
CLW	3.9	3.8	3.1	2.7	
TRWL	28.4	28.6	33.4	18.2	
OC (ln units)	0.080	0.087	0.086	0.090	
PB2 (ln units)	0.344	0.321	0.321	0.238	

**Reference Oil Test Targets:**

The current T-8/T-8E reference oil test targets are shown in the table below. For the consideration of a possible target update, the TMC will advise the Surveillance Panel when ten tests have been run on oil 1005-2.

**T-8/T-8E Reference Oil Test Targets**

Oils	N	Parameter	Mean	S
1005-2	5	VI38	5.11	0.66
		RV48	1.78	0.11
		RV2	2.03	0.12

The current T-10A reference oil test targets are shown in the table below.

**T-10A Reference Oil Test Targets**

Oils	N	Parameter	Mean	S
820-2	30	MRV	13128	497

The current T-11 reference oil test targets are shown in the table below. To date, 32 tests have been completed on oil 820-3 and the results are presented for comparison purposes. The Surveillance Panel may soon wish to consider updating the T-11 targets.

**T-11 Reference Oil Test Targets**

Oil	N	Parameter	Mean (cSt)	s
820-3	11	SOOT	5.92	0.22
		MRV	14981	916
		SOOT4	3.95	0.30
		SOOT5	6.51	0.20
820-3	32 <sup>A</sup>	SOOT	5.96	0.20
		MRV	14629	950
		SOOT4	4.07	0.32
		SOOT5	6.55	0.19

<sup>A</sup>Presented for comparison purposes.

The current T-12 reference oil test targets are shown in the following table. Note that the current targets for oil 821-1 are based on the previous blend of the reference oil. To date, seven tests have been

completed on oil 821-1 and the results are presented for comparison purposes. For the consideration of a possible target update, the TMC will advise the Surveillance Panel when ten tests have been run on oil 821-1.

**T-12 Reference Oil Test Targets**

Oils	N	Parameter	Mean	S
821-1	25 <sup>B</sup>	PB (ln units)	3.106	0.242
		CLW	16.2	3.7
		TRWL	62.0	28.2
		OC (ln units)	4.093	0.079
		PB2 (ln units)	2.125	0.333
821-1	7 <sup>C</sup>	PB (ln units)	3.117	0.172
		CLW	17.3	2.0
		TRWL	75.6	19.0
		OC (ln units)	4.114	0.083
		PB2 (ln units)	2.171	0.161

<sup>B</sup>Based on twenty-five tests on oil 821.

<sup>C</sup>Presented for comparison purposes.

**Reference Oil Supply:**

The table below shows current reference oil inventories. Based upon these levels, no action regarding reference oil supply is necessary at this time.

**Reference Oil Inventory and Estimated Life**

Oil	Tests	TMC Inventory <sup>C</sup>	Lab Inventory <sup>D</sup>	Estimated Life <sup>E</sup>
820-2	T-10A, T-11	10	5	> 1 year
820-3	T-10A, T-11	1542	8	3.5 years
821-1	T-12	648	8	5+ years
1005-2	T-8/T-8E <sup>F</sup>	75	7	~ 1 year

<sup>C</sup>Inventories are expressed in gallons.

<sup>D</sup>Active laboratories.

<sup>E</sup>Time estimate is based on most recent activity levels.

<sup>F</sup>The T-8/T-8E shares reference oils with other tests. Activity levels all tests are taken into account in the estimated life of the reference oils.

**Information Letters:**

T-12 Information Letter 08-01, Sequence No. 3, was issued October 13, 2008. This letter detailed the protocol for running a “split test kit” using both batch P and batch R test parts.

T-12 Information Letter 09-01, Sequence No. 4, was issued January 5, 2009. This letter implemented a correction factor for cylinder liner wear for batch R test parts. Refer to the Hardware Issues section of this report for more information.

**TMC Laboratory Visits:**

One T-8 laboratory visit was conducted this period and no deficiencies were noted.

Quality Index:

No QI deviations were issued this report period.

Hardware Issues:

T-12 test results from earlier this year indicated a severity shift in cylinder liner wear that was tied to the use of batch R cylinder kits. As a result, a multiplicative correction factor of 0.58 (CLW x 0.58) was approved on October 27, 2008.

Additional Information:

The T-8/T-8E, T-10A, T-11, and T-12 databases, timelines, and alarm logs can be accessed from the links in the table below. If you have any questions about this information, please contact the TMC.

**Mack Surveillance Panel Information Links**

<b>Test Area</b>	<b>Information Link</b>
<b>T-8/T-8E</b>	<a href="ftp://ftp.astmtmc.cmu.edu/refdata/diesel/t8/data/">ftp://ftp.astmtmc.cmu.edu/refdata/diesel/t8/data/</a>
<b>T-10A</b>	<a href="ftp://ftp.astmtmc.cmu.edu/refdata/diesel/t10a/data/">ftp://ftp.astmtmc.cmu.edu/refdata/diesel/t10a/data/</a>
<b>T-11</b>	<a href="ftp://ftp.astmtmc.cmu.edu/refdata/diesel/t11/data/">ftp://ftp.astmtmc.cmu.edu/refdata/diesel/t11/data/</a>
<b>T-12</b>	<a href="ftp://ftp.astmtmc.cmu.edu/refdata/diesel/t12/data/">ftp://ftp.astmtmc.cmu.edu/refdata/diesel/t12/data/</a>

JAC/jac/mem09-022.jac.doc

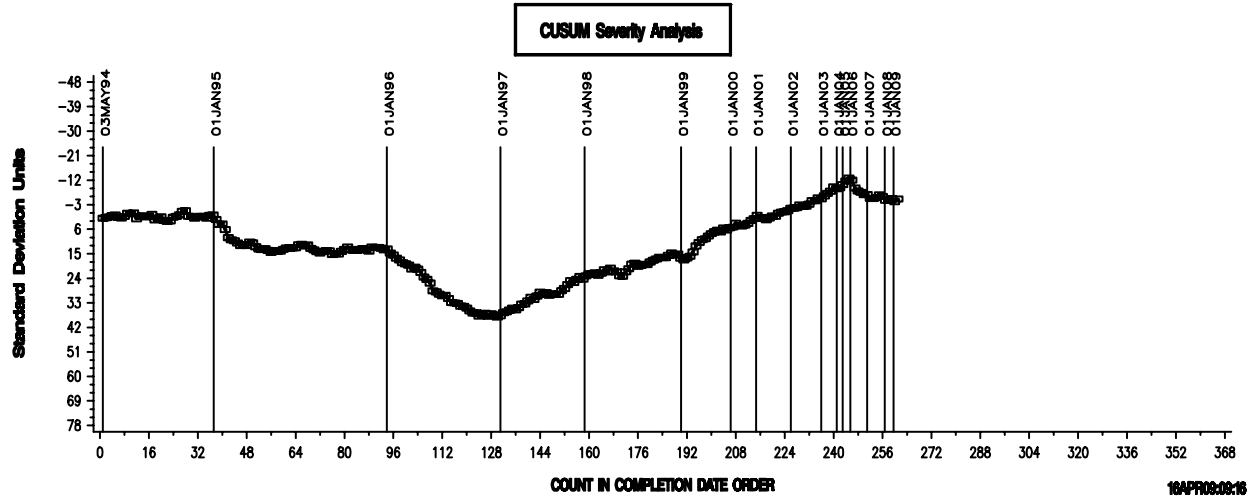
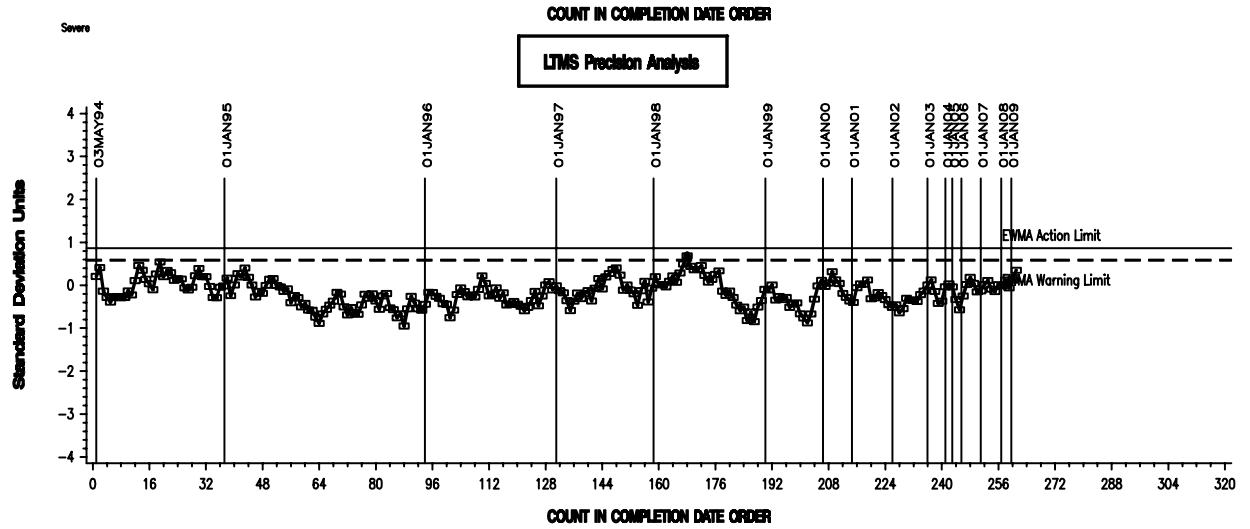
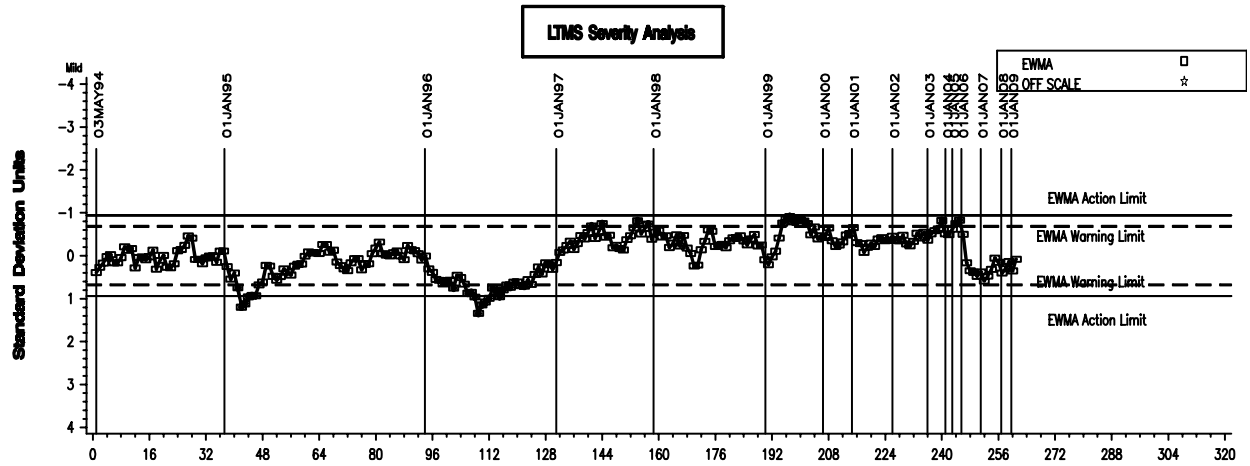
## Attachments

c: J.L. Zalar, TMC  
 F.M. Farber, TMC  
 Mack Surveillance Panel  
<ftp://ftp.astmtmc.cmu.edu/docs/diesel/mack/semiannualreports/MACK-04-2009.pdf>

Distribution: Email

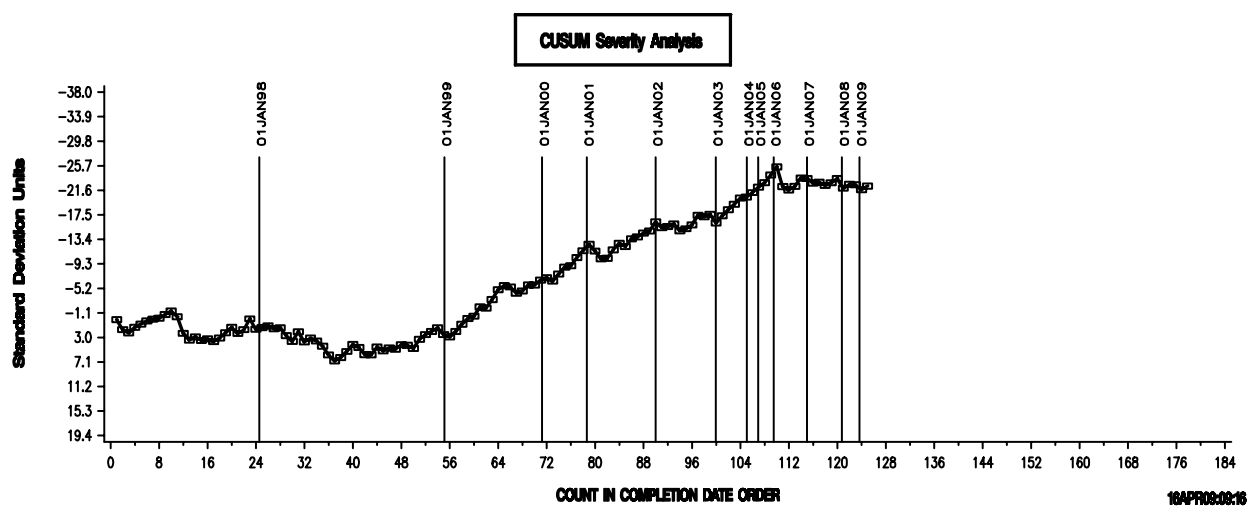
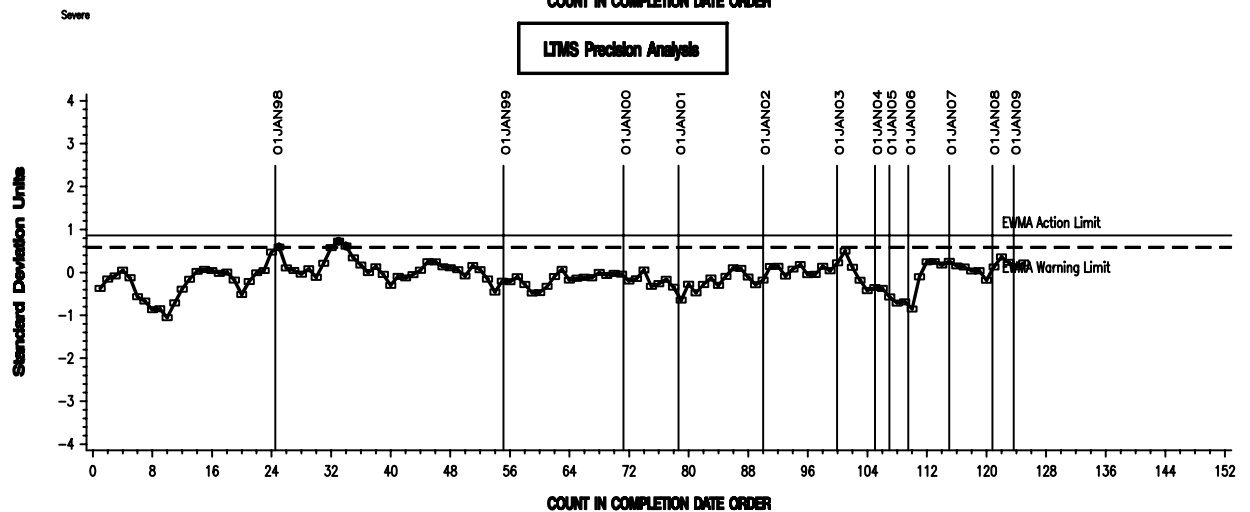
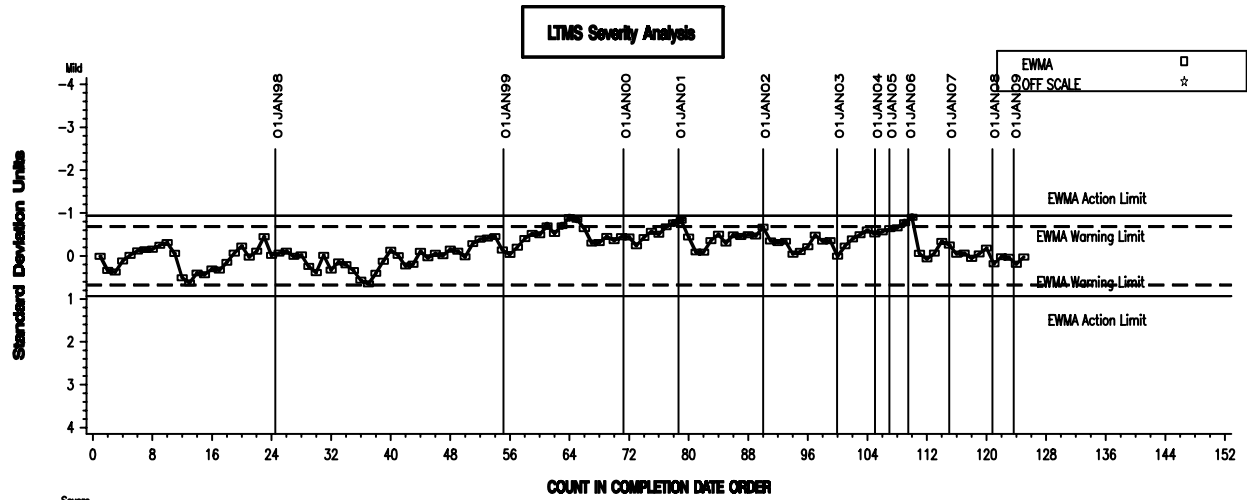
**FIGURE 1**  
**T-8/T-8E INDUSTRY OPERATIONALLY VALID DATA**

**VISCOSITY INCREASE AT 3.8% SOOT**

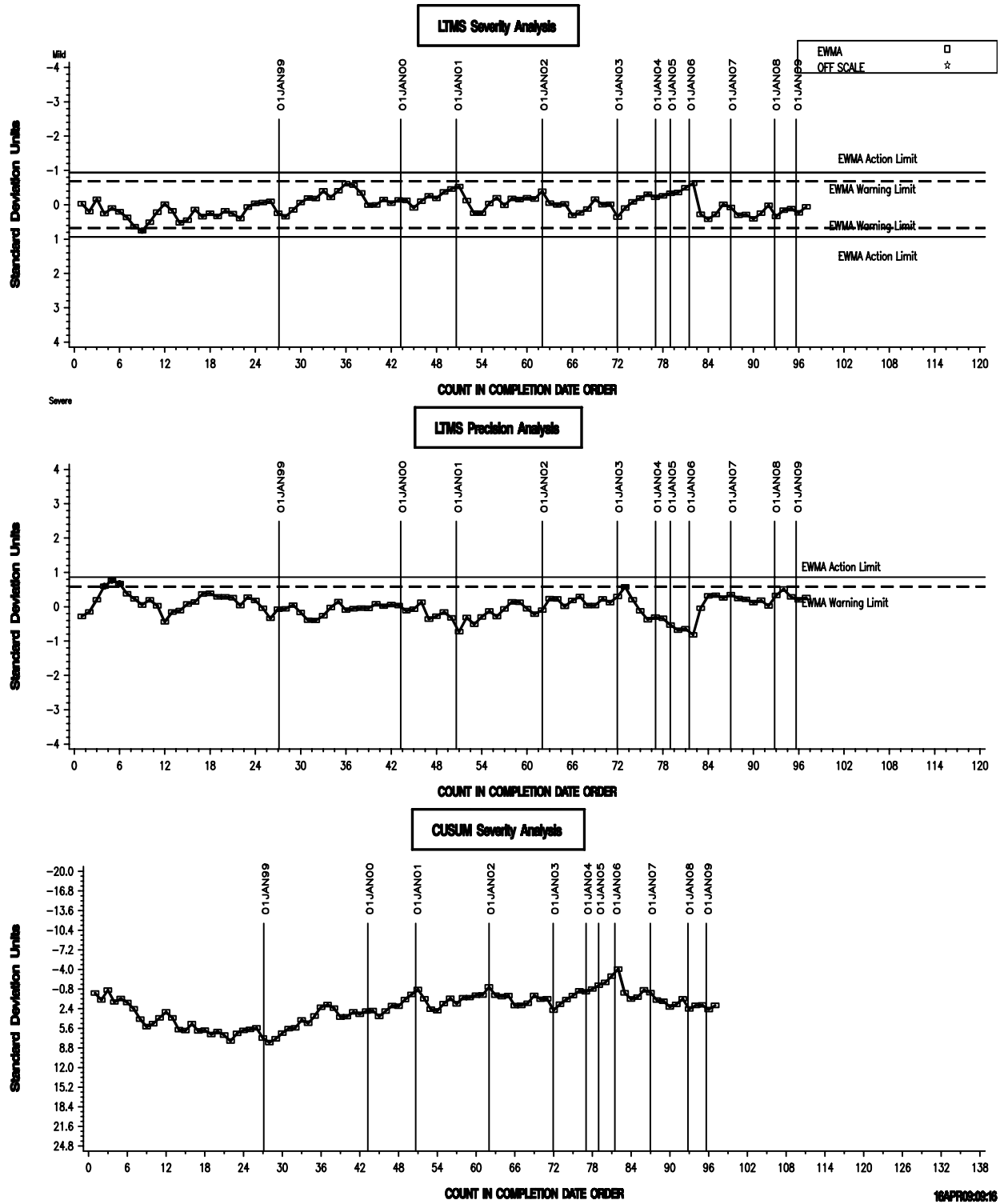


**FIGURE 2**  
**T-8/T-8E INDUSTRY OPERATIONALLY VALID DATA**

RELATIVE VISCOSITY AT 4.8% (50% LOSS)



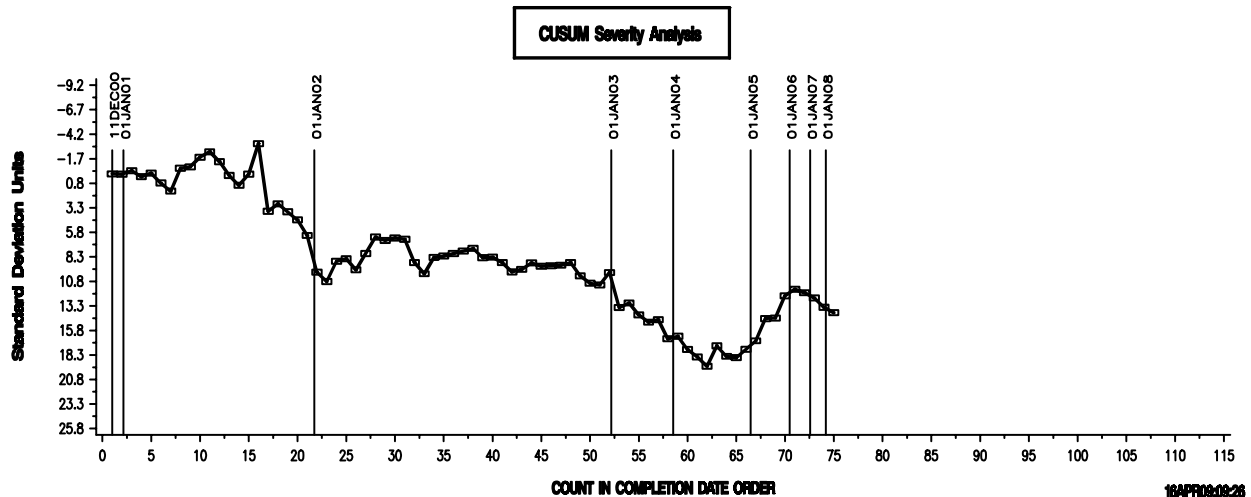
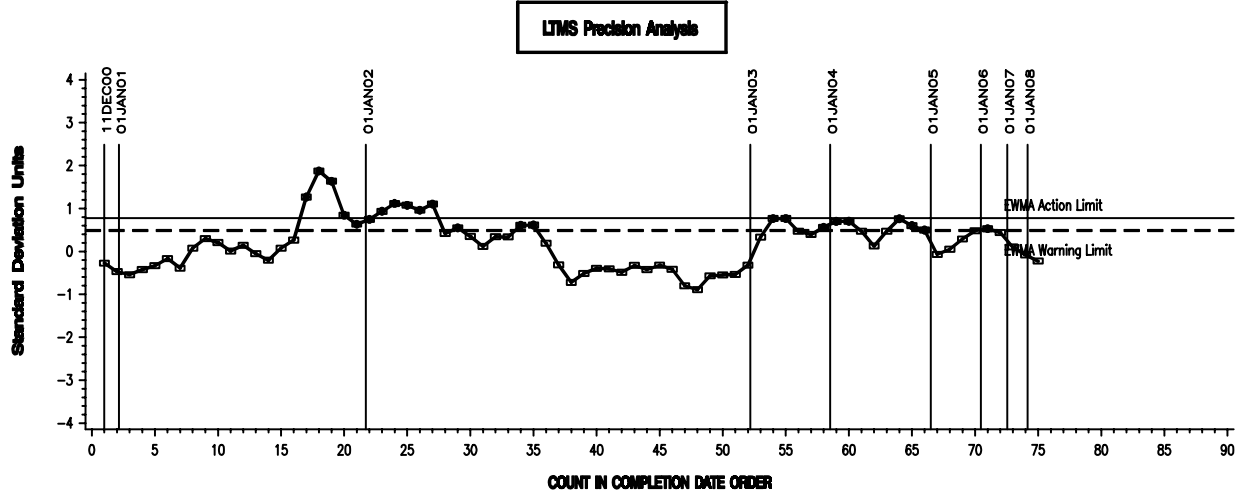
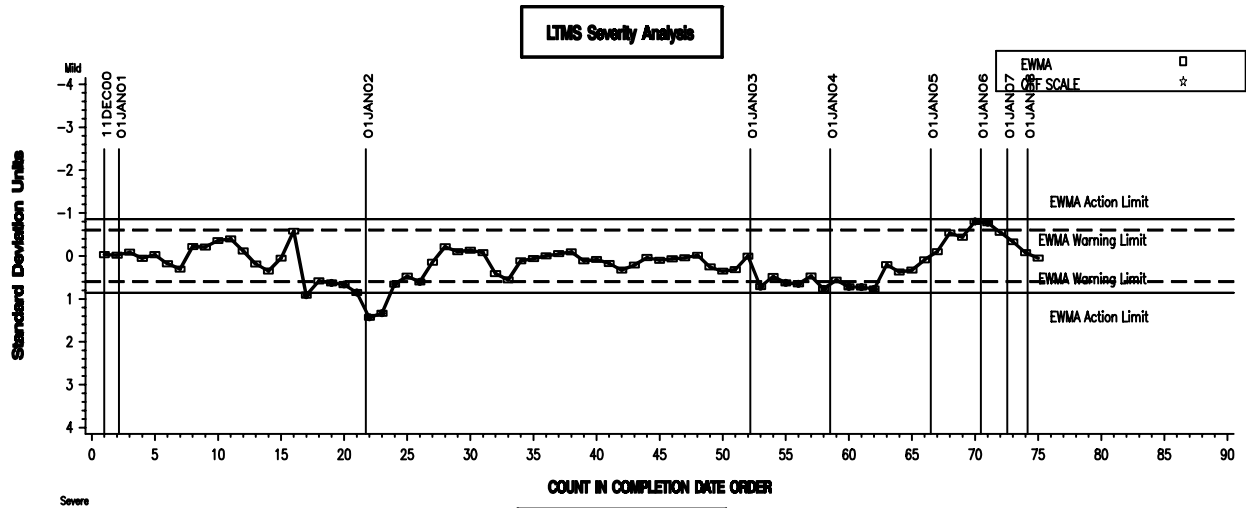
**FIGURE 3**  
**T-8/T-8E INDUSTRY OPERATIONALLY VALID DATA**  
**REFERENCE RELATIVE VISCOSITY AT 4.8% (100% LOSS)**





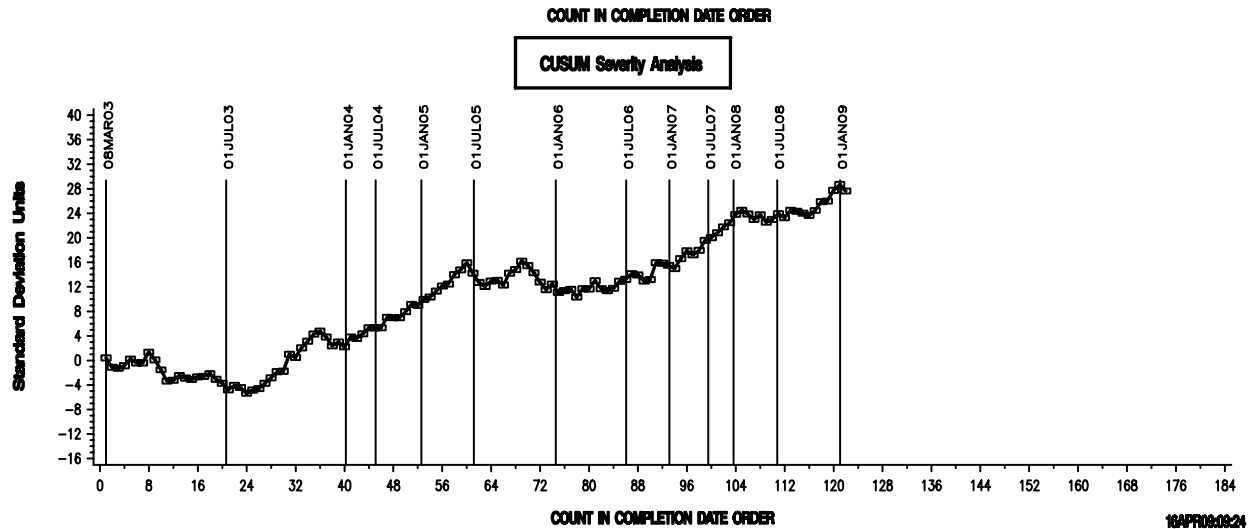
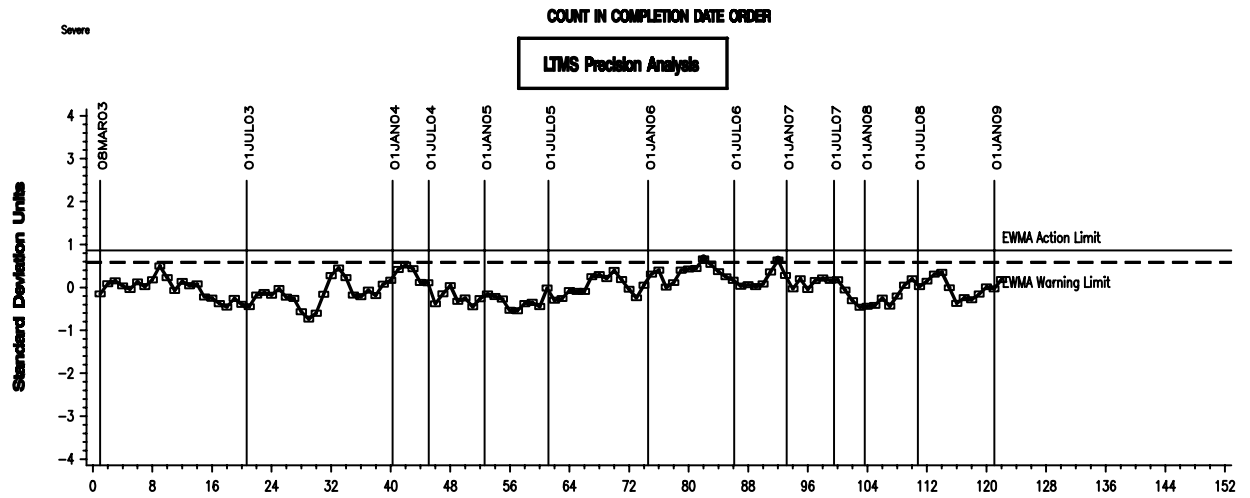
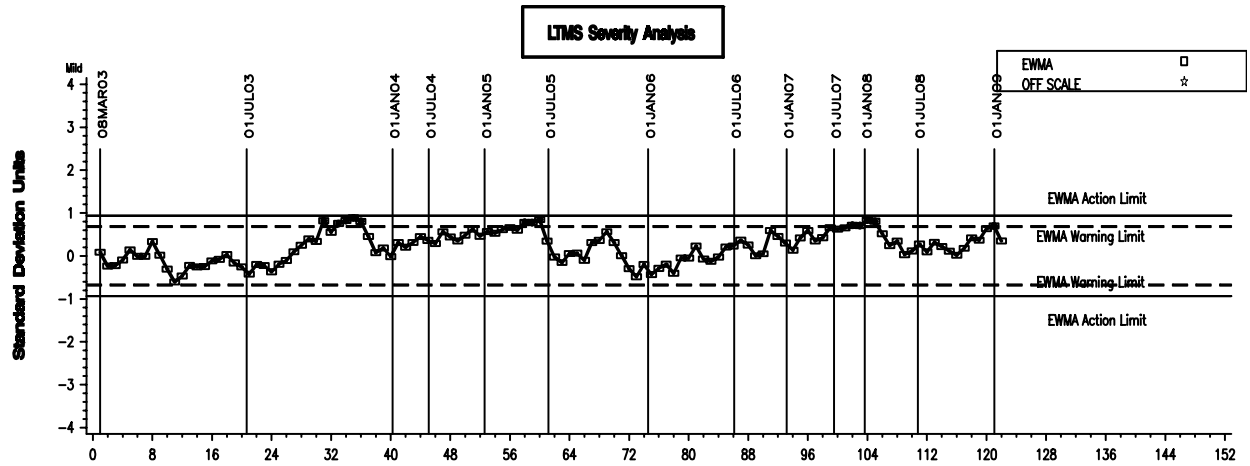
**FIGURE 4**  
**TKA INDUSTRY OPERATIONALLY VALID DATA**

MRV VISCOSITY @ 75H



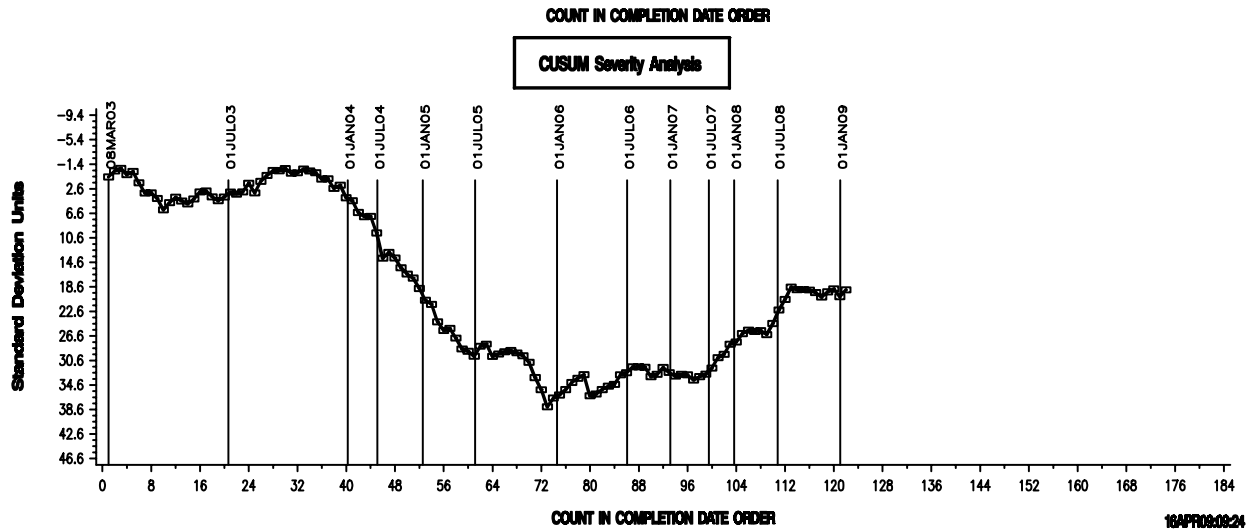
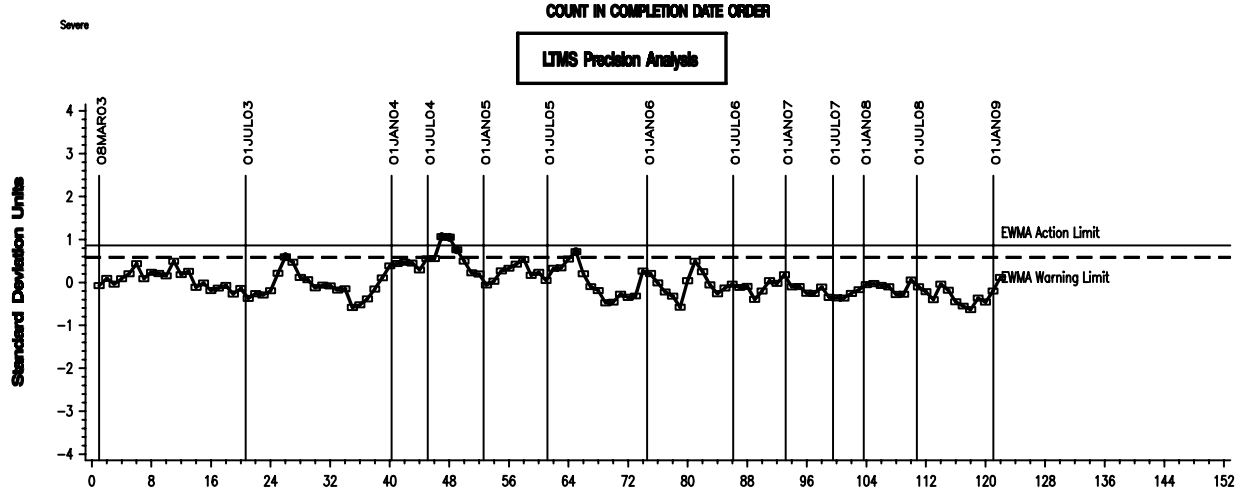
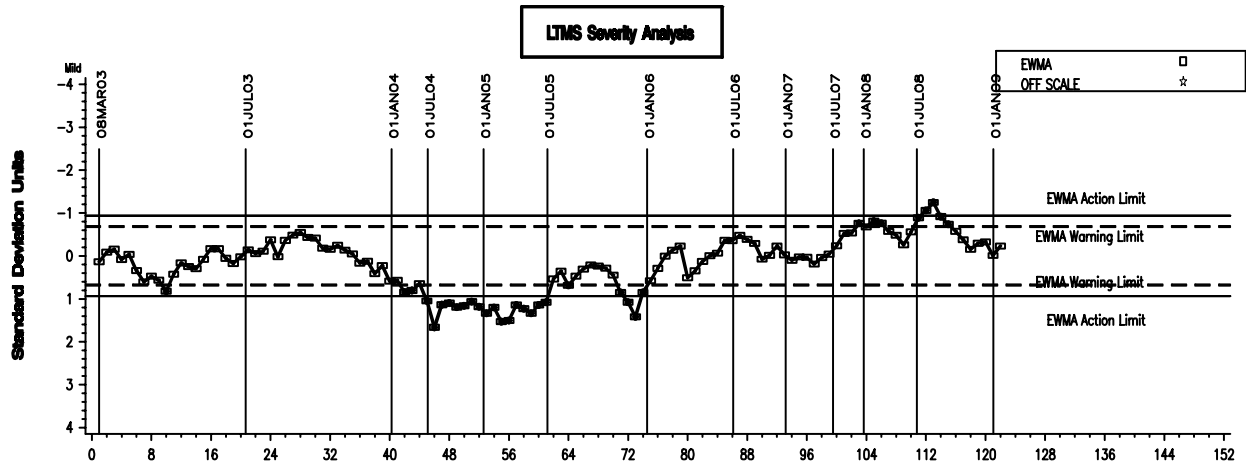
**FIGURE 5**  
**T-11 INDUSTRY OPERATIONALLY VALID DATA**

SOOT AT 12 cSt



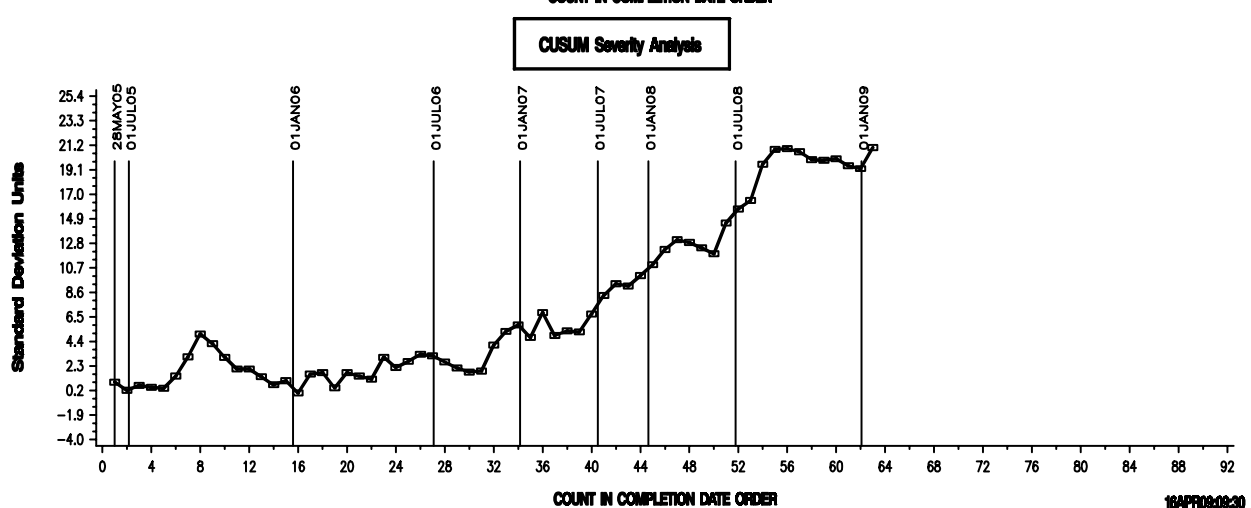
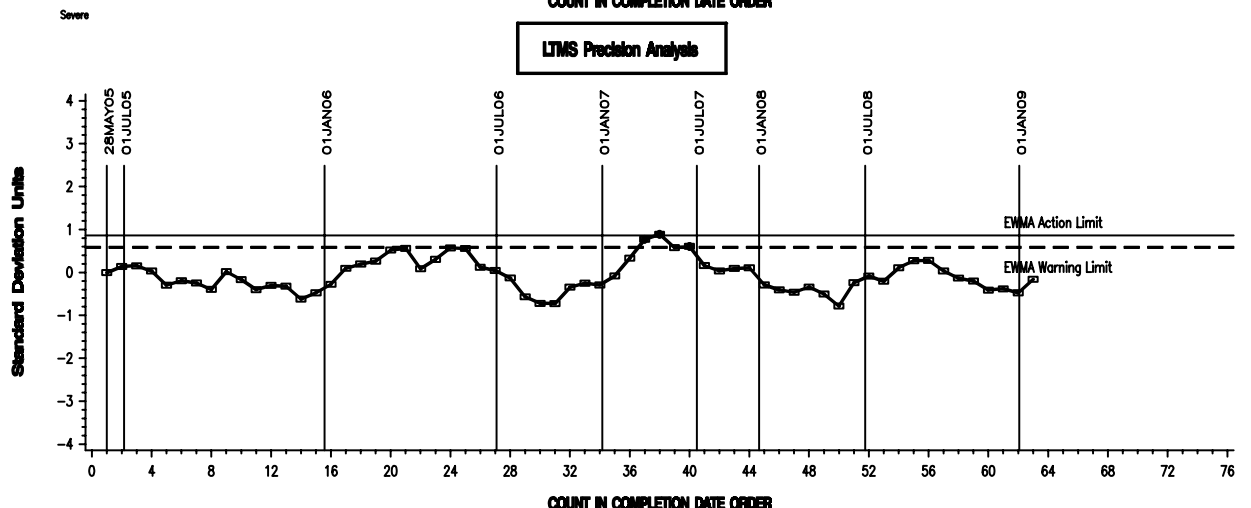
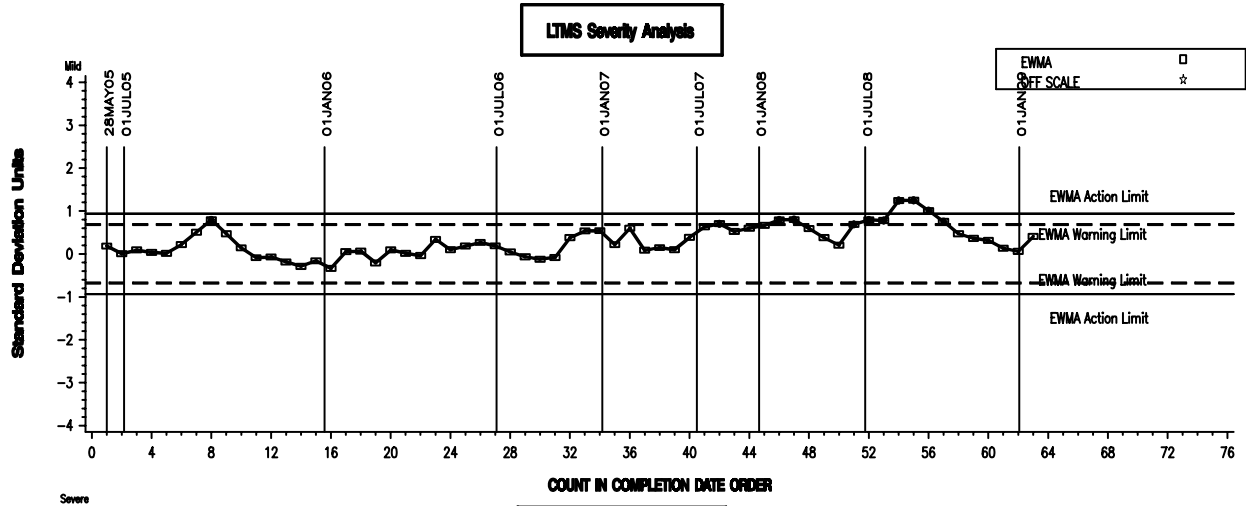
**FIGURE 6**  
**T-11 INDUSTRY OPERATIONALLY VALID DATA**

**MIRV VISCOSITY**



# FIGURE 7 T-11 INDUSTRY OPERATIONALLY VALID DATA

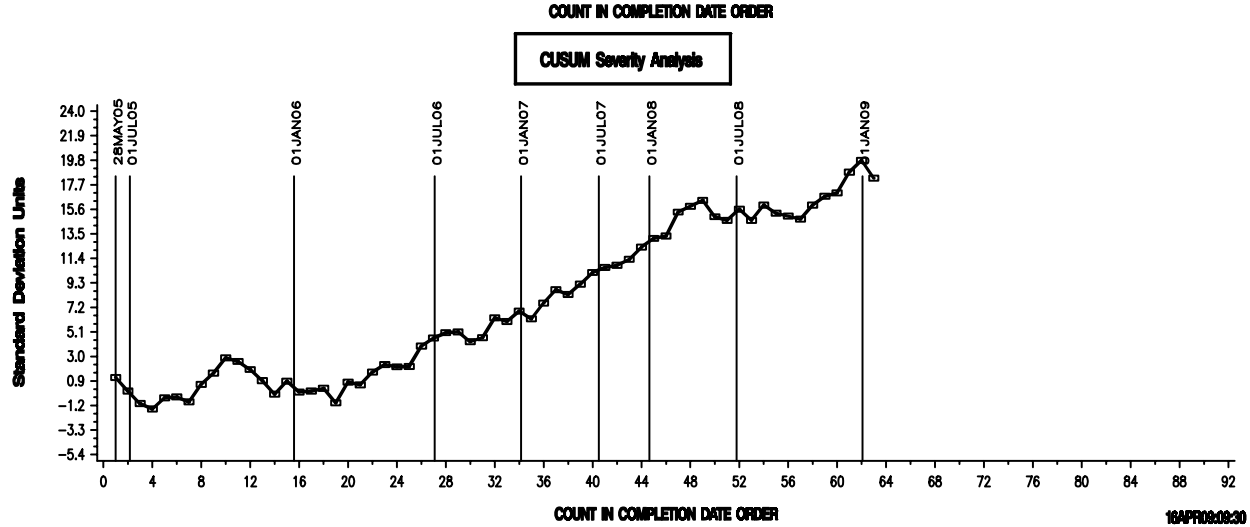
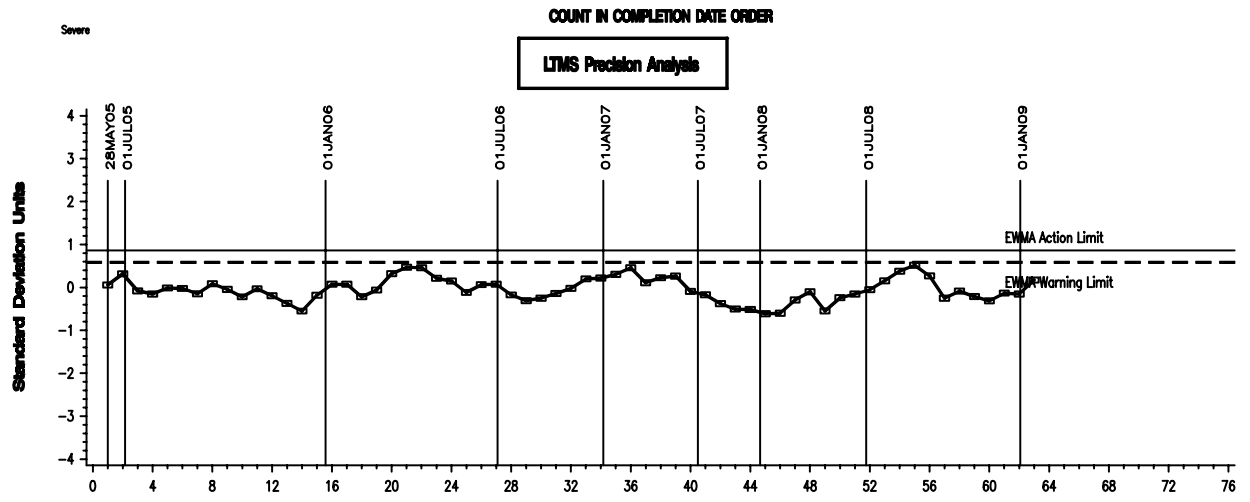
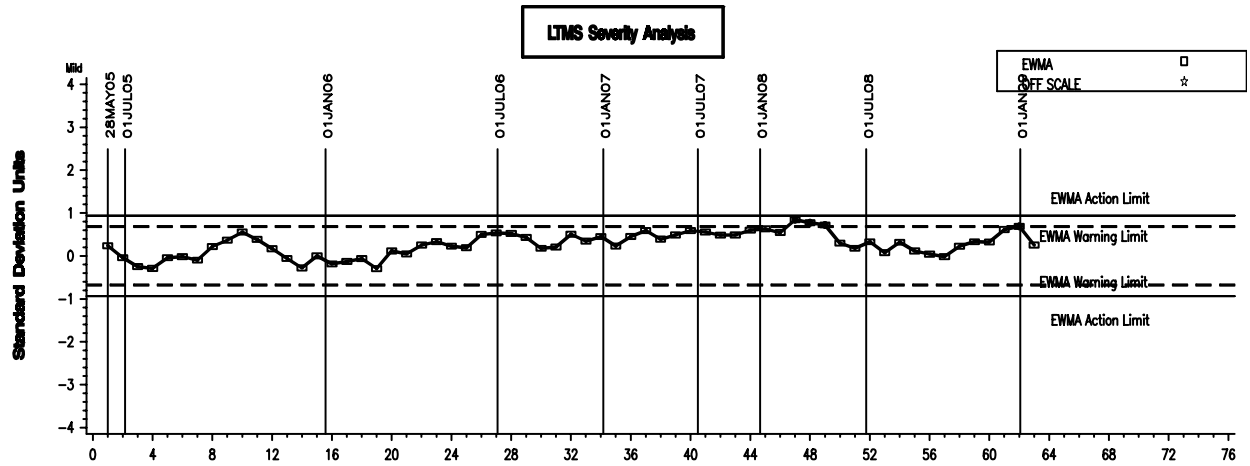
SOOT @ 4 cSt - FINAL RESULT



# FIGURE 8

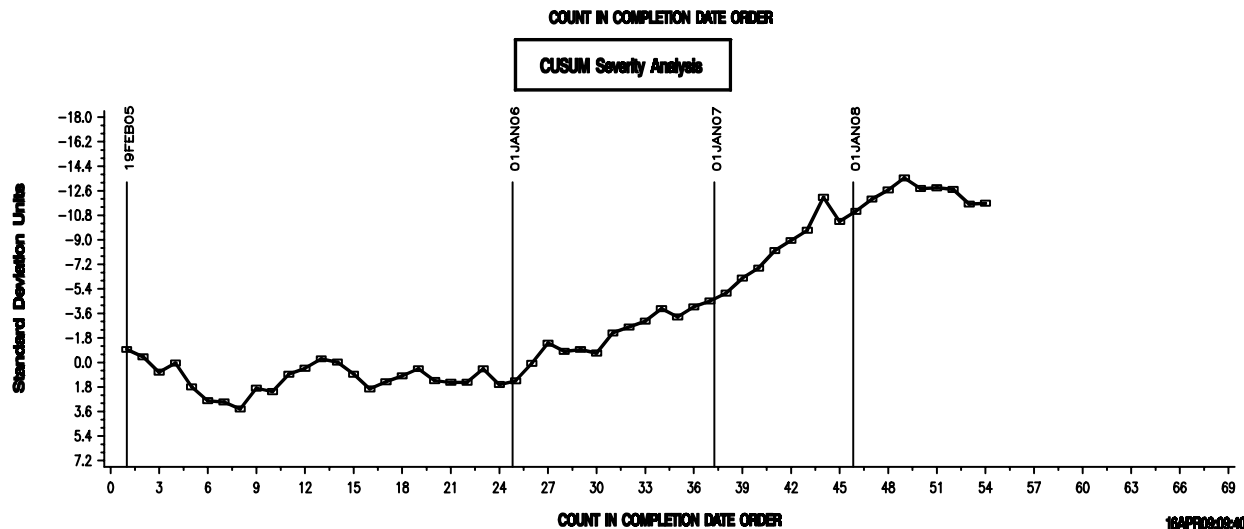
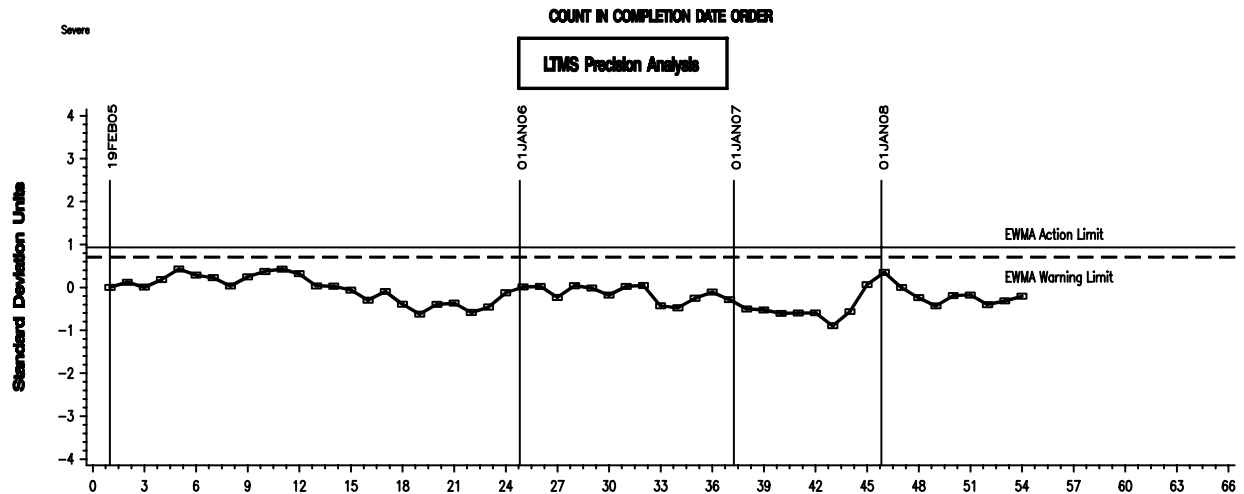
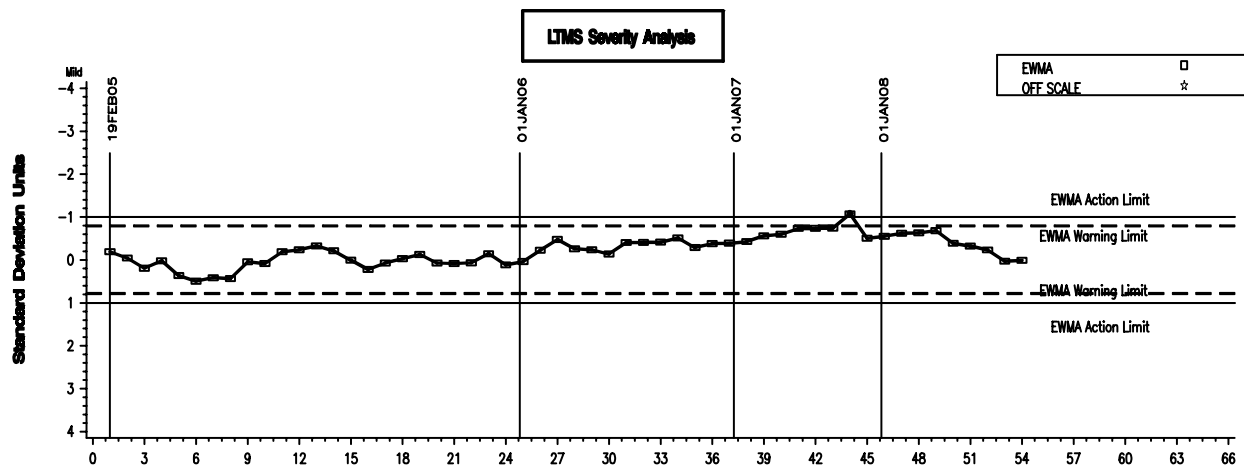
## T-11 INDUSTRY OPERATIONALLY VALID DATA

SOOT @ 15 cSt - FINAL RESULT



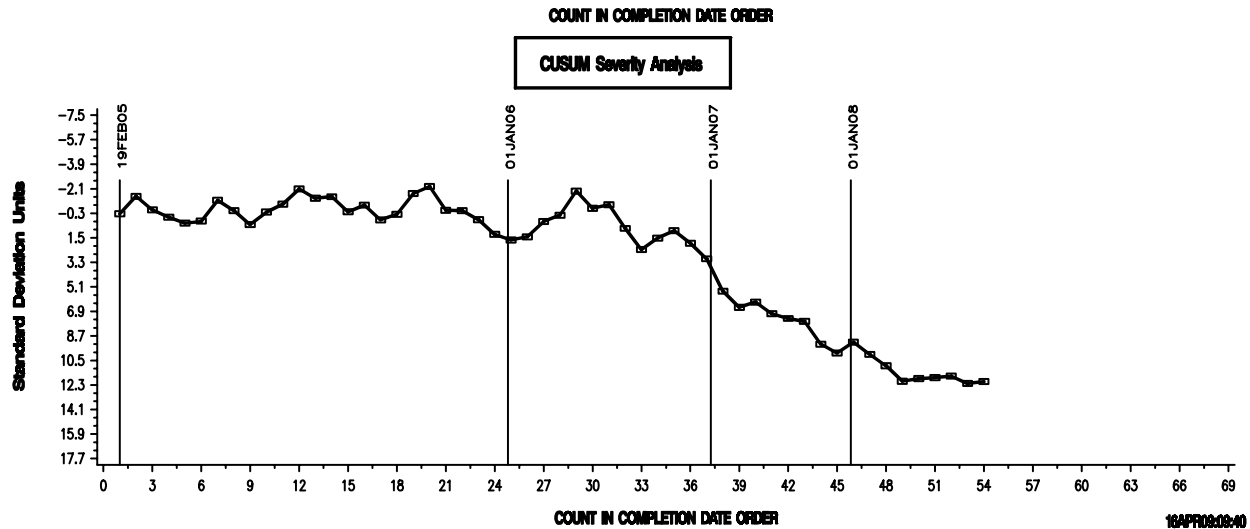
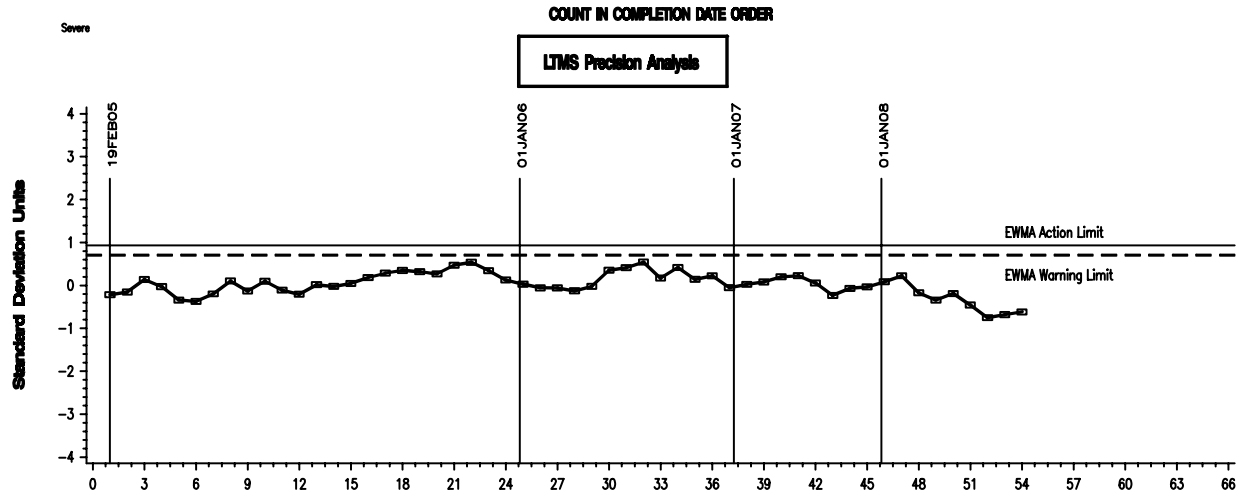
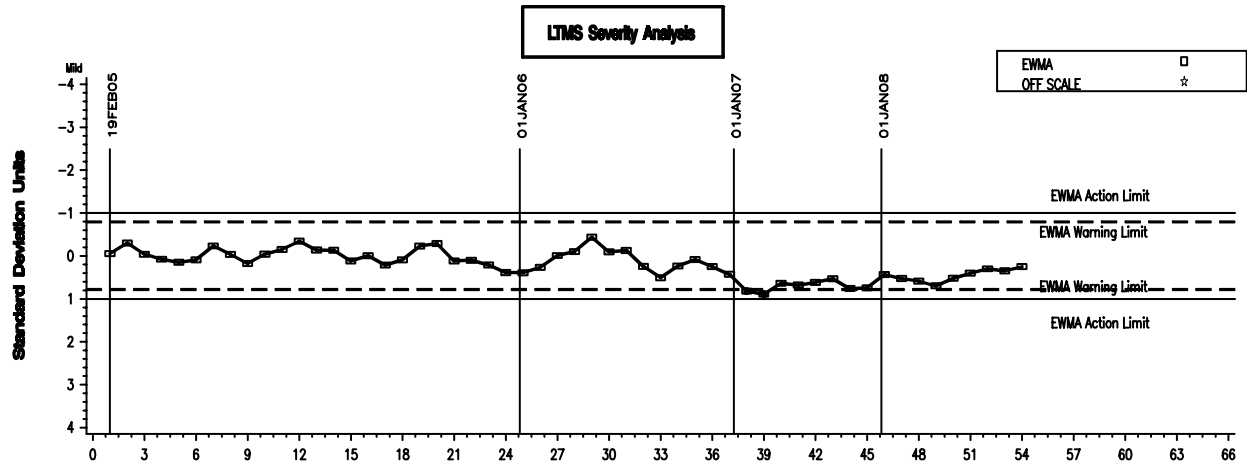
**FIGURE 9**  
**MACK T-12 INDUSTRY OPERATIONALLY VALID DATA**

DELTA PB @ EOT (PB)



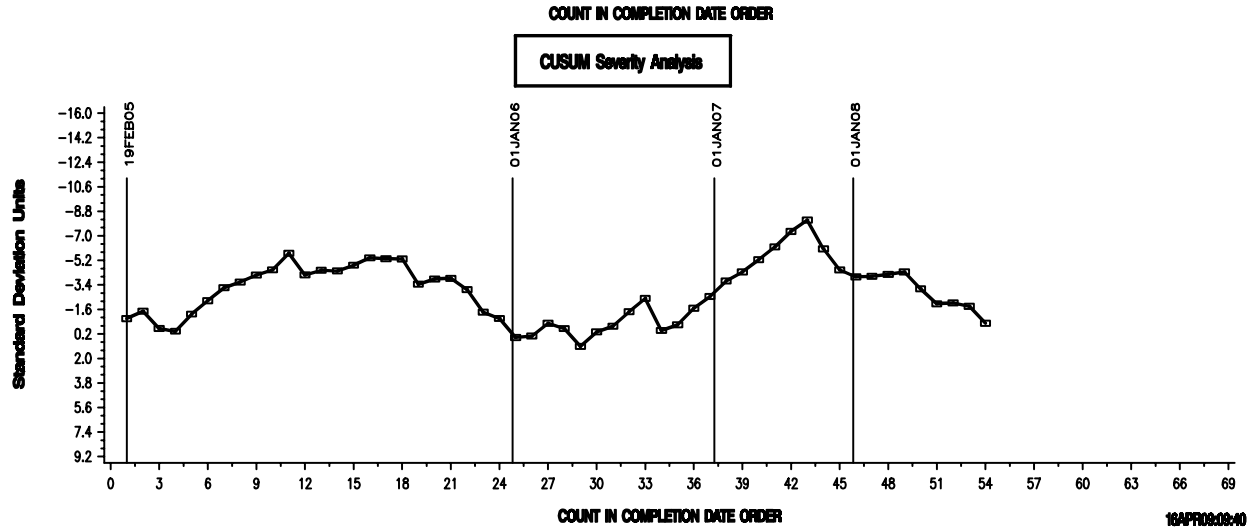
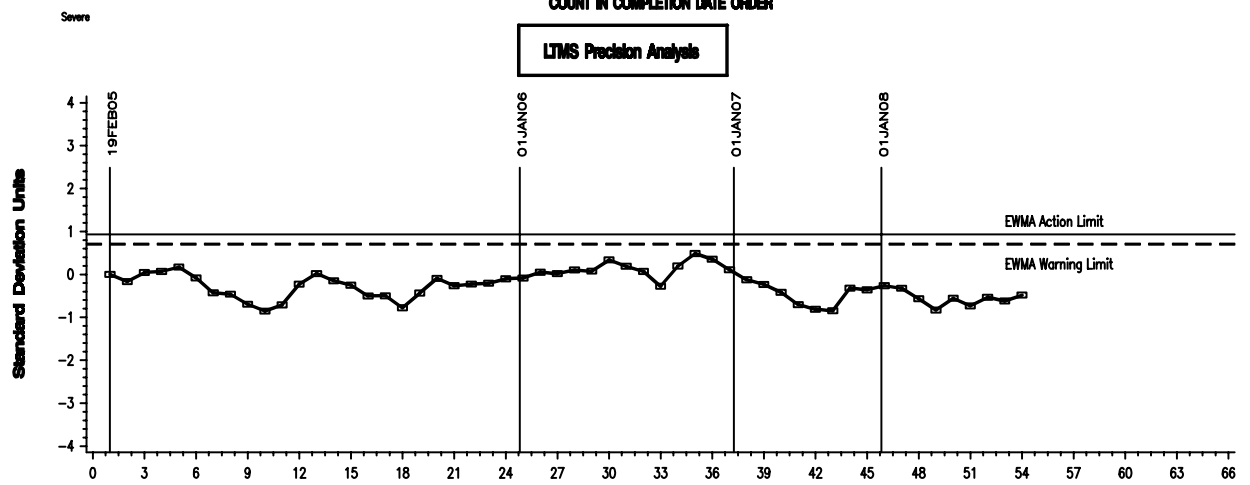
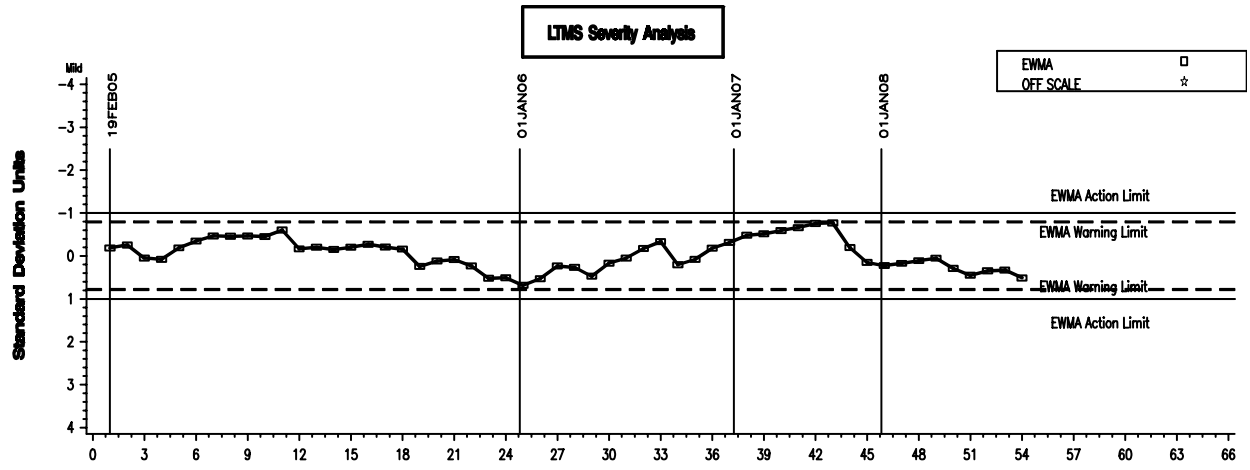
**FIGURE 10**  
**MACK T-12 INDUSTRY OPERATIONALLY VALID DATA**

**AVG. CYLINDER LINER WEAR (CLW)**



**FIGURE 11**  
**MACK T-12 INDUSTRY OPERATIONALLY VALID DATA**

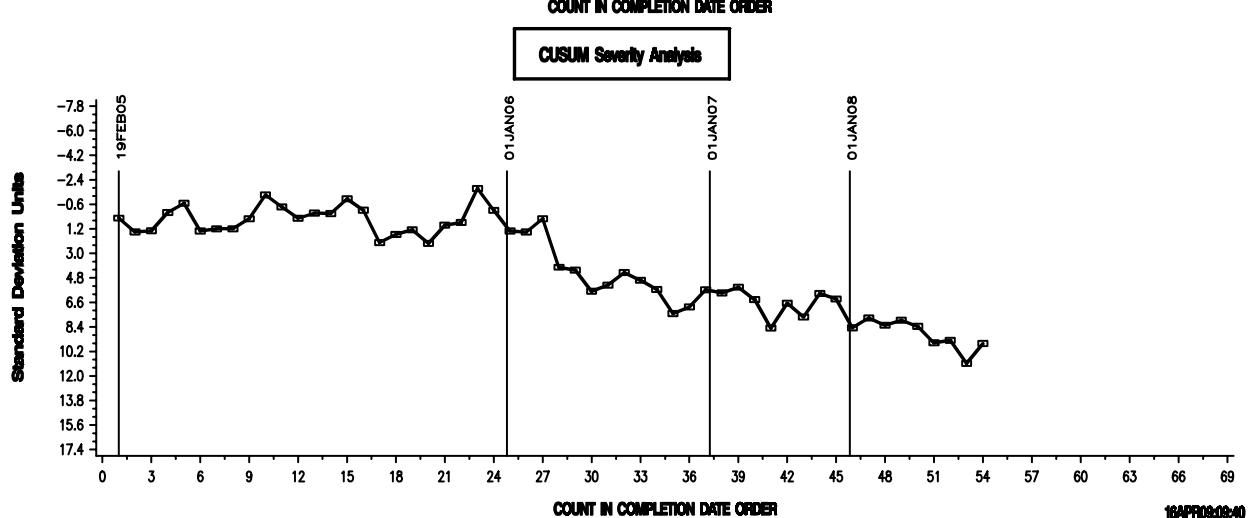
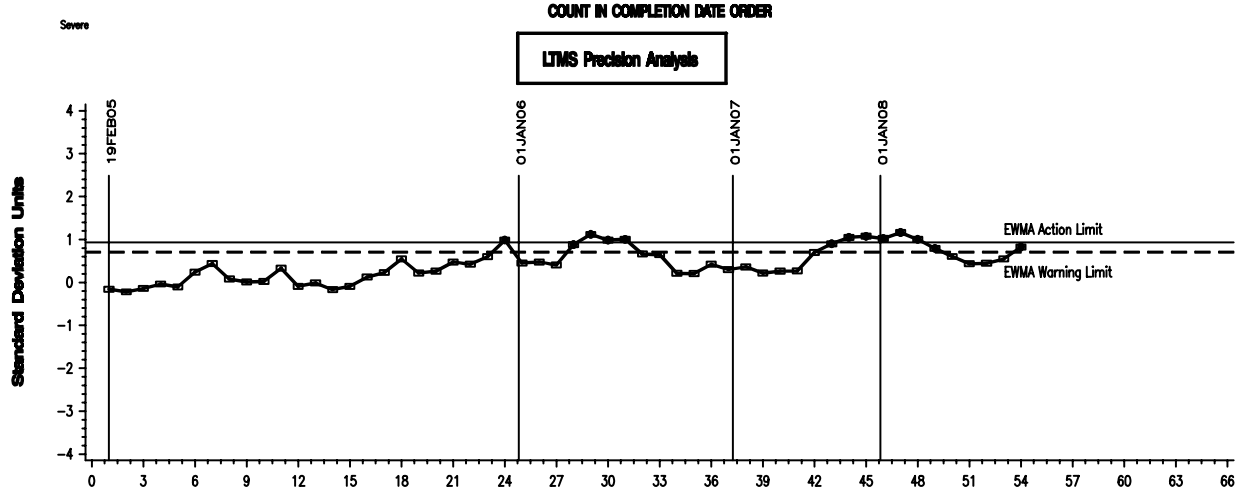
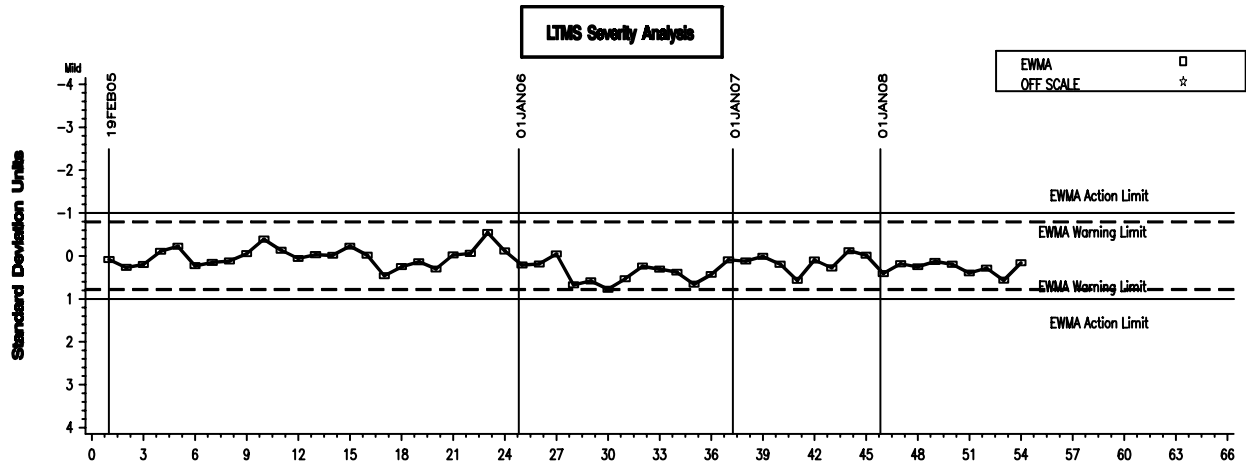
AVG. TOP RING WEIGHT LOSS (TRWL)





**FIGURE 12**  
**MACK T-12 INDUSTRY OPERATIONALLY VALID DATA**

**OIL CONSUMPTION (OC)**



**FIGURE 13**  
**MACK T-12 INDUSTRY OPERATIONALLY VALID DATA**

DELTA PB 250-300H (PB2)

