

1. T-13 LTMS Requirements

The following are the specific T-13 calibration test requirements.

A. Reference Oils and Critical Performance Criteria

The critical performance criteria are IR Oxidation Peak Height at 360 hours and percent increase in 40° kinematic viscosity from 300 to 360 hours. The reference oils required for test stand and test laboratory referencing are reference oils accepted by the ASTM T-13 Test Development Task Force. The means and standard deviations for the current reference oils for each critical performance criterion are presented below.

IR Oxidation Peak Height
Unit of Measure: *absorbance / cm*

Reference Oil	Mean	Standard Deviation
PC11A	142.7	12.4
PC11B	59.7	12.4
PC11C	121.1	12.4
PC11D	133.5	12.4
PC11E	59.2	12.4
PC11F	123.6	12.4

Percent Increase in Viscosity at 40°C from 300 to 360 hour
Unit of Measure: %

Reference Oil	Mean	Standard Deviation
PC11A	86.9	23.2
PC11B	25.2	23.2
PC11C	68.8	23.2
PC11D	77.6	23.2
PC11E	23.2	23.2
PC11F	87.1	23.2

B. Acceptance Criteria

1. New Test Stand

a. The first two stands in a laboratory

- A minimum of two (2) operationally valid calibration tests, with no stand Shewhart severity alarms and no stand Shewhart precision alarms, must be conducted on any approved reference oils.
- All operationally valid calibration test results must be charted to determine if the test stand is currently “in control” as defined by the control charts from the Lubricant Test Monitoring System.

b. Third and subsequent stands in a laboratory

- The first operationally valid calibration test run on any approved calibration oil must have no stand Shewhart severity alarm and no stand Shewhart precision alarm using the Reduced K values. If the first operationally valid calibration test does not meet this acceptance criterion, then the New Test Stand criteria listed above in 1.a must be followed.

2. Existing Test Stand

- The test stand must have been accepted into the system by meeting LTMS calibration requirements.
- All operationally valid calibration test results on reference oil PC11A and subsequent approved reblends must be charted to determine if the test stand is currently “in control” as defined by the control charts from the Lubricant Test Monitoring System.

3. Reference Oil Assignment

Once test stands have been accepted into the system, the TMC will assign reference oils for continuing calibration according to the reference oil mix:

- 100% of the scheduled calibration tests should be conducted on reference oil PC11A or subsequent approved reblends.

4. Control Charts

In Section 1, the construction of the control charts that constitute the Lubricant Test Monitoring System is outlined. For the T-13, $Z_0 = \text{Mean } Y_i$ of first two tests acceptable for Shewhart severity plus all operationally valid tests in between. The constants used for the construction of the control charts for the T-13, and the response necessary in the case of control chart limit alarms, are depicted below. Note that control charting all parameters is required.

LUBRICANT TEST MONITORING SYSTEM CONSTANTS

		EWMA Chart				Shewhart Chart	
		LAMBDA		K		K	
Chart Level	Limit Type	Precision	Severity	Precision	Severity	Precision	Severity
Stand	Reduced K	--	--	--	--	1.48	1.44
	Action	0.3	0.3	1.74	2.05	1.74	2.00
Lab	Warning	0.2	--	1.74	--	--	--
	Action	0.2	0.2	2.58	0	1.74	2.00
Industry	Warning	0.2	0.2	1.74	2.05	--	--
	Action	0.2	0.2	2.58	2.81	--	--

The following are the steps that must be taken in the case of exceeding control chart limits. The steps are listed in order of priority, although charts should be studied simultaneously to determine the cause(s) of a problem. In the case of multiple alarms, contact the TMC for guidance.

- Exceed EWMA laboratory chart action limit for precision
 - Immediately provide written notice of the alarm and its meaning to all Test Purchasers and the TMC. This notice shall be appended to all test reports during the alarm period.
- Exceed EWMA laboratory chart warning limit for precision
 - Immediately provide written notice of the alarm and its meaning to all Test Purchasers and the TMC. This notice shall be appended to all test reports during the alarm period.
- Exceed EWMA test stand chart limit for precision
 - Immediately provide written notice of the alarm and its meaning to all Test Purchasers and the TMC. This notice shall be appended to all test reports for the stand in question during the alarm period.

- Exceed Shewhart test stand chart limit for precision
 - Immediately provide written notice of the alarm and its meaning to all Test Purchasers and the TMC. This notice shall be appended to all test reports for the stand in question during the alarm period.
- Exceed Shewhart laboratory chart action limit for precision
 - Immediately provide written notice of the alarm and its meaning to all Test Purchasers and the TMC. This notice shall be appended to all test reports during the alarm period.
- Exceed EWMA laboratory chart action limit for severity
 - Calculate laboratory Severity Adjustment (SA) for each parameter that exceeds action limit, using the current laboratory EWMA (Z_i) as follows:

IR Oxidation Peak Height at 360 hours:	$SA = (-Z_i) \times (12.4)$
Percent Increase in Viscosity at 40°C from 300 to 360 hour:	$SA = (-Z_i) \times (23.2)$
 - Confirm calculations with the TMC.
- Exceed EWMA test stand chart limit for severity
 - Notify the TMC. If the direction of the test stand severity is deemed different from that of the test laboratory, conduct an additional calibration test in the identified test stand. If this limit is still exceeded after the additional calibration test, then remove test stand from the system, notify the TMC, correct test stand severity problem, and follow requirements for entry of a new test stand into the system.
- Exceed Shewhart test stand chart limit for severity
 - Conduct an additional calibration test.

The following industry issues are handled by the TMC and do not require individual laboratory action.

- Exceed EWMA industry chart action limit
 - TMC to notify test developer, surveillance panel chairman, and ACC Monitoring Agency. Meeting of the TMC, test developer, and surveillance panel required to determine course of action.
- Exceed EWMA industry chart warning limit
 - TMC to notify test developer, surveillance panel chairman, and ACC Monitoring Agency. Coordination of TMC, test developer, and surveillance panel chairman required to discuss potential problem.