



# Test Monitoring Center

6555 Penn Avenue  
Pittsburgh, PA 15206-4489  
(412) 365-1000

MEMORANDUM: 01-157  
DATE: November 19, 2001  
TO: Wim Van Dam, Chairman, Mack Surveillance Panel  
FROM: Jeff Clark  
SUBJECT: T-10 Calibration Testing for the October 2001 ASTM Report Period

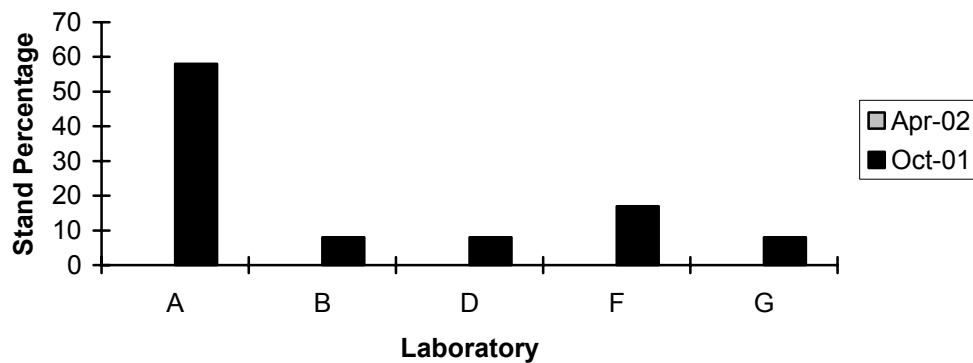
The following is a summary of T-10 reference oil tests completed during the October 2001 ASTM report period, which began on April 1, 2001 and ended on September 30, 2001. Note, this summary also covers PC-9 matrix tests, some of which completed prior to this summary period.

### Lab / Stand Distribution:

	Reporting Data	Calibrated as of 9/30/01
Number of Laboratories	5	5
Number of Stands	12	11

The figure below shows the T-10 laboratory / stand distribution for tests completed this report period:

### Laboratory / Stand Distribution

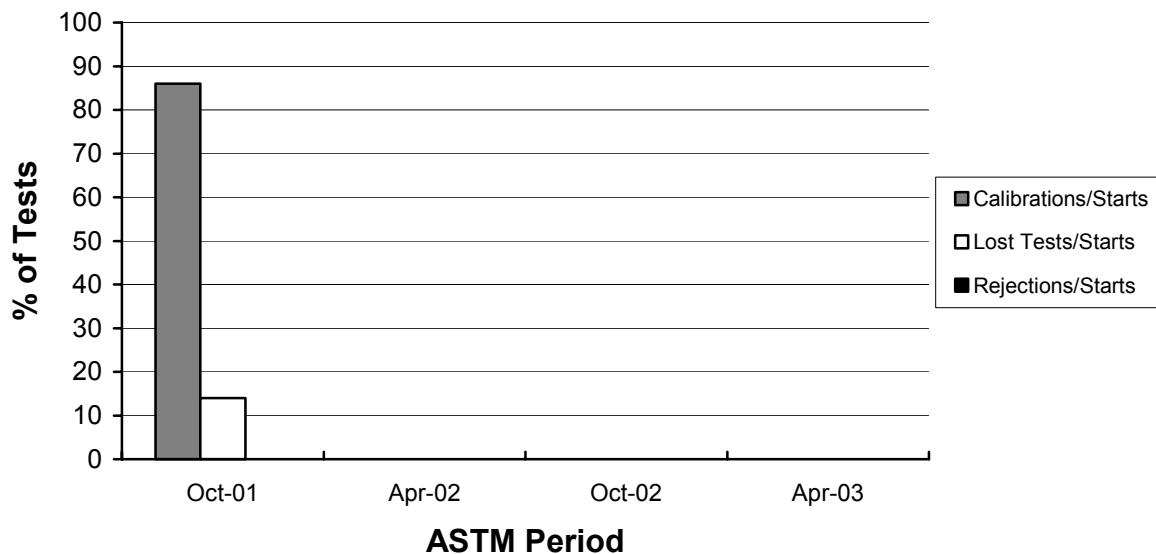


The table below summarizes the status of the reference oil tests reported to the TMC this ASTM report period:

Test Status	TMC Validity Code	Number of T-8E Tests
Acceptable Calibration Test	AC	6
Acceptable Matrix Test	AO	17
Failed Calibration Test (LTMS Criteria)	OC	0
Failed Matrix Test (Matrix Analysis)	OO	10
Accepted for Matrix Contribution	NO	2
Operationally Invalid Matrix Test	LO	3
Aborted Calibration Test	XC	1
Aborted Matrix Test	XO	1
Total		40

Calibrations per start, lost tests per start and rejections per start rates (post-matrix only) are summarized in the figure below:

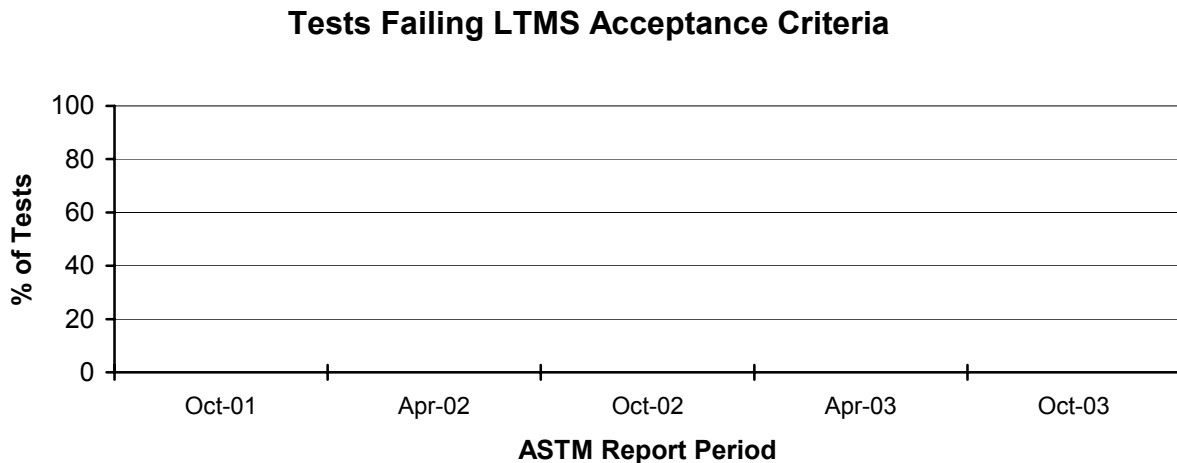
### Calibration Attempt Summary



Two tests were accepted for contribution to the PC-9 matrix but were not included in the official matrix dataset for analysis (validity = NO) because the task force felt that the results from these tests were outliers. A detailed list of reasons tests failed the acceptance criteria (OC and OO validities) is shown in Table 1. Table 2 lists the operationally invalid tests (LC and LO validities) and Table 3 lists the aborted tests (XC and XO validities).

LTMS Acceptance Criteria / Stand Alarms:

LTMS was implemented on August 20, 2001. The following figure shows the percentage of operationally valid tests that failed the LTMS acceptance criteria (TMC validity code = OC) for recent ASTM report periods:



There were no LTMS stand alarms for the current period. No LTMS deviations were issued this period. No LTMS deviations have been issued during the history of the T-10.

Severity and Precision:

Figure 1 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Delta Pb @ EOT (PB). PB is currently in control. For this period, PB is trending an average of 0.34  $\Delta/s$  mild. This is equivalent to 0.10 natural log units or approximately 3 ppm at the proposed CI-4 Merit Rating Anchor value of 30 ppm. For a history of PB industry alarms, refer to the industry alarm log shown in Table 4.

Figure 2 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Cylinder Liner Wear (CLW). CLW is currently in control. For this period, CLW is trending an average of 0.44  $\Delta/s$  mild. This is equivalent to 1.50 microns. For a history of CLW industry alarms, refer to the industry alarm log shown in Table 5.

Figure 3 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Top Ring Weight Loss (TRWL). TRWL is currently in control. For this period, TRWL is trending an average of 0.30  $\Delta/s$  mild, or approximately 8 mg. For a history of TRWL industry alarms, refer to the industry alarm log shown in Table 6.

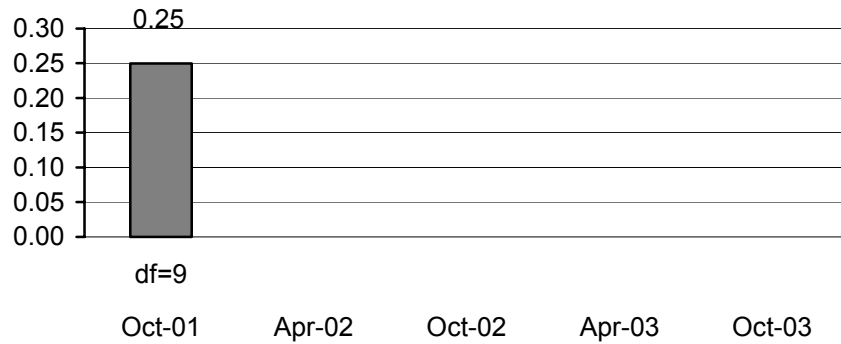
Figure 4 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Oil Consumption (OC). OC is currently in control. For this period, OC is trending an average of 0.39  $\Delta/s$  mild. This is equivalent to 4.3 g/hr. For a history of OC industry alarms, refer to the industry alarm log shown in Table 7.

Figure 5 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Delta Pb 250-300 Hours (PB2). PB2 is currently in control. For this period, PB2 is trending an

average of 0.33  $\Delta$ /s mild, or approximately 2 ppm. For a history of PB2 industry alarms, refer to the industry alarm log shown in Table 8.

Precision, as estimated by the pooled standard deviation, is shown in the following figures. For comparison purposes, the TMC will continue to report precision by ASTM period.

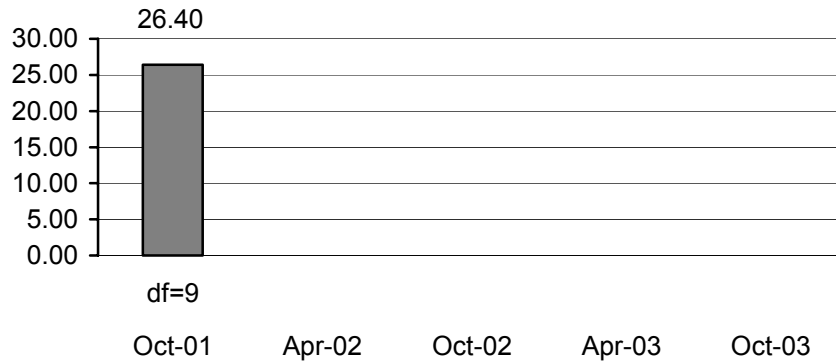
### Delta PB @ EOT Pooled Precision



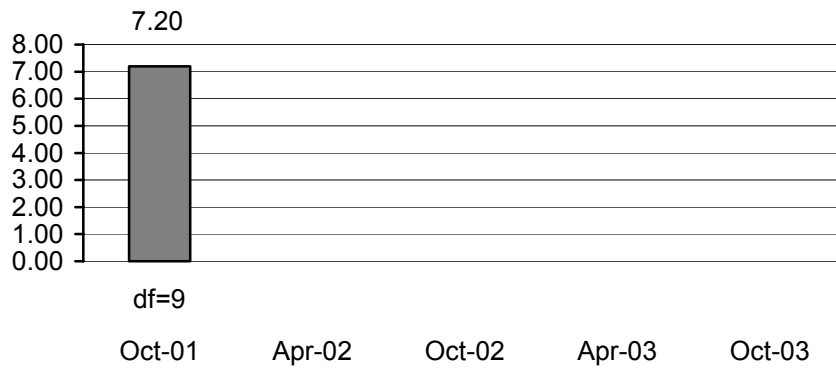
### Cylinder Liner Wear Pooled Precision



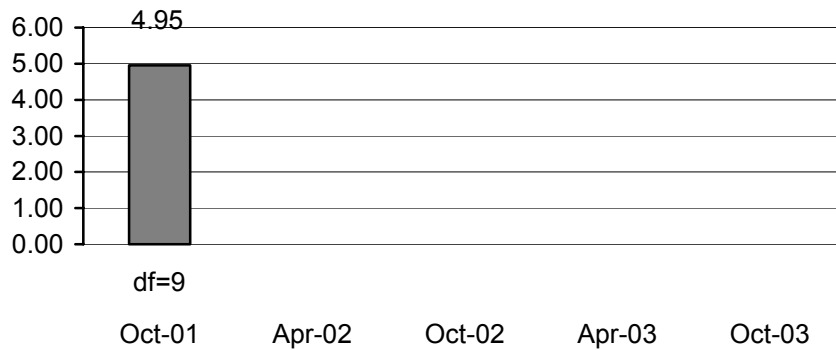
### Top Ring Weight Loss Pooled Precision



### Oil Consumption Pooled Precision



### Delta PB 250-300 Hours Pooled Precision



Please note, that the degrees of freedom (df) equals  $\Sigma(n \text{ observations per oil} - 1)$ .

Reference Oils:

The current reference oil test targets are shown below:

Oils	Parameter	N	Mean (cSt)	S
PC-9A and 820-1	PB	13	3.1298	0.2847
	CLW	13	32.5	3.4
	TRWL	13	134	26
	OC	13	49.6	10.9
	PB2	13	8.2	5.2

The supplies of PC-9A and 820-1 (PC-9A mini-reblend) have been exhausted. Oil 820-2 is currently being blended and should be available shortly. At a minimum, the first five tests on oil 820-2 will be judged against the current targets.

Abbreviated Length Test T-10A:

On October 24, 2001, the task force approved adding the abbreviated length test T-10A to the T-10 procedure. The TMC monitors the T-10A for the determination of laboratory severity adjustments for MRV viscosity. Figure 6 (attached) shows the current industry EWMA severity, EWMA precision, and CUSUM charts for MRV viscosity. For a history of MRV viscosity industry alarms, refer to the industry alarm log shown in Table 9.

Information Letters:

No information letters were issued this ASTM period.

TMC Laboratory Visits:

No TMC laboratory visits were conducted this ASTM period.

Quality Index:

Quality Index has not yet been implemented for the T-10. The TMC will be finishing an industry capability study shortly, at which time a QI proposal will be brought to the panel for consideration.

Additional Information:

Table 10 contains the T-10 / T-10A Timeline which details changes to the test since its inception.

The T-10 and T-10A databases can be accessed on the TMC's homepage. If you have any questions on how to access this information, contact the TMC.

JAC/jac/mem01-157.jac.doc

Attachments

c: J.L. Zalar, TMC

F.M. Farber, TMC

Mack Surveillance Panel

<ftp://tmc.astm.cmri.cmu.edu/docs/diesel/mack/semiannualreports/T10-10-2001.pdf>

**Table 1**  
**Summary of Reasons for Rejected Tests**

	No. of Tests
Oil Consumption, Severe	1
Delta Pb EOT Mild	4
Delta Pb EOT Severe	4
Top Ring Weight Loss and Cylinder Liner Wear, Mild	1

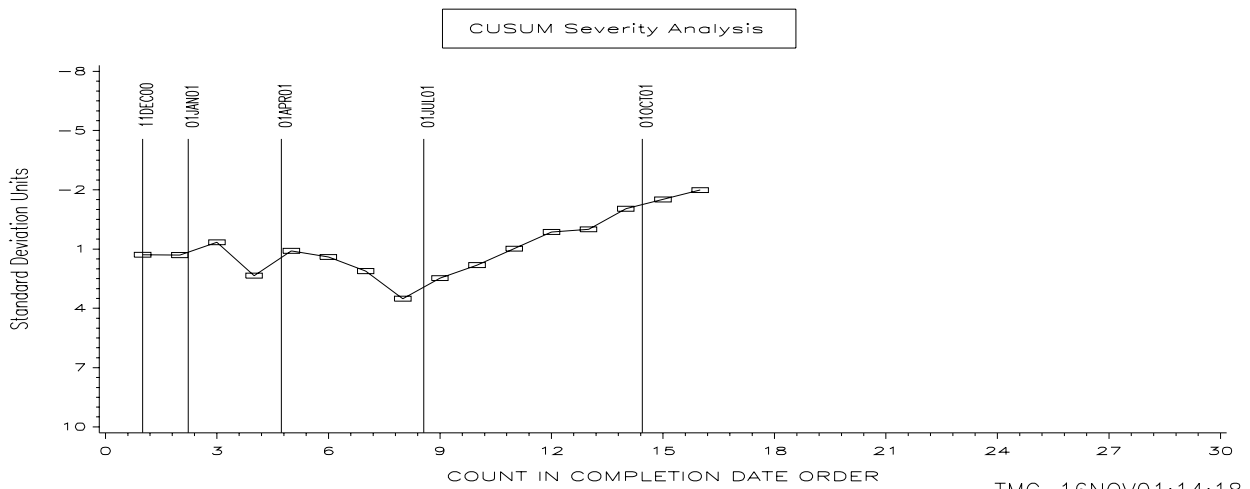
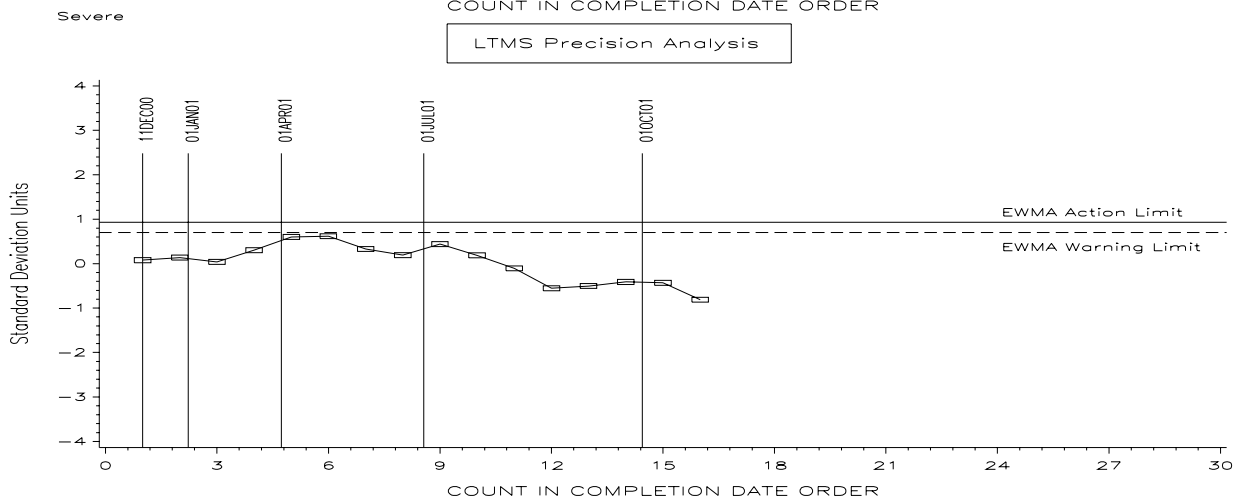
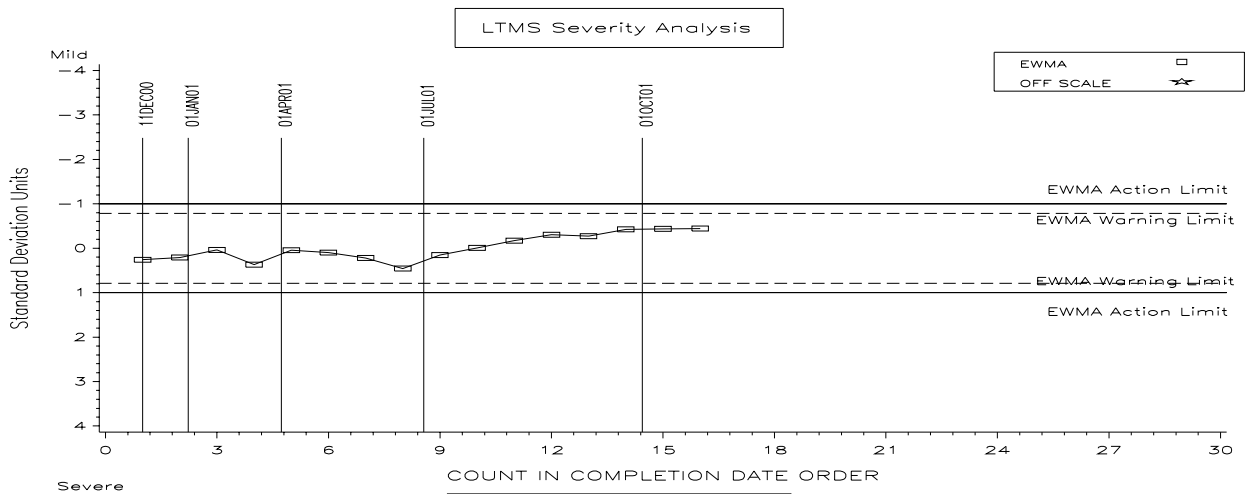
**Table 2**  
**Summary of Reasons for Invalid Tests**

	No. of Tests
High intake manifold temperature, Stage 1	1
Cam installation shoe left in engine build, causing oil contamination and filter plugging	1
Failed EGR pipe consumed by engine	1

**Table 3**  
**Summary of Reasons for Aborted Tests**

	No. of Tests
Missed 75-hour soot window	1
Fuel dilution	1

**FIGURE 1**  
T-10 INDUSTRY OPERATIONALLY VALID DATA  
DELTA PB @ EOT



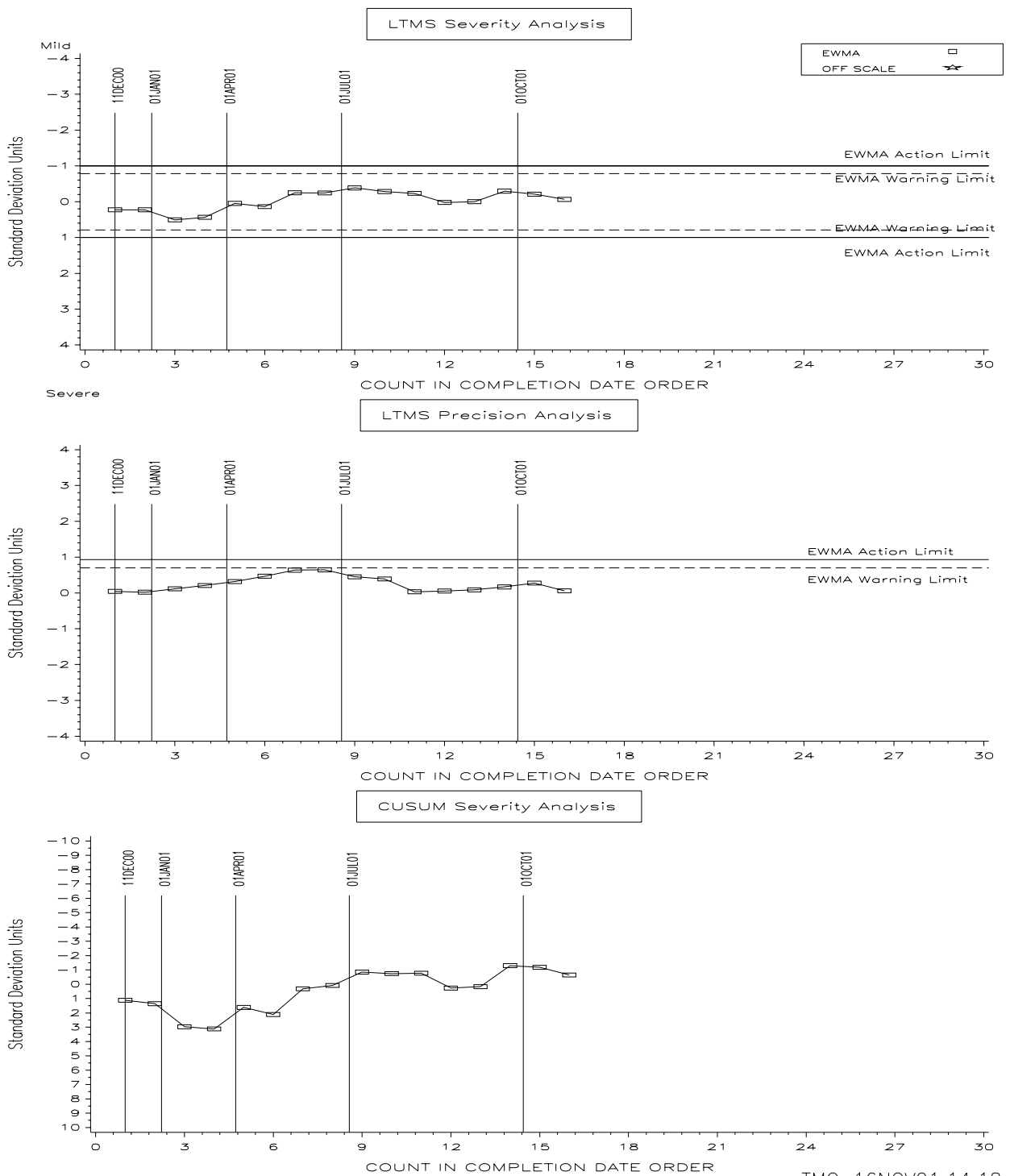


**TABLE 4**  
**DELTA PB @ EOT INDUSTRY ALARM LOG**

No alarms have occurred.

Updated 11/19/01

**FIGURE 2**  
 T-10 INDUSTRY OPERATIONALLY VALID DATA  
 CYLINDER LINER WEAR

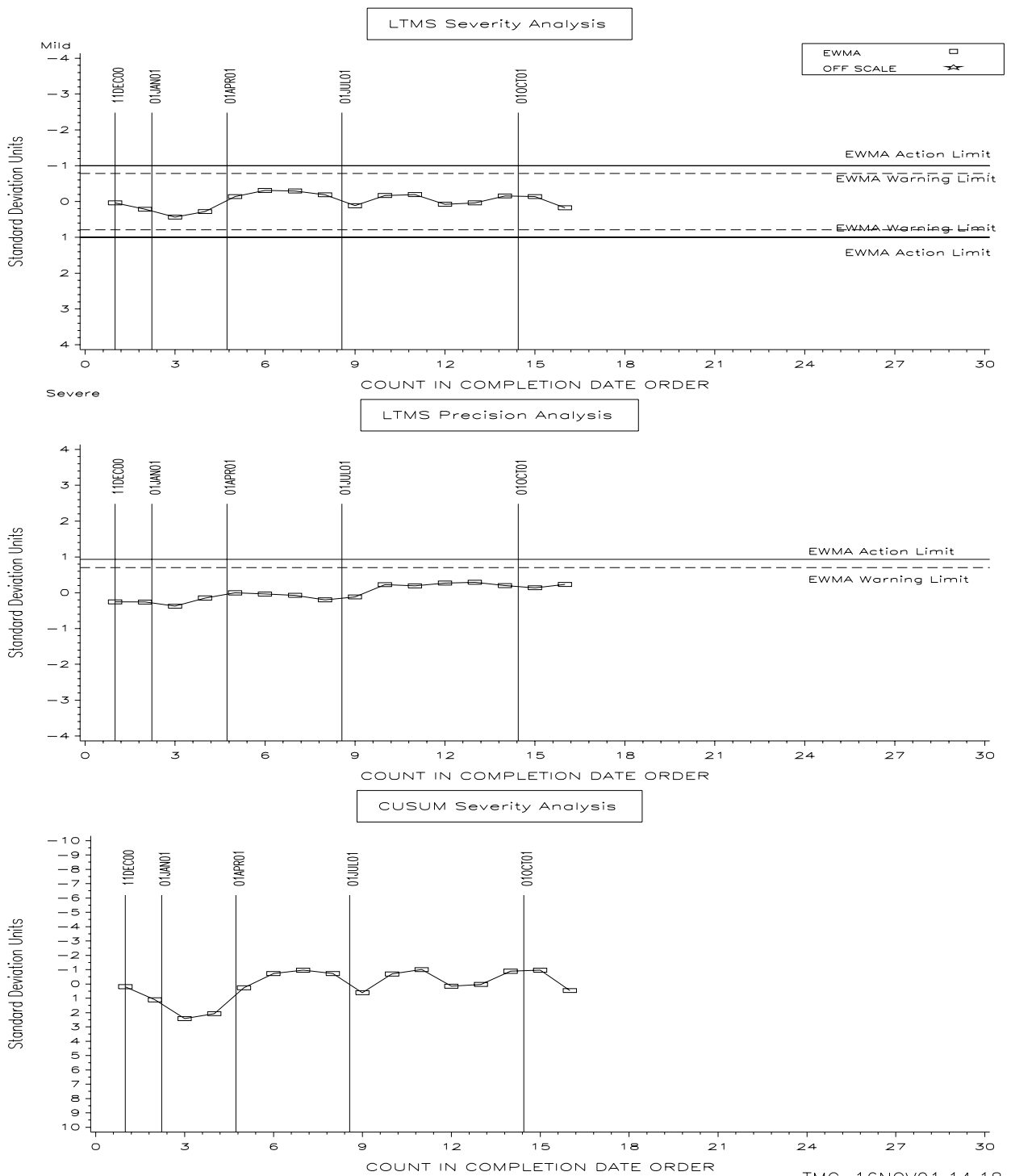


**TABLE 5**  
**CYLINDER LINER WEAR INDUSTRY ALARM LOG**

No alarms have occurred.

Updated 11/19/01

**FIGURE 3**  
 T-10 INDUSTRY OPERATIONALLY VALID DATA  
 TOP RING WEIGHT LOSS

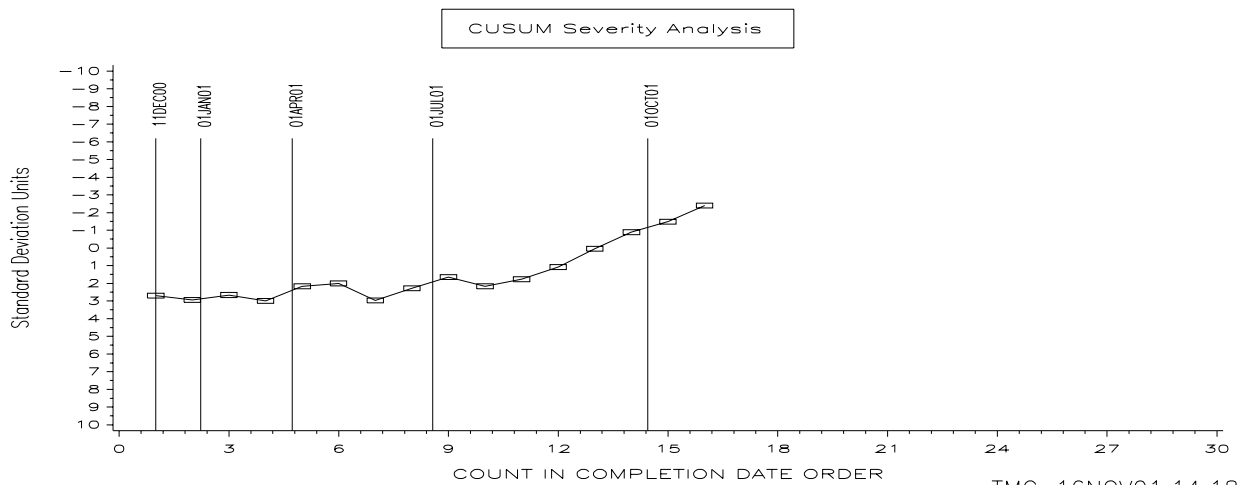
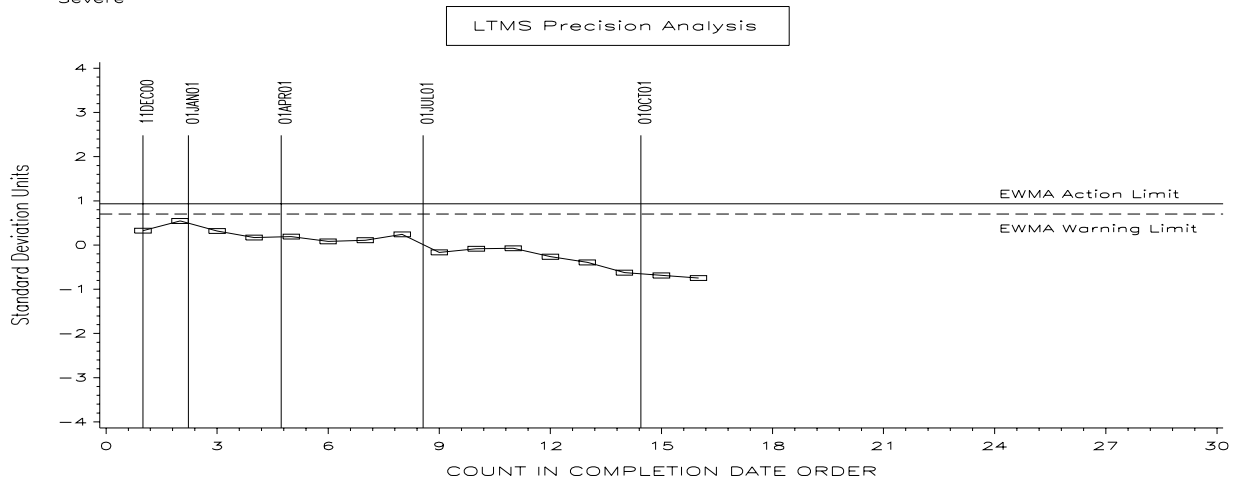
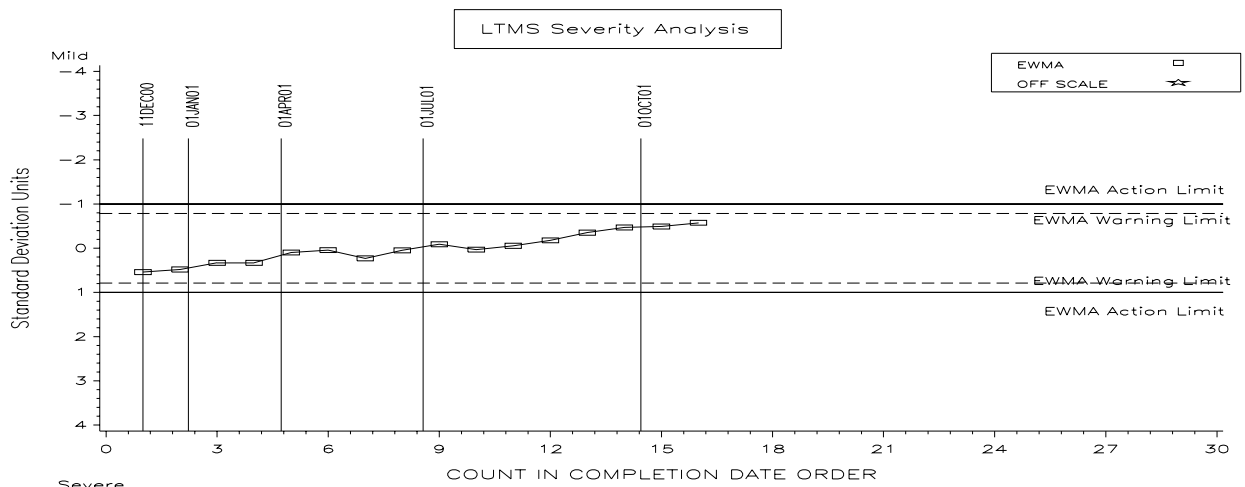


**TABLE 6**  
**TOP RING WEIGHT LOSS INDUSTRY ALARM LOG**

No alarms have occurred.

Updated 11/19/01

**FIGURE 4**  
T-10 INDUSTRY OPERATIONALLY VALID DATA  
OIL CONSUMPTION



**TABLE 7**  
**OIL CONSUMPTION INDUSTRY ALARM LOG**

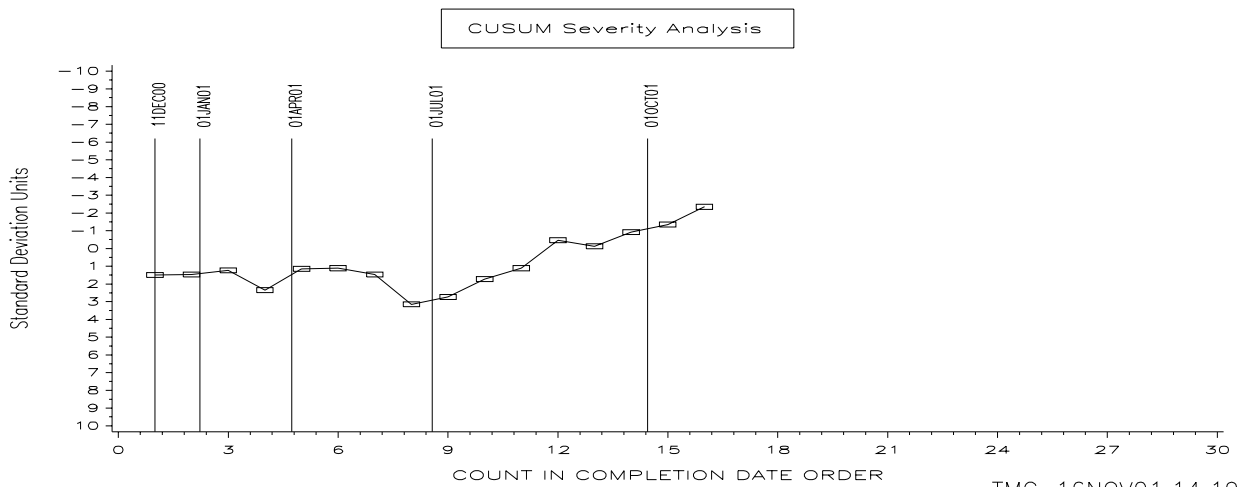
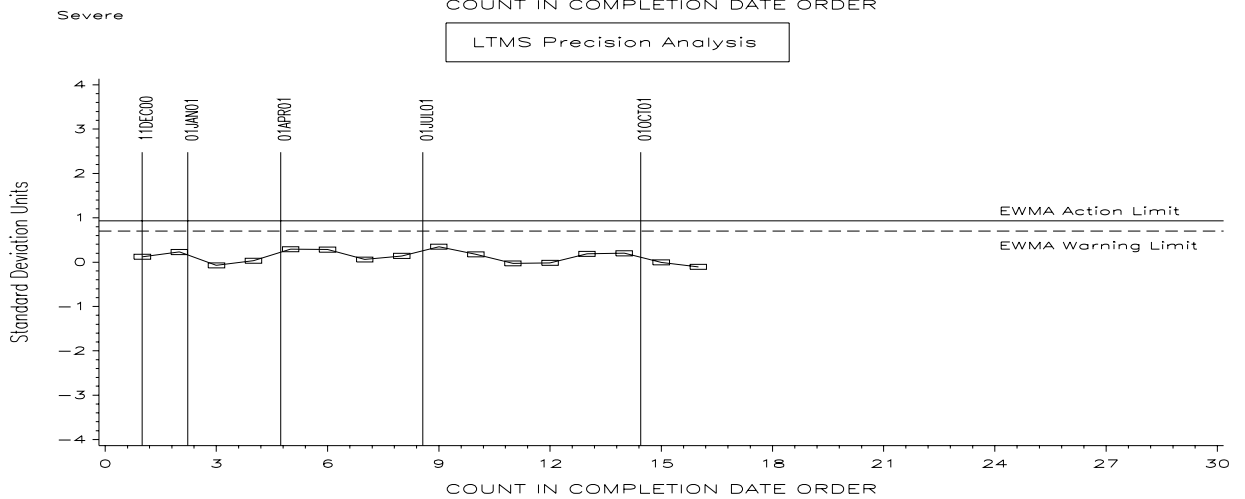
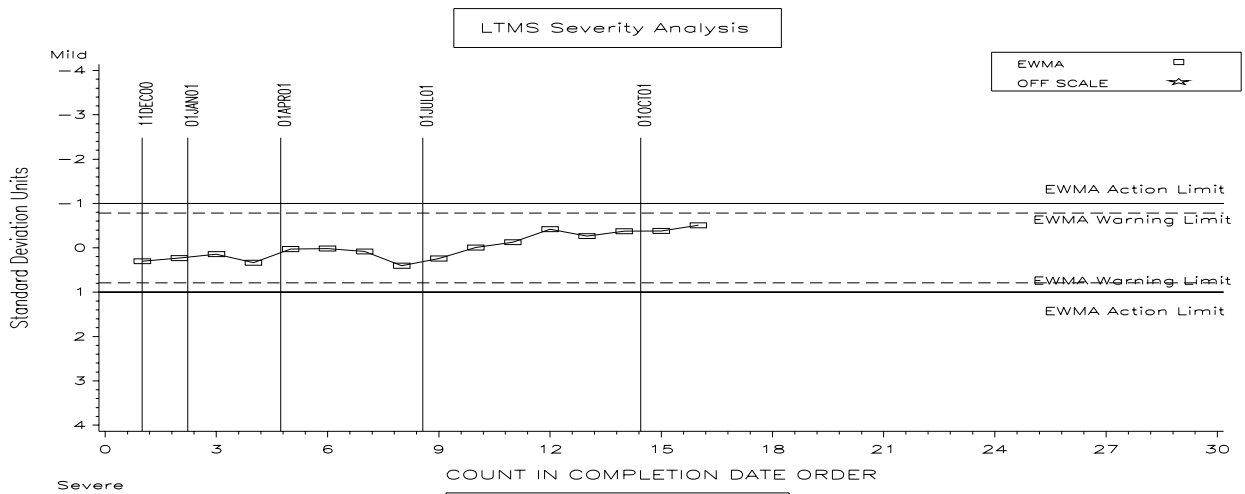
No alarms have occurred.

Updated 11/19/01

# FIGURE 5

T-10 INDUSTRY OPERATIONALLY VALID DATA

DELTA PB 250-300 HOURS





**TABLE 8**  
**DELTA PB 250-300 HOURS INDUSTRY ALARM LOG**

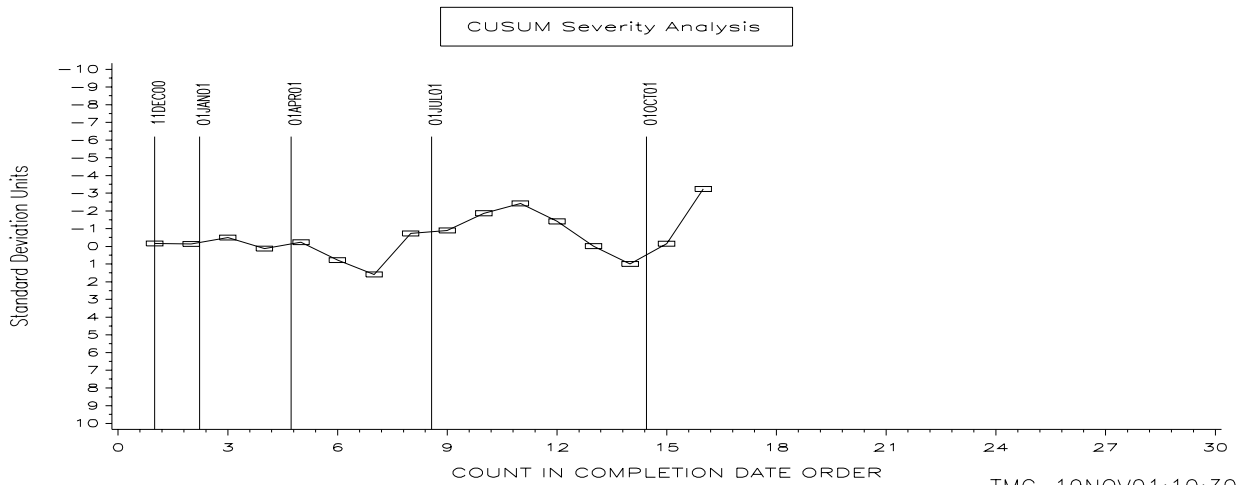
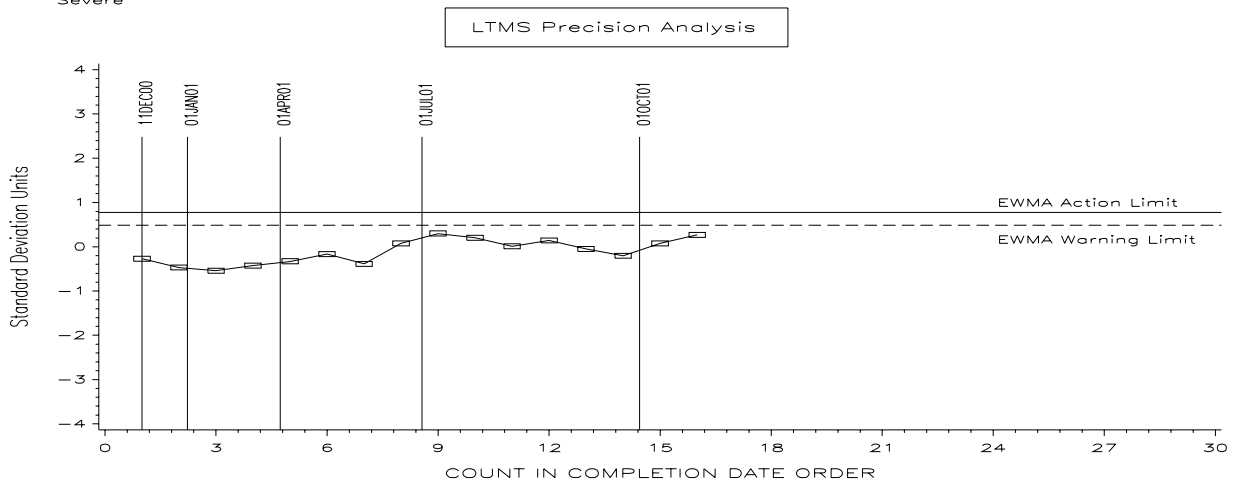
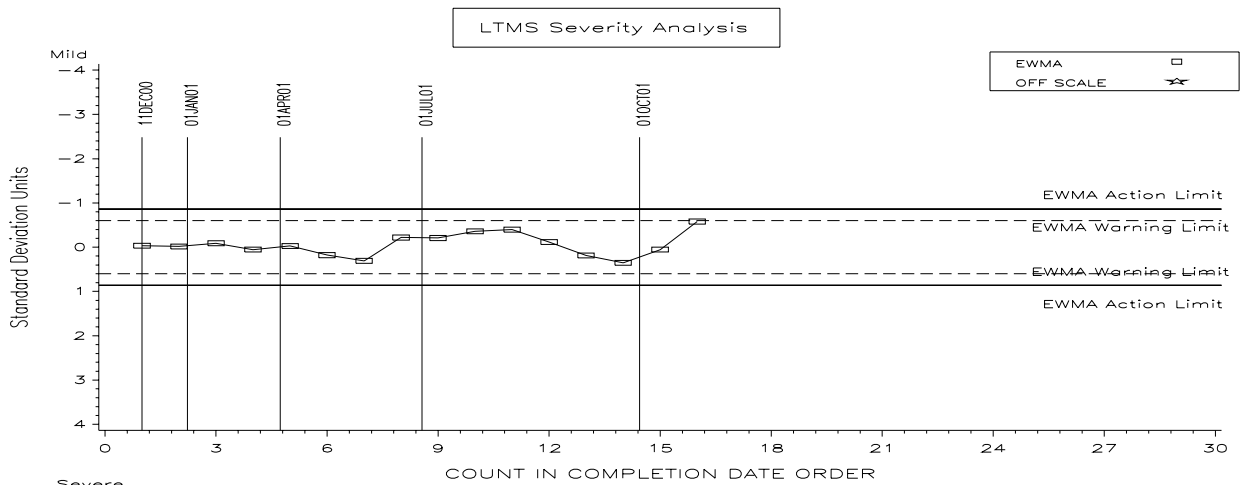
No alarms have occurred.

Updated 11/19/01

# FIGURE 6

T-10A INDUSTRY OPERATIONALLY VALID DATA

FNL. ORIG. UNIT MRV VISCOSITY @ 75H



## **TABLE 9**

### **MRV VISCOSITY INDUSTRY ALARM LOG**

No alarms have occurred.

Updated 11/20/01

**TABLE 10**  
**T-10/ T-10A TIMELINE**

<b>Date</b>	<b>IL No., Topic</b>
20000524,	PROCEDURE PRELIMINARY DRAFT ISSUED
20000831,	PROCEDURE DRAFT NO. 1 ISSUED
20001127,	BEGINNING OF PC-9 MATRIX
20010703,	COMPLETION OF PC-9 MATRIX
20010710,	LABS EXPERIMENT WITH CONTROLLING EGR BASED ON CO2 INTAKE
20010809,	EGR CONTROL SET WITH CO2 INTAKE; EXHAUST O2 USED FOR REPORT ONLY
20010820,	LTMS IMPLEMENTED
20010906,	PROCEDURE DRAFT NO. 2 ISSUED
20011024,	ABBREVIATED TEST T-10A APPROVED
20011029,	PROCEDURE DRAFT NO. 3 ISSUED