

30. L-33-1 LTMS Requirements

The following are the specific L-33-1 calibration test requirements.

A. Reference Oils and Critical Parameter

The critical parameter is Final Rust. The reference oils required for test stand and test laboratory calibration are reference oils accepted by the ASTM L-33-1 Surveillance Panel. The mean and standard deviations for the current reference oils for the critical parameter are presented below.

FINAL RUST
Unit of Measure: Merits
Gear Versions V99.1 & V01.1

Reference Oil	Mean	Standard Deviation
123	8.560	0.230
123-2	8.740	0.260
151-3	9.640	0.250
155	9.580	0.250
155-1	9.580	0.250

FINAL RUST
Unit of Measure: Merits
Gear Version AAM K2XX & T1XX

Reference Oil	Mean	Standard Deviation
123-2	8.51	0.35
126*	8.90	0.27
155-1	9.47	0.16
155-2	9.47	0.16

*Oil 126 approved for use on T1XX hardware only.

B. Acceptance Criteria

1. New Test Stand

- A minimum of two (2) operationally valid calibration tests, with no stand Shewhart severity alarms, must be conducted on any approved reference oils assigned by the TMC.
- 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.

2. Existing Test Stand

- The test stand must have been an ASTM TMC calibrated test stand prior to LTMS introduction or have previously been accepted into the system by meeting LTMS calibration requirements.
- 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.

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 following reference oil mix:

- 50% of the scheduled calibration tests should be conducted on reference oil 123 or 126 or subsequent approved reblends.
- 50% of the scheduled calibration tests should be conducted on reference oil 151-3 or 155 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. The constants used for the construction of the control charts for the L-33-1, and the response necessary in the case of control chart limit alarms, are depicted below.

LUBRICANT TEST MONITORING SYSTEM CONSTANTS

		EWMA Chart				Shewhart Chart	
		LAMBDA		K		K	
Chart Level	Limit Type	Precision	Severity	Precision	Severity	Precision	Severity
Stand	Warning	0.30	0.30	1.65	--	--	--
	Action	0.30	0.30	2.33	1.96	1.46	1.80
Lab	Action	--	0.20	--	1.80	--	--
Industry	Warning	0.20	0.20	1.46	1.80	--	--
	Action	0.20	0.20	2.33	2.58	--	--

The following are the steps that must be taken in the case of exceeding control chart limits.

- Exceed EWMA test stand chart action limit for precision
 - Remove test stand from the system. Notify the TMC. Correct test stand precision problem. Follow requirements for entry of a new test stand into the system.

- Exceed EWMA test stand chart warning limit for precision
 - Immediately begin two calibration tests on the test stand.
- Exceed Shewhart test stand chart limit for precision
 - Conduct an additional calibration test.
- Exceed EWMA test stand chart action limit for severity
 - Calculate test stand Severity Adjustment (SA) for Final Rust, using the current test stand EWMA (Z_i) as follows:

$$\text{Final Rust:} \quad \text{SA} = (-Z_i) \times (0.25)$$

- Confirm calculations with the TMC.
- 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 surveillance panel chairman. Meeting of TMC and the surveillance panel required to determine course of action.
- Exceed EWMA industry chart warning limit
 - TMC to notify surveillance panel chairman. Coordination of TMC and the surveillance panel chairman required to discuss potential problem.

L-33-1 Reference Oil Targets						
Oil	Gear Version	n	Effective Dates		Rust	
			From ¹	To	\bar{X}	s
121	V94.1	12 ²	6-5-96	4-19-00	9.370 ²	0.280 ²
	V95.1	12 ²	6-5-96	4-19-00	9.370 ²	0.280 ²
121-1	V94.1	--	1-19-98	4-29-99	9.370 ³	0.280 ³
	V94.1	45 ²	4-30-99	11-17-00	9.390 ²	0.218 ²
	V95.1	--	1-19-98	4-29-99	9.370 ³	0.280 ³
	V95.1	45 ²	4-30-99	11-17-00	9.390 ²	0.218 ²
	V99.1	8	4-20-00	11-17-00	9.830	0.260 ⁴
	V94.1	--	12-14-99	11-17-00	9.390 ⁵	0.218 ⁵
121-2	V95.1	--	12-14-99	11-17-00	9.390 ⁵	0.218 ⁵
	V99.1	--	4-20-00	11-17-00	9.830 ⁶	0.260 ⁴
123	V94.1	54 ²	5-5-95	4-19-00	9.000 ²	0.330 ²
	V95.1	54 ²	5-5-95	4-19-00	9.000 ²	0.330 ²
	V99.1	12	6-11-02	8-24-04	8.430	0.390
	V01.1	--	11-25-02	8-24-04	8.430 ¹⁰	0.390 ¹⁰
	V99.1 & V01.1	30	8-25-04	***	8.560	0.230
	V94.1	13 ⁷	4-20-00	11-17-00	8.240 ⁷	0.330 ⁸
123-1	V95.1	--	12-14-99	4-19-00	9.000 ⁹	0.330 ⁹
	V95.1	13 ⁷	4-20-00	11-17-00	8.240 ⁷	0.330 ⁸
	V99.1	13 ⁷	4-20-00	11-17-00	8.240 ⁷	0.330 ⁸
	V99.1	--	11-25-02	8-24-04	8.430 ¹⁰	0.390 ¹⁰
123-2	V99.1 & V01.1	--	8-25-04	6-1-06	8.560 ⁹	0.230 ⁹
	V99.1 & V01.1	15	6-2-06	***	8.740	0.260
	AAM K2XX	10	6-24-16	06-28-17	8.05	0.43
	AAM K2XX	19	6-29-17	11-07-17	8.09	0.41
	AAM K2XX	22	11-08-17	0-01-20	8.12	0.38
	AAM K2XX	19	01-02-20	08-31-20	8.37	0.39
	K2XX & T1XX	37	09-01-20	***	8.51	0.35
	T1XX	6	02-22-23	***	8.90	0.27
126	V99.1	13	6-11-02	8-24-04	9.690	0.350
	V01.1	--	11-25-02	8-24-04	9.690 ¹¹	0.350 ¹¹
	V99.1 & V01.1	30	8-25-04	***	9.640	0.250
	V99.1 & V01.1	--	6-2-06	---	9.580	0.250 ¹²
155	V99.1 & V01.1	--	4-4-12	---	9.580	0.250 ¹²
	AAM K2XX	9	6-24-16	06-28-17	9.26	0.12
	AAM K2XX	20	6-29-17	11-07-17	9.24	0.19
	AAM K2XX	23	11-08-17	01-01-20	9.25	0.22
	AAM K2XX	20	01-02-20	08-31-20	9.47	0.13
	K2XX & T1XX	42	09-01-20	***	9.47	0.16
155-2	K2XX & T1XX	-	08-25-21	***	9.47	0.16

1 Effective for all tests completed on or after this date.

2 Based on V94.1 & V95.1 data.

3 Based on oil 121 data.

4 Based on lab pooled s of V94.1 & V95.1 data (all blends of oil 121).

5 Based on oil 121-1 data.

6 Based on V99.1 data on oil 121-1.

7 Based on V99.1 and V95.1 data.

8 Based on lab pooled s of V94.1 & V95.1 data (all blends of oil 123).

9 Based on oil 123 data.

10 Based on V99.1 data on oil 123.

11 Based on V99.1 data on oil 151-3.

12 Based on V99.1 & V01.1 data on oil 151-3.