



## Test Monitoring Center

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

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

MEMORANDUM: 11-028

DATE: June 10, 2011

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 2011 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 2011 ASTM report period, which began on October 1, 2010 and ended on March 31, 2011.

Test Status	TMC Validity Code	Number of Tests			
		T-8/T-8E	T-10A	T-11	T-12
Acceptable Calibration Test	AC	2	1	6	4
Failed Calibration Test (LTMS Criteria)	OC	0	0	0	0
Operationally Invalid Test	LC	2	0	2	0
Aborted	XC	2	0	0	0
Donated	AG	0	0	1	0
Non-blind	NN	0	0	0	4
<b>Total</b>		<b>6</b>	<b>1</b>		

Both aborted T-8/T-8E tests were projected to miss the soot window. One invalid T-8/T-8E missed the soot window and one invalid test was due to excessive oil loss from a leak at the filter.

Both invalid T-11 tests were due to contaminated fuel. The donated test was run on PC-9-HS fuel.

The four non-blind T-12 tests were run on the STVN hardware combination.

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

PC-9-HS fuel, which was developed to return the T-11 test to its original severity, was introduced to T-8 testing on January 26, 2011.

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 in industry alarm in the mild direction, the result of a mild trend that may have begun as early as April 2009. 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 0.70  $\Delta$ /s severe, which is approximately 348 cP. Figure 4 (attached) shows the current industry EWMA severity and cusum charts for MRV.

### **T-11 Severity:**

After an extensive surveillance panel investigation, the long mild trend that had been seen in the T-11 was attributed to changes in the test fuel. To address this, PC-9-HS fuel was developed to return the T-11 test to its original severity. The fuel was successfully introduced; the first charted T-11 test with the new fuel eot'd on October 9, 2010. It may still be too early to determine if the new fuel completely addresses the mild trend and the surveillance panel is continuing to monitor the situation.

Soot at 12 cSt Viscosity Increase (SOOT) and Soot at 15 cSt Viscosity Increase (SOOT5) are in severity alarm in the mild direction. MRV Viscosity (MRV) and Soot at 4 cSt Viscosity Increase (SOOT4), are currently within control chart limits. 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:**

During this report period, the surveillance panel ran tests on two new hardware combinations, with the intent of establishing a 'life-of-test' hardware supply. The first of these two combinations, designated as STVN, was not successfully introduced as the rod bearings did not provide sufficiently precise results. The second combination, STWN, was successfully introduced. This hardware combination was approved after the close of this report period, but it is worth noting that a severity shift was seen with this hardware and as such, corrections factors were implemented accordingly.

Delta PB @ EOT (PB), Cylinder Liner Wear (CLW), Top Ring Weight Loss (TRWL), and Oil Consumption (OC) are all currently within control chart limits. Delta PB 250 – 300 Hours (PB2) is in an industry severity alarm in the severe direction. 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/T-8E and T-10A.

The 2010 T-11 precision estimates show improvement for all parameters as compared to historical levels. Preliminary precision estimates are not yet available for 2011.

**T-11 Precision Estimates**

<b>Parameter</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>
df	9	16	8	9	
SOOT	0.18	0.18	0.31	0.22	
MRV	820	967	938	739	
SOOT4	0.32	0.33	0.27	0.14	
SOOT5	0.18	0.18	0.25	0.17	

The T-12 2011 preliminary precision estimates show some degradation for PB, CLW, and PB2. The TRWL precision shows improvement and is more precise than historical levels. OC precision appears to be at historical levels. Due to low activity levels, no estimates of precision are available for 2009 and 2010.

**T-12 Precision Estimates**

<b>Parameter</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2011</b>
df	11	6	7	6
PB (ln units)	0.2030	0.274	0.164	0.249
CLW	3.8	3.1	2.7	3.8
TRWL	28.6	33.4	18.2	15.9
OC (ln units)	0.087	0.086	0.090	0.091
PB2 (ln units)	0.321	0.321	0.238	0.511

**Reference Oil Supply:**

The following table shows current reference oil inventories. Supply of oils 820-3 and 1005-3 will likely be exhausted within 2 years. The TMC will investigate a re-blend for 820-3 in due course; 1005-3 cannot be re-blended and the surveillance panel will need to start work on finding a suitable replacement oil. Oil 821-2 has been distributed to labs and will be introduced as lab supplies of 821-1 are exhausted.

**Reference Oil Inventory and Estimated Life**

Oil	Tests	Original Blend Amount	Quantity Used in last 6 months	TMC Inventory <sup>A</sup>	Lab Inventory <sup>B</sup>	Estimated Life <sup>C</sup>
820-3	T-10A, T-11	2750	246	631	8	1.5 years
821-1	T-12	1050	198	25	7	0.5 years
821-2	T-12	450	100	350	4	2.5 years
1005-3	T-8/T-8E <sup>D</sup>	2000	366	1103	4	1.5 years

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

<sup>B</sup>Active laboratories.

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

<sup>D</sup>Oil cannot be resupplied.

Information Letters:

T-10 Information Letter 11-1, Sequence No. 12, was issued February 8, 2011. This information letter removed the requirement to rebuild T-10A engines after three calibration periods. Engine rebuilds are now performed at the discretion of the test laboratory.

TMC Laboratory Visits:

No laboratory visits were conducted this period.

Quality Index:

One T-12 QI Deviation was issued this report period. The test in question had negative QI values for coolant out temperature and oil gallery temperature due to a failure to close a bypass valve during the transition from Stage 1 to Stage 2, which resulted in low temperatures at the start of Stage 2. This was the second QI Deviation issued for T-12 reference testing since the test's inception.

Additional Information:

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

JAC/jac/mem11-028.jac.doc

## Attachments

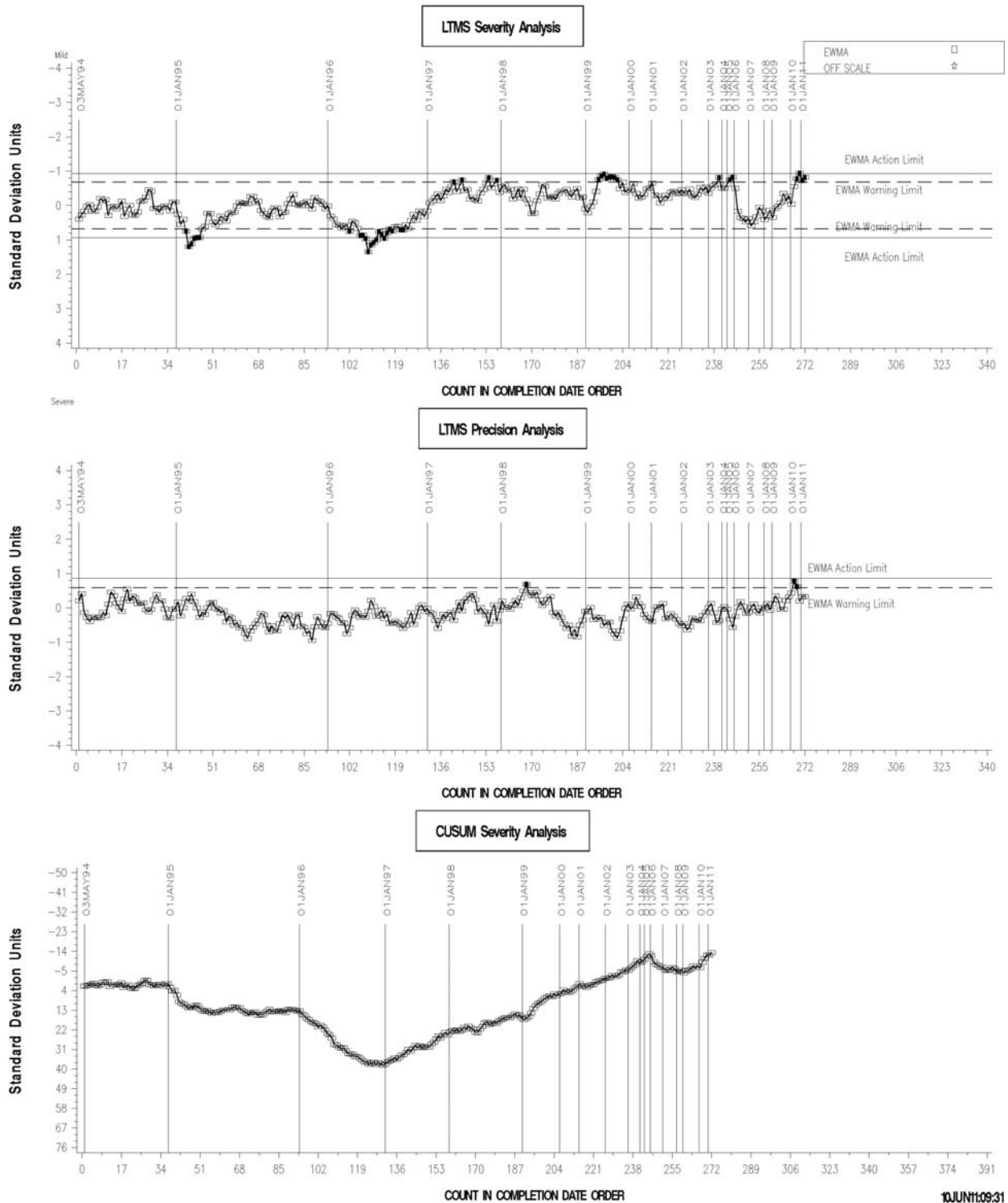
c: F.M. Farber, TMC

Mack Surveillance Panel

<ftp://ftp.astmtmc.cmu.edu/docs/diesel/mack/semiannualreports/MACK-04-2011.pdf>

Distribution: Email

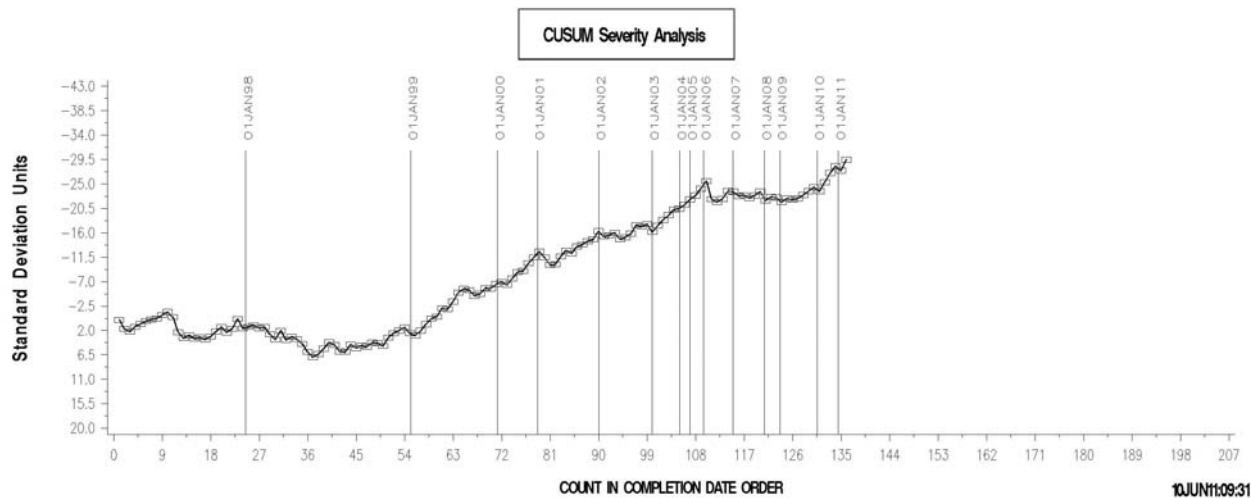
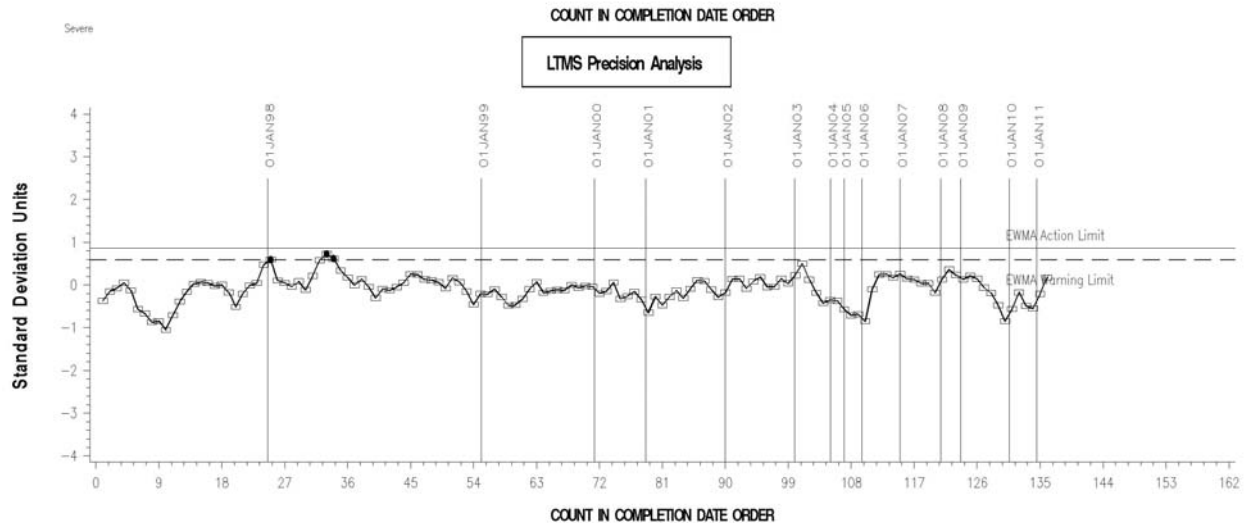
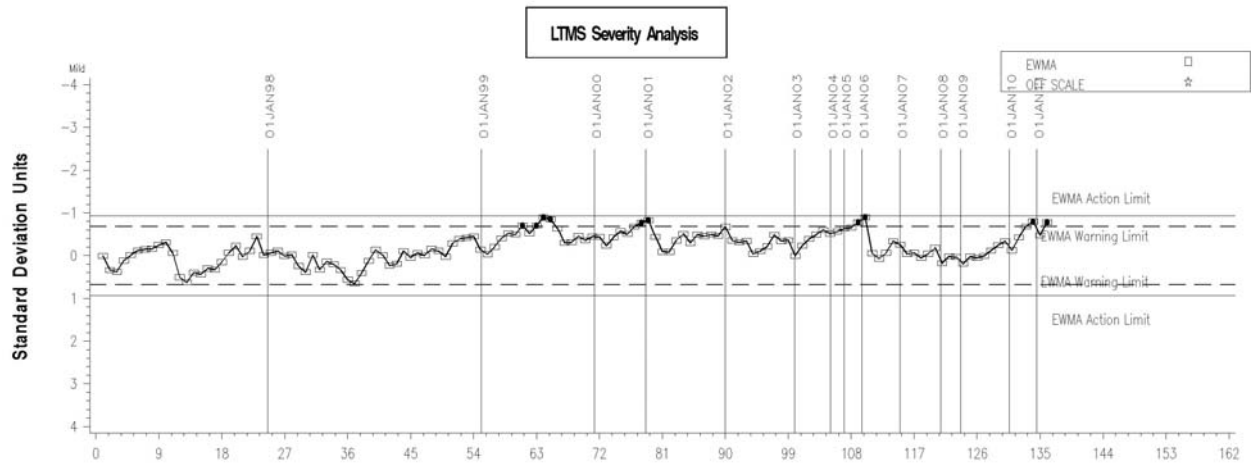
**FIGURE 1**  
**T-8/T-8E INDUSTRY OPERATIONALLY VALID DATA**  
**VISCOSITY INCREASE AT 3.8% SOOT**



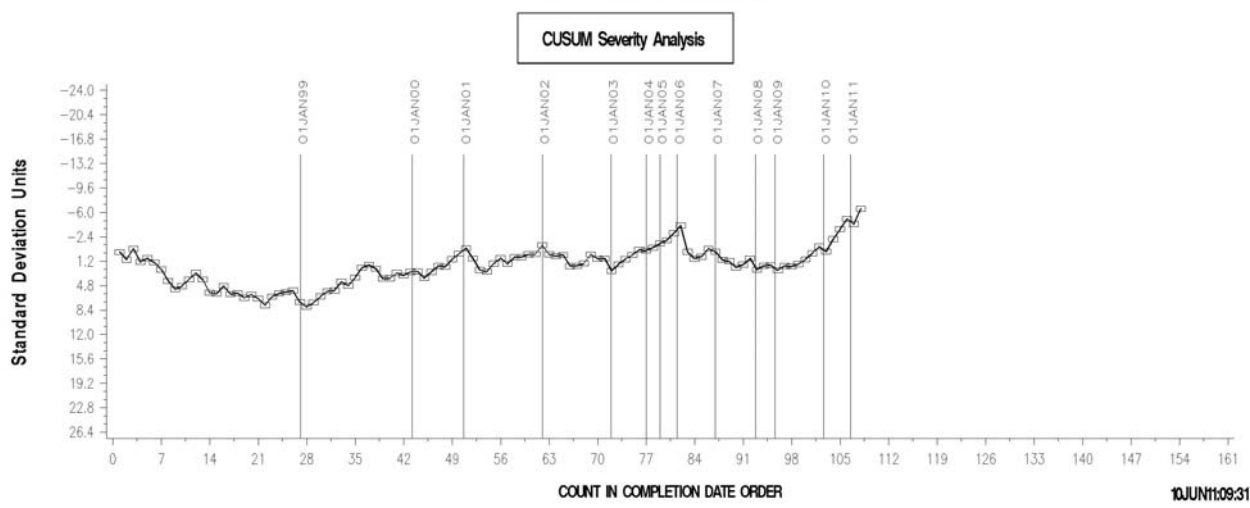
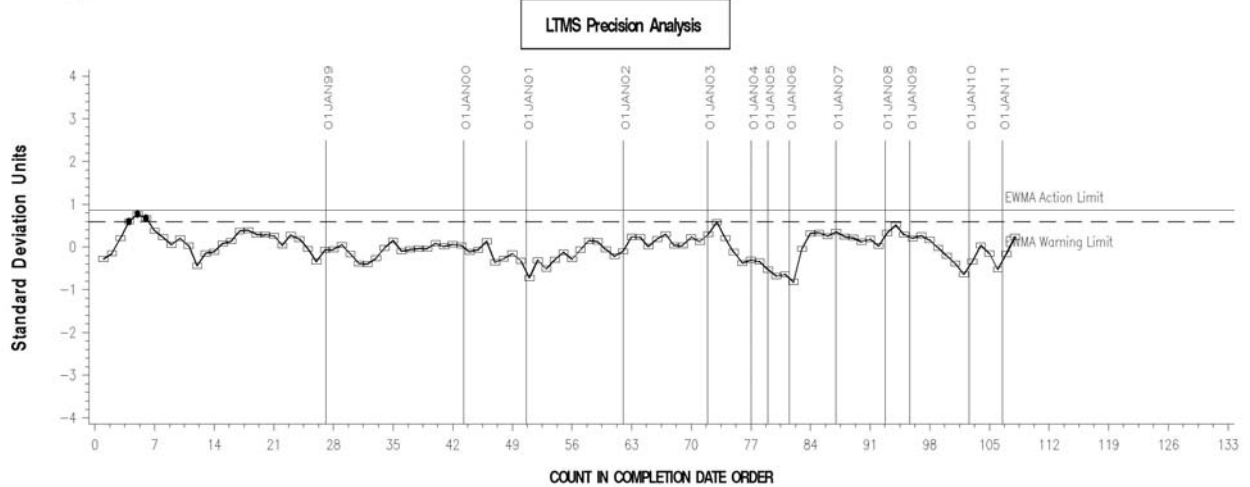
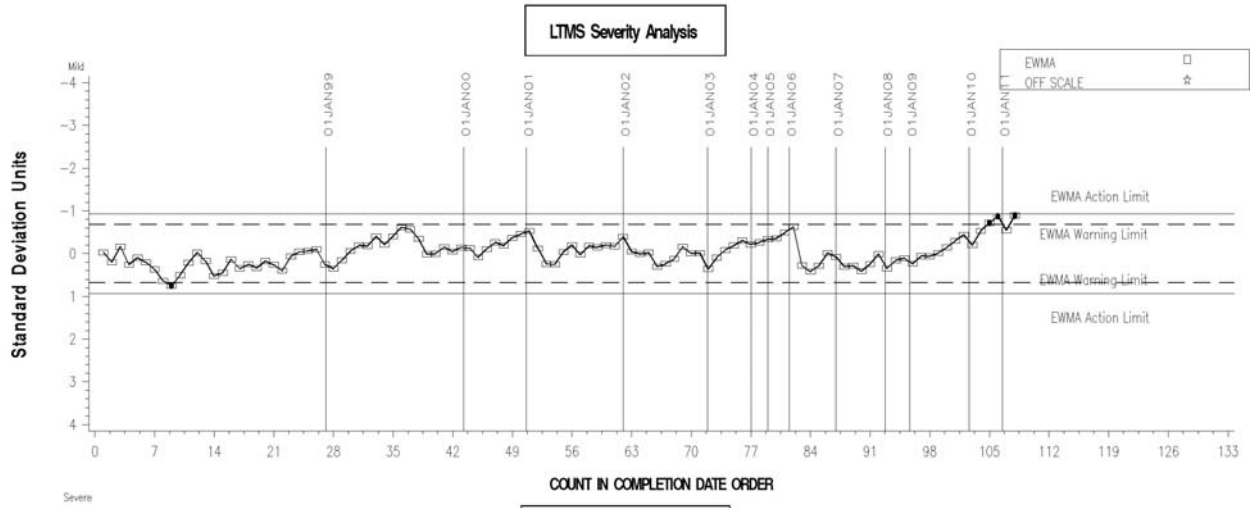
**FIGURE 2**  
**T-8/T-8E INDUSTRY OPERATIONALLY VALID DATA**



RELATIVE VISCOSITY AT 4.8% (50% LOSS)



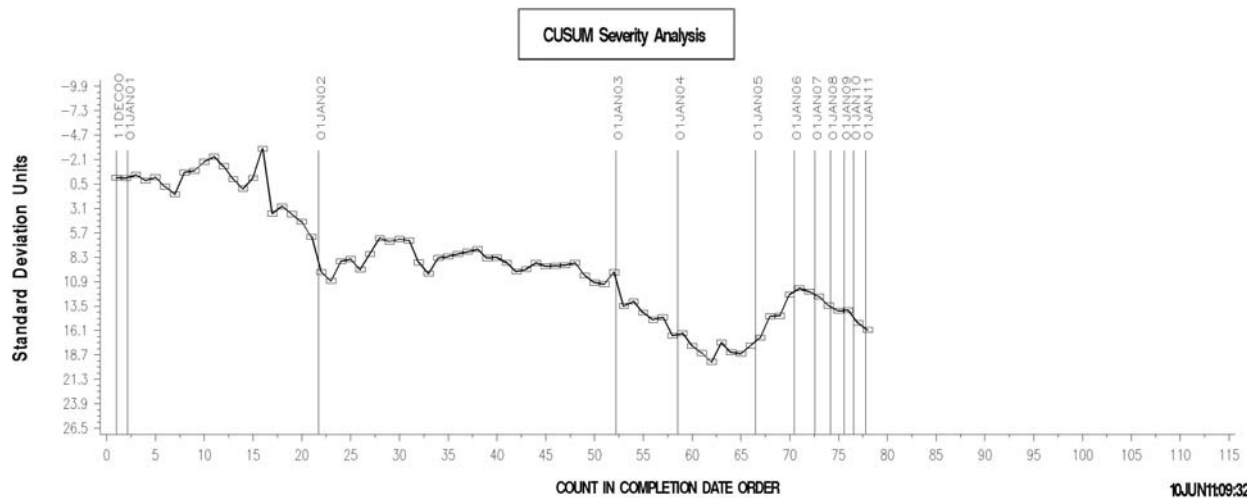
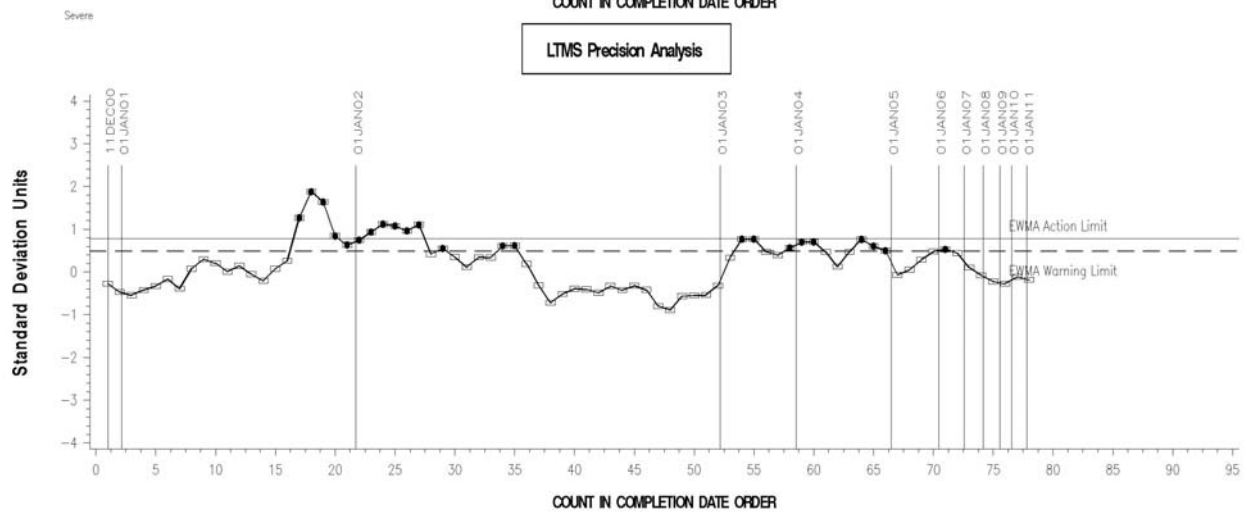
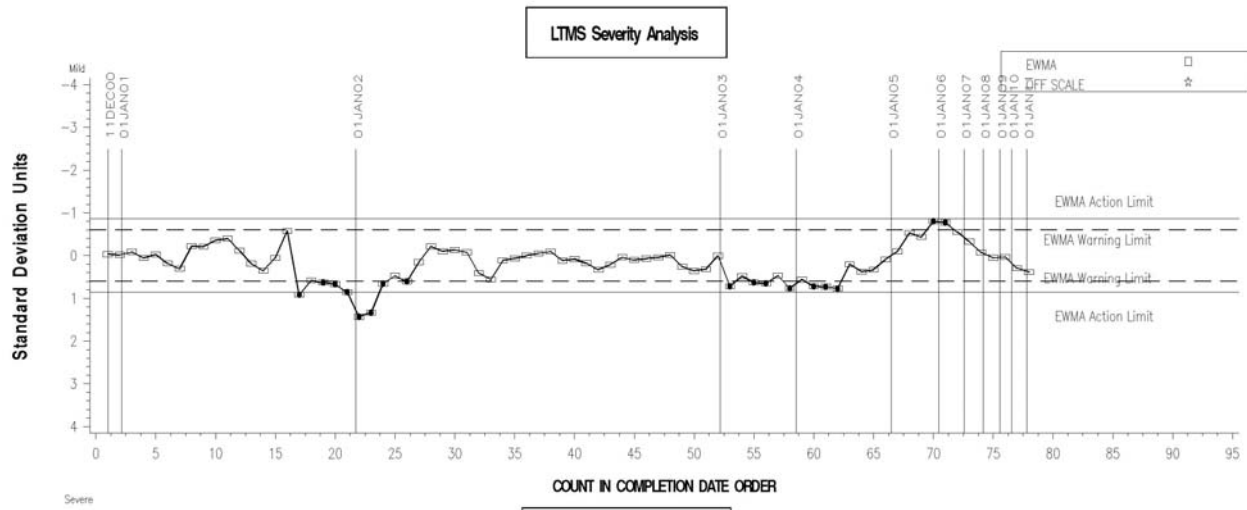
**FIGURE 3**  
**T-8/T-8E INDUSTRY OPERATIONALLY VALID DATA**  
**RELATIVE VISCOSITY AT 4.8% (100% LOSS)**



**FIGURE 4**  
**T10A INDUSTRY OPERATIONALLY VALID DATA**



MRV VISCOSITY @ 75H

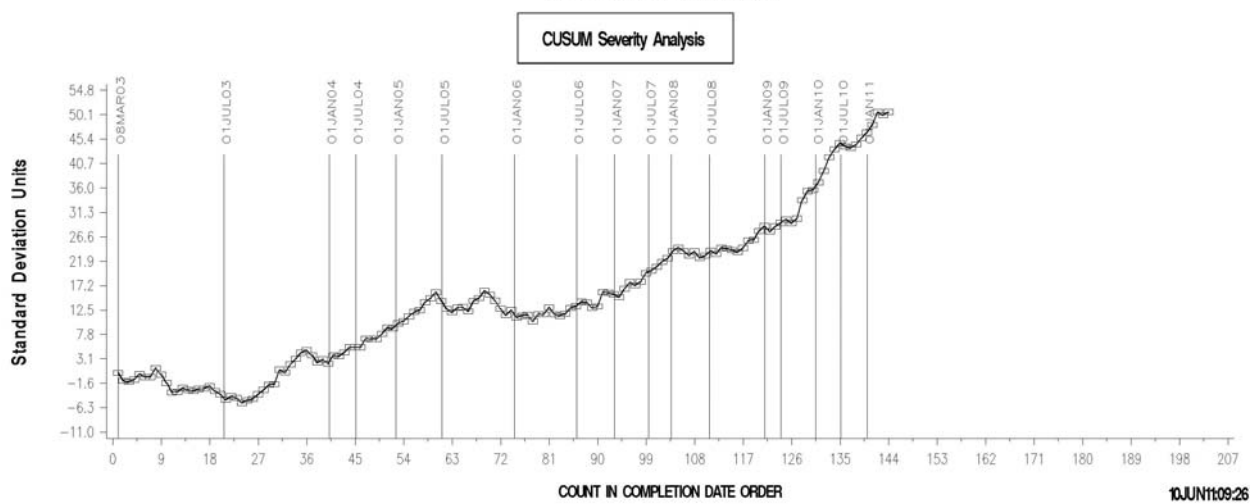
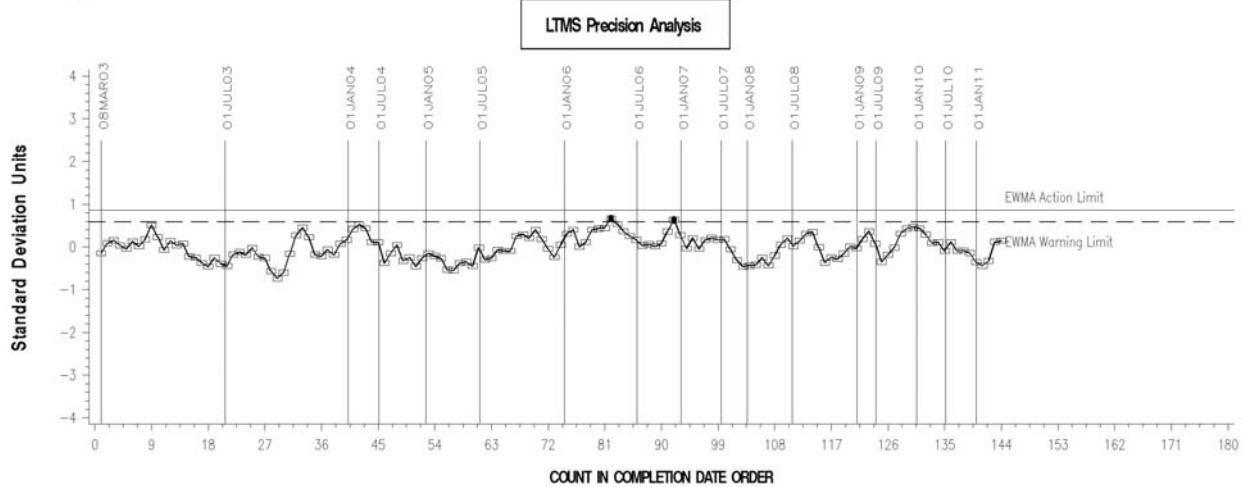
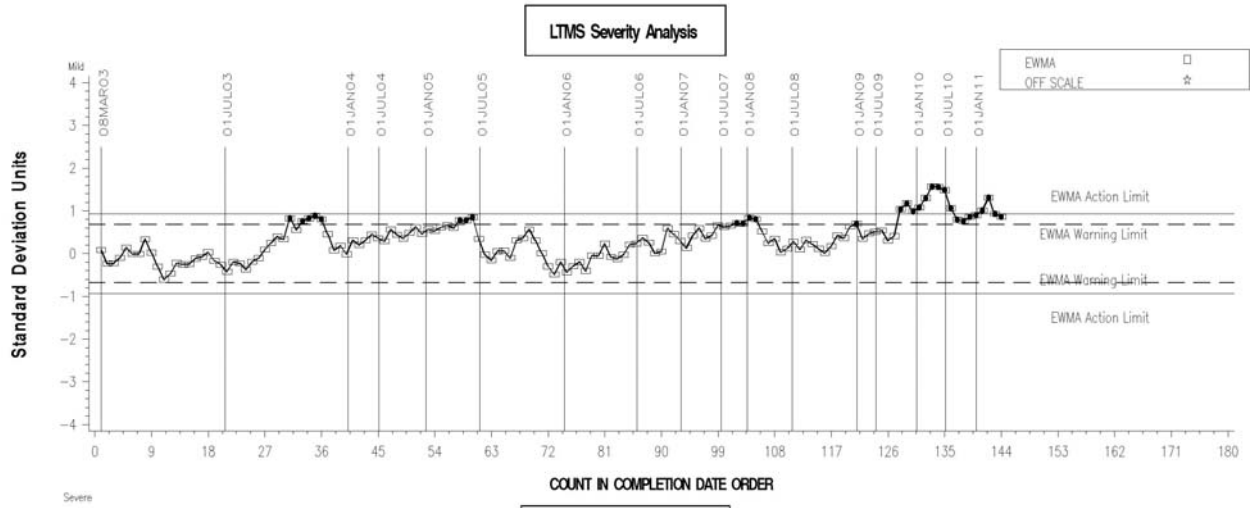




**FIGURE 5**  
**T-11 INDUSTRY OPERATIONALLY VALID DATA**



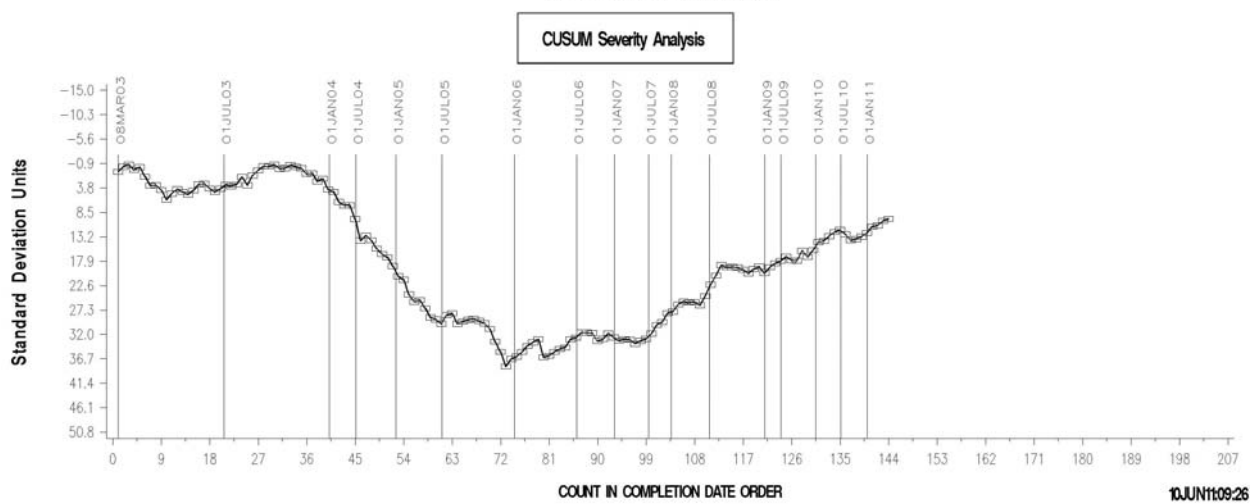
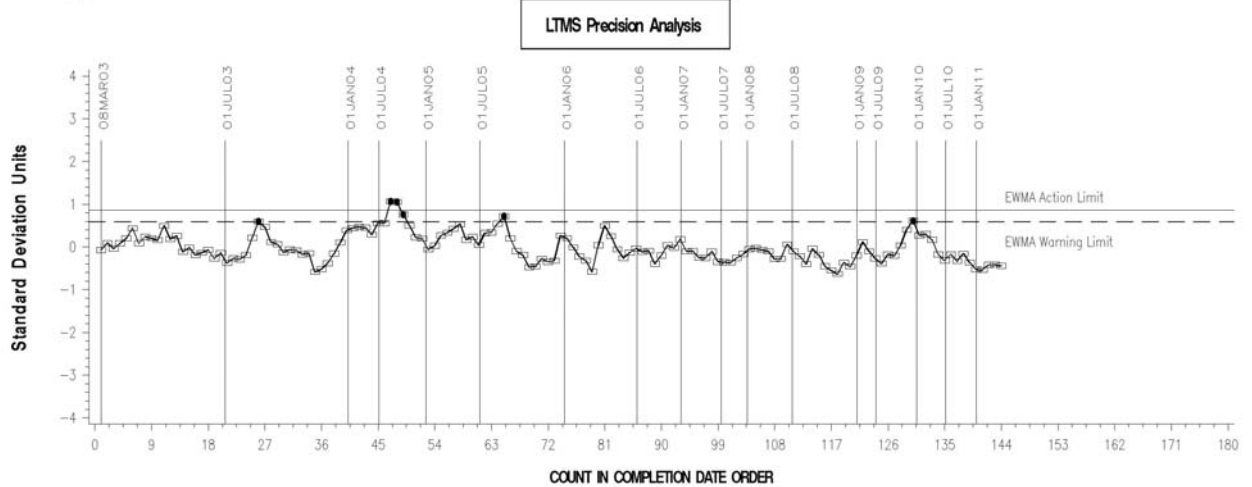
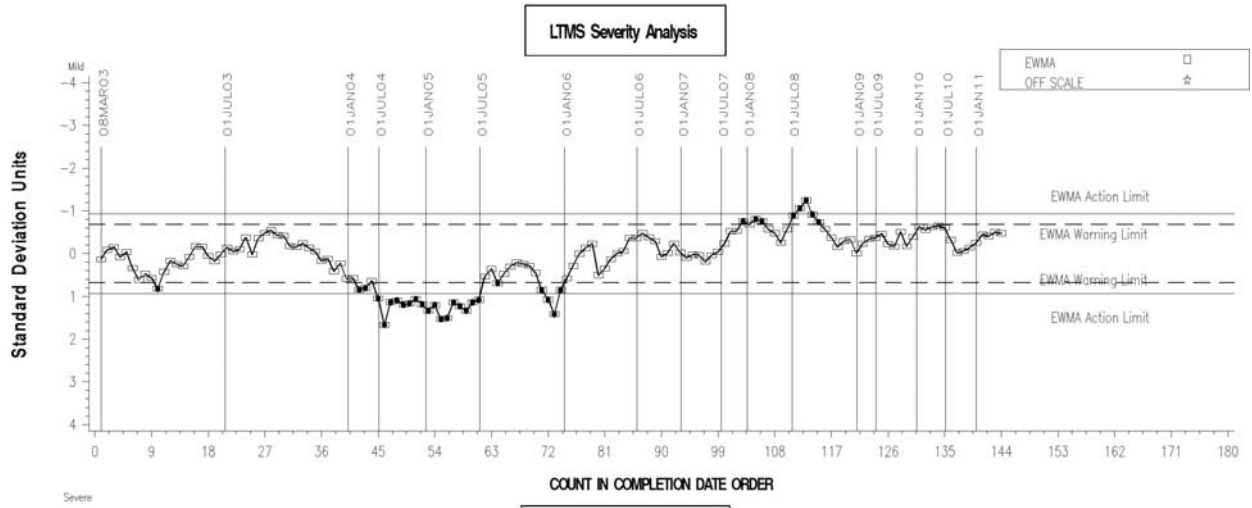
SOOT AT 12 cSt



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



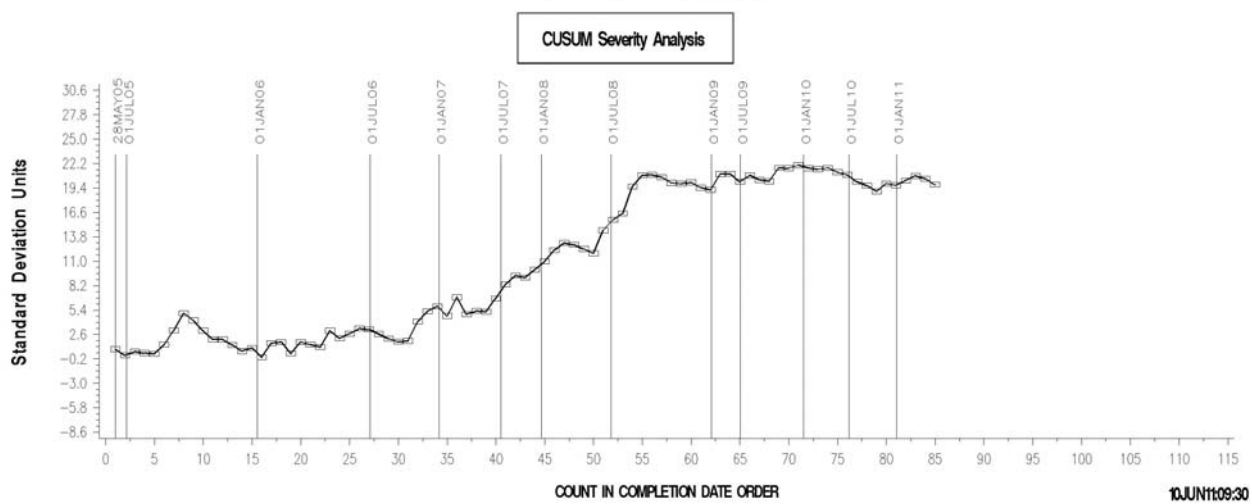
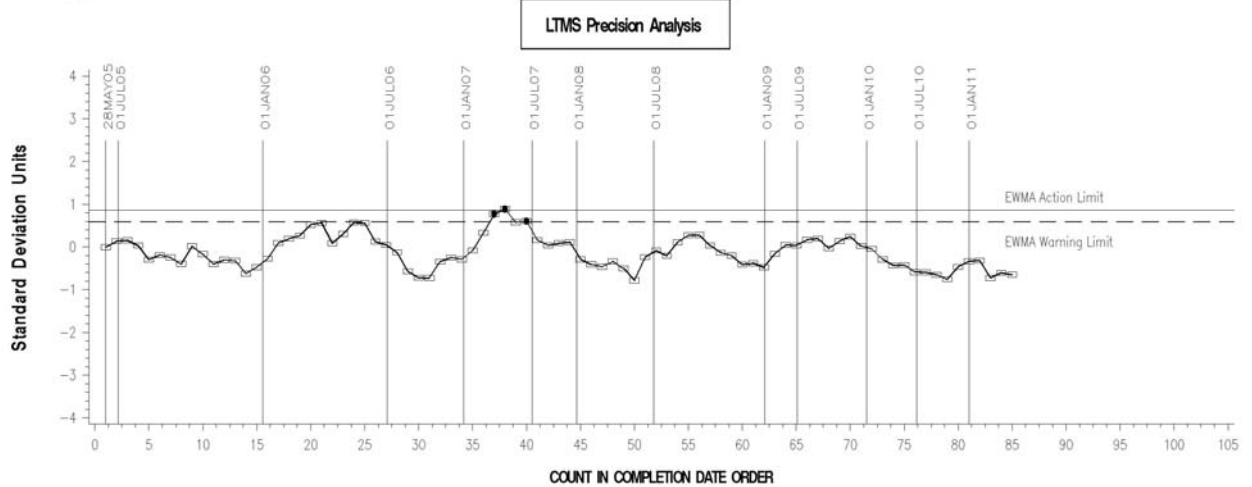
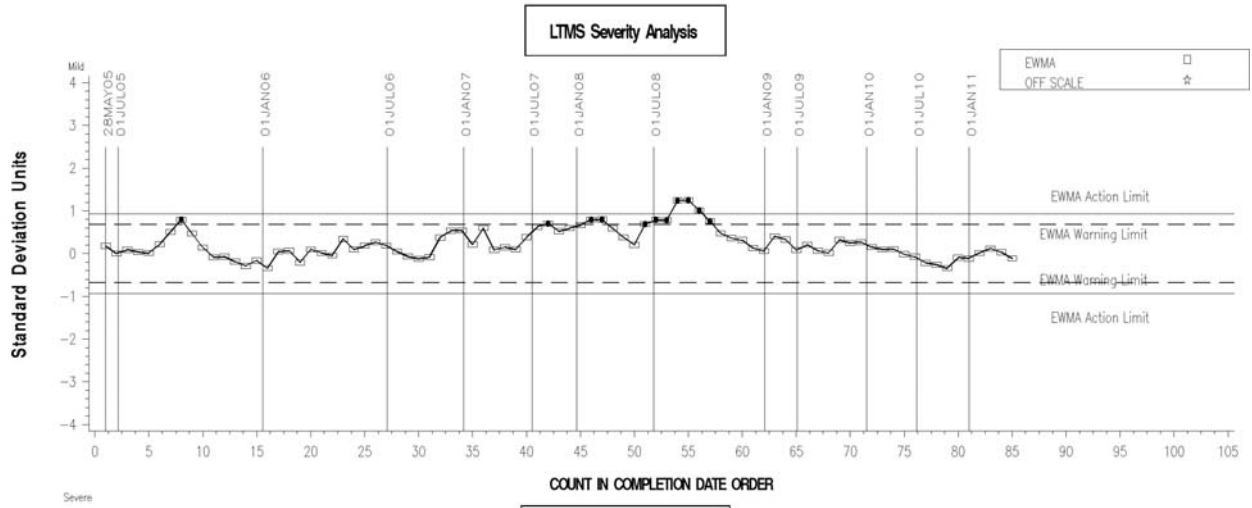
**MRV VISCOSITY**



**FIGURE 7**  
**T-11 INDUSTRY OPERATIONALLY VALID DATA**

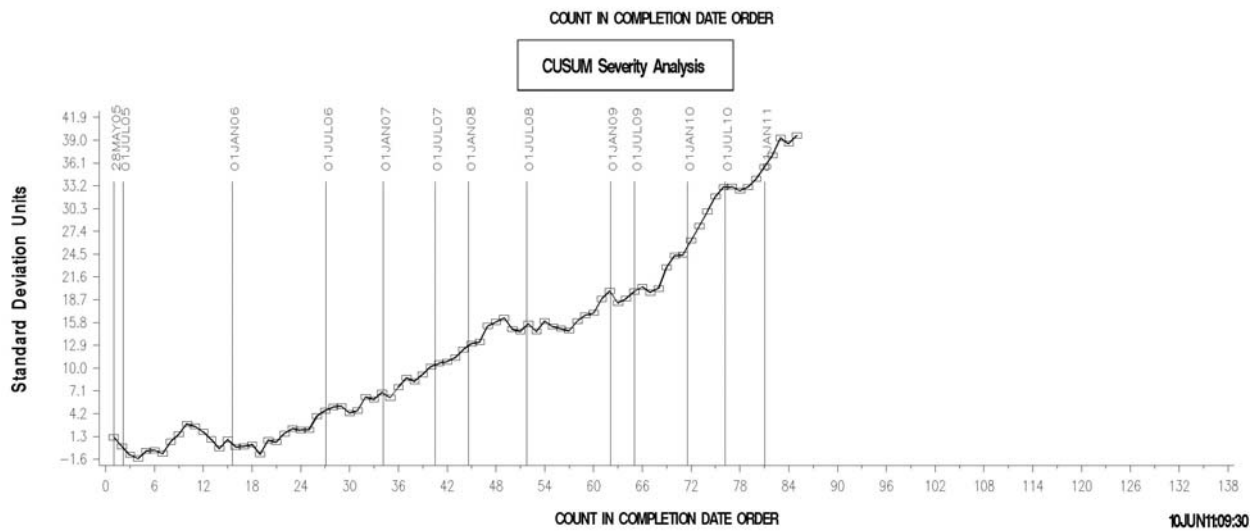
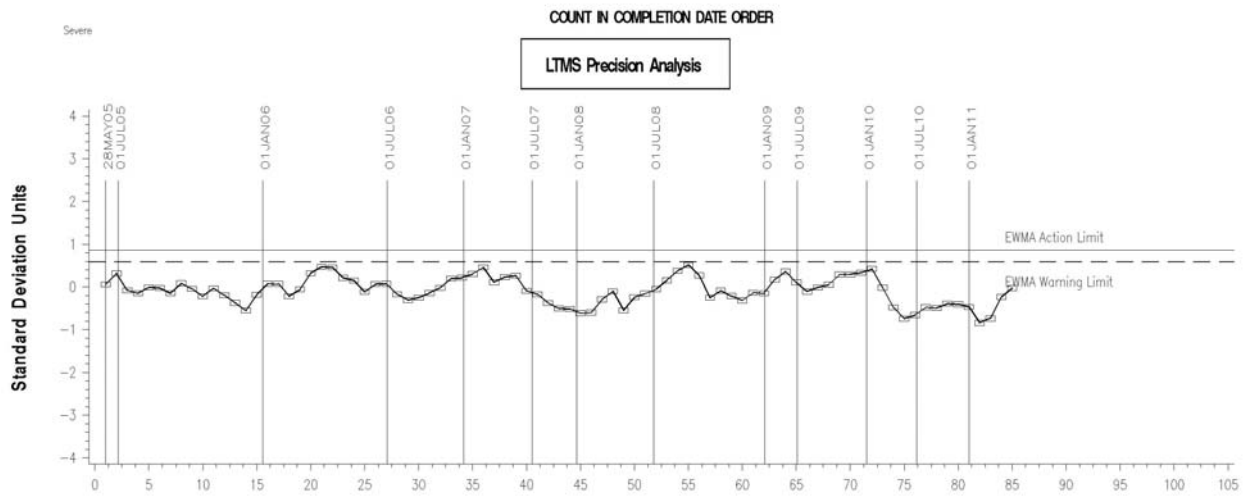
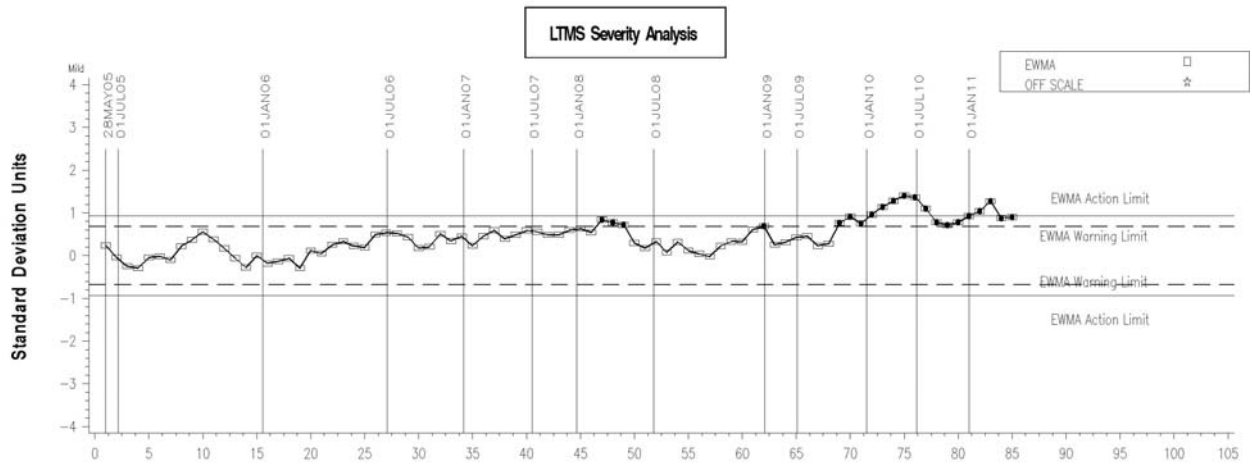


SOOT @ 4 cSt - FINAL RESULT



**FIGURE 8**  
**T-11 INDUSTRY OPERATIONALLY VALID DATA**

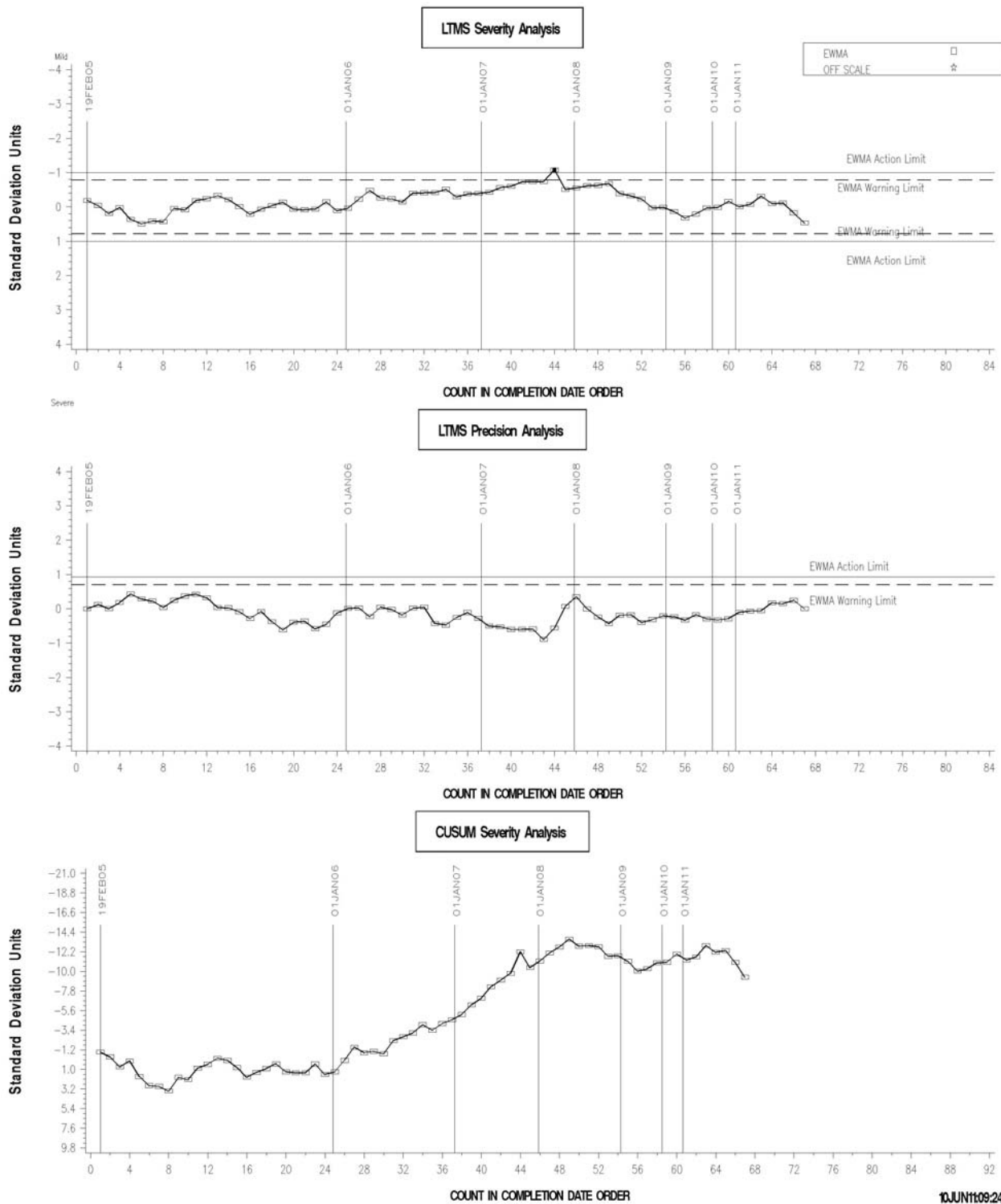
SOOT @ 15 cSt - FINAL RESULT



# FIGURE 9

## MACK T-12 INDUSTRY OPERATIONALLY VALID DATA

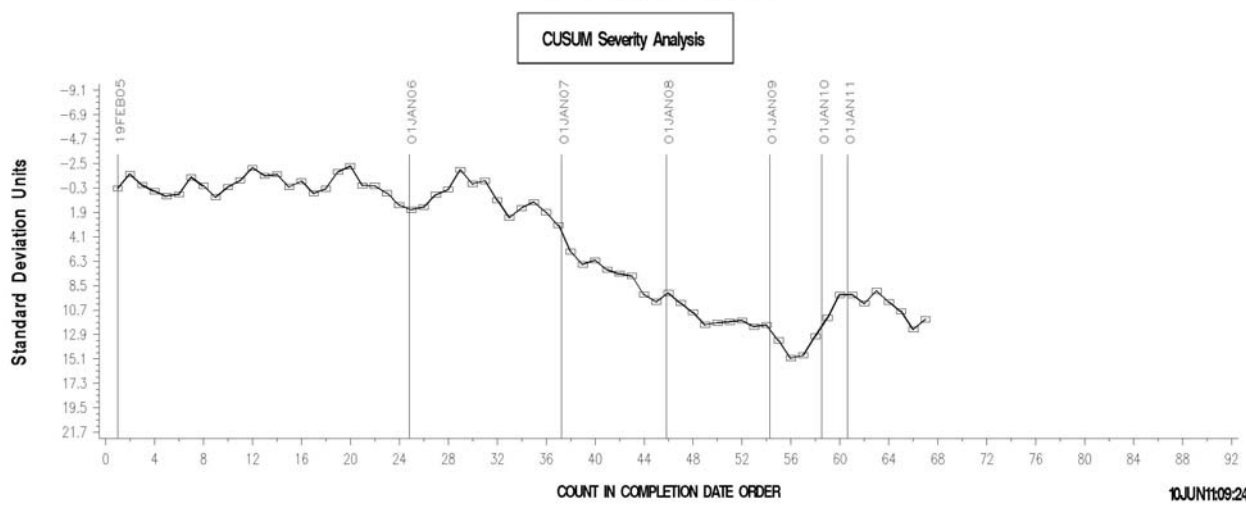
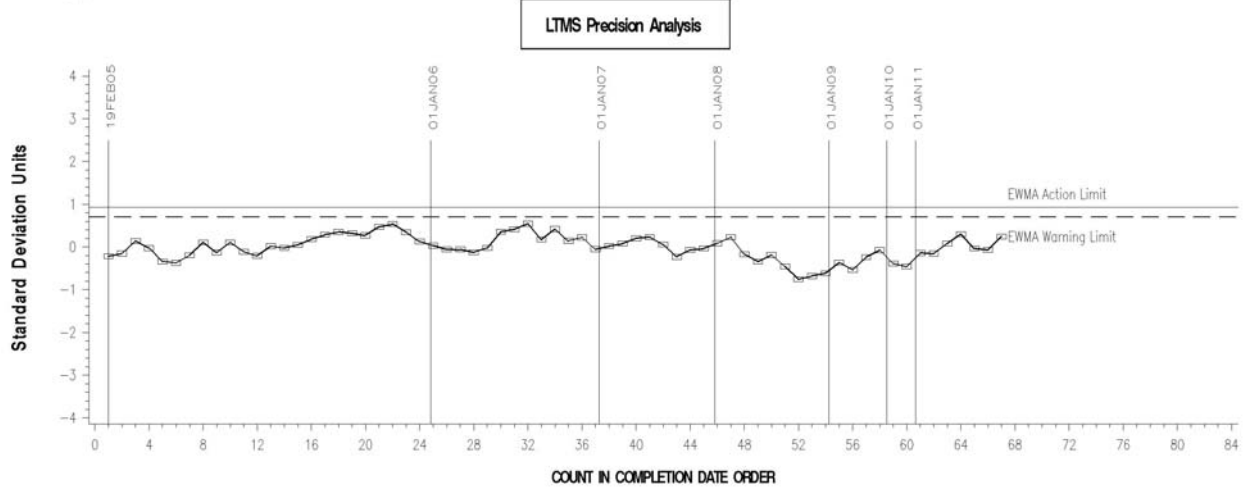
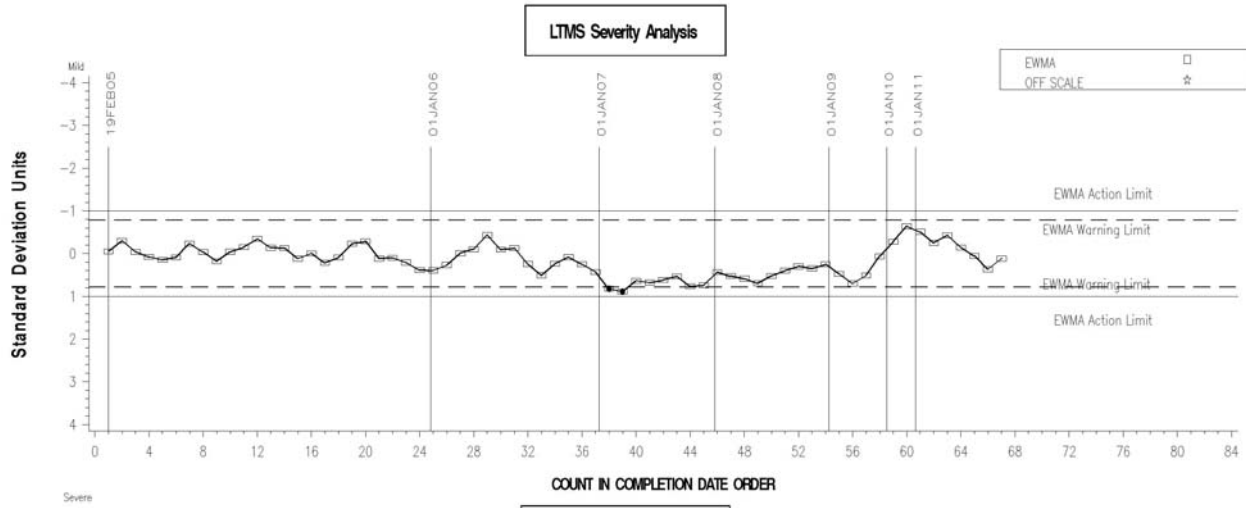
FINAL TRANS. RES. DELTA PB @ EOT



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



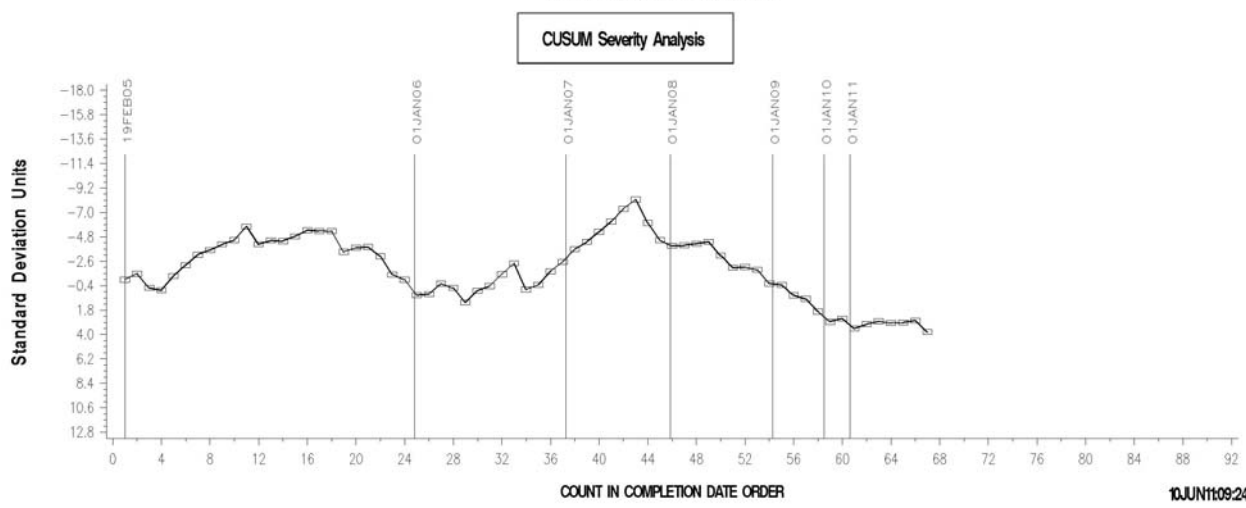
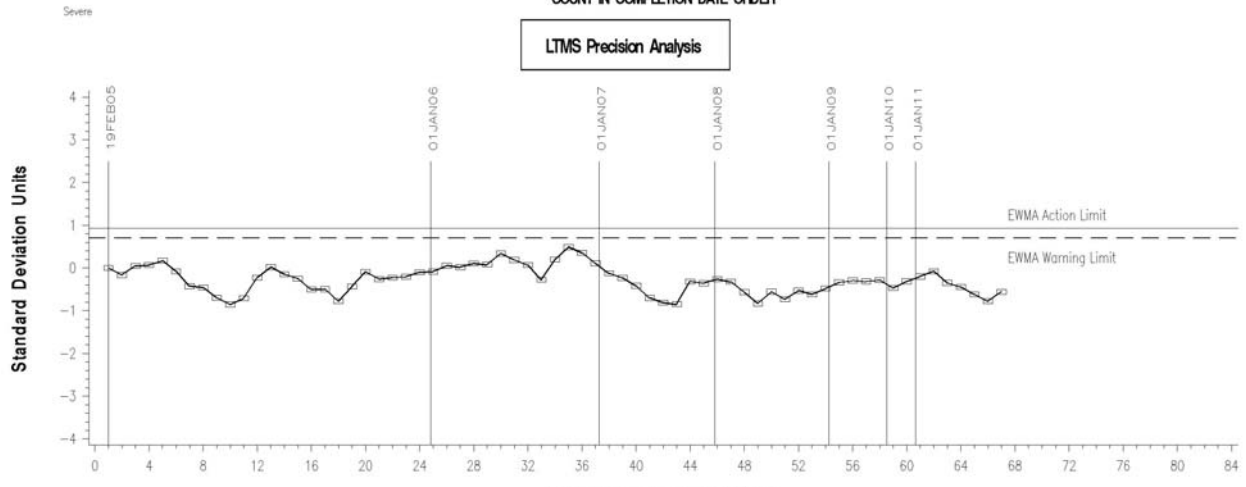
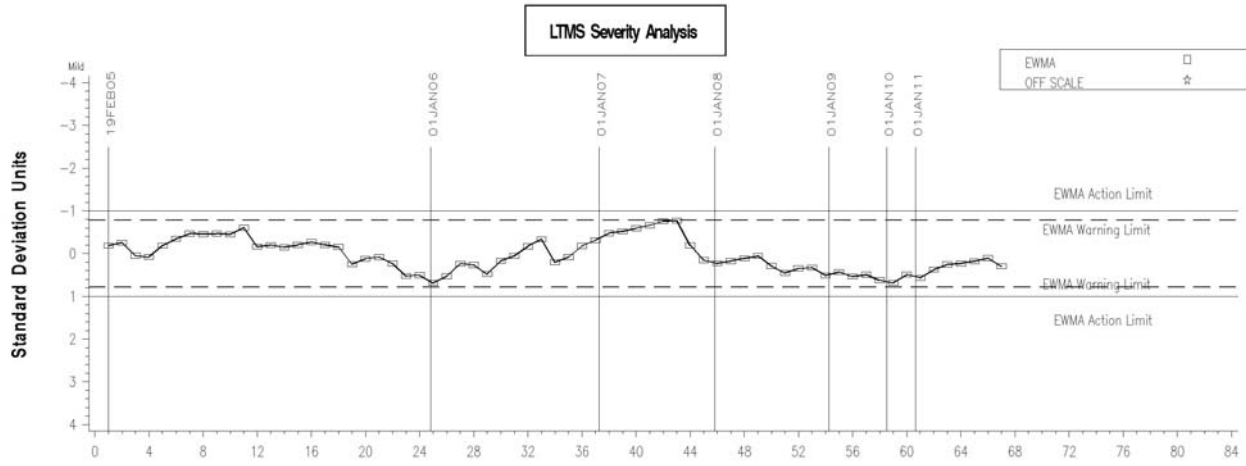
**AVG. CYLINDER LINER WEAR (CLW)**



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



AVG. TOP RING WEIGHT LOSS (TRWL)

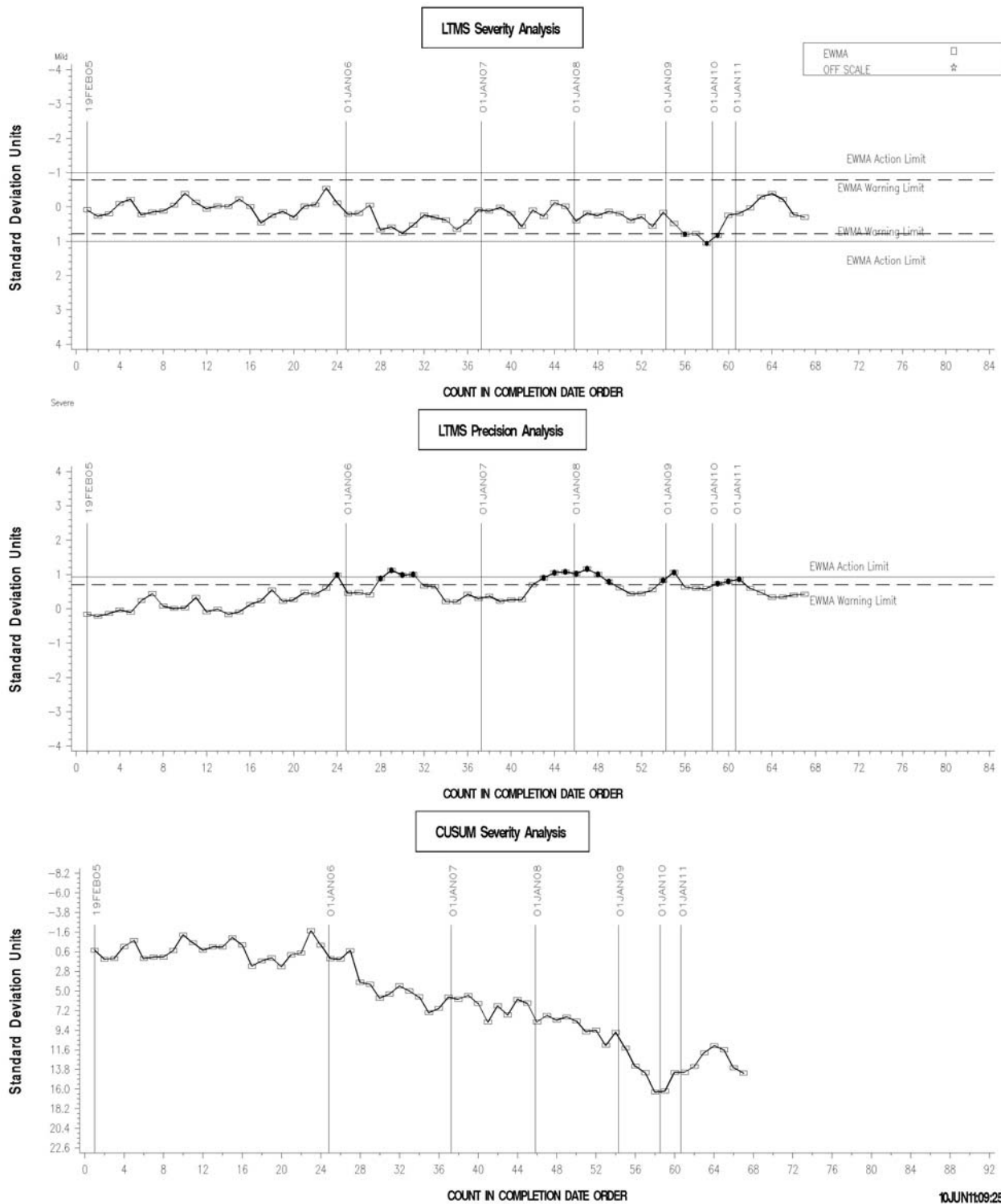




**FIGURE 12**  
**MACK T-12 INDUSTRY OPERATIONALLY VALID DATA**



FINAL TRANS. RES. OIL CONSUMPTION





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

FINAL TRANS. RES. DELTA PB 250-300H

