



Test Monitoring Center

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SEQUENCE VID INFORMATION LETTER 09-1
SEQUENCE NUMBER 1
May 27, 2009

ASTM consensus has not been obtained on this information letter. An appropriate ASTM ballot will be issued in order to achieve such consensus.

TO: Sequence VI Mailing List

SUBJECT: 1. Revision to Stand/Engine Calibration Requirements
2. Adjustment of FEI Results for Engine Hours
3. Precision Statement

1. During the May 13, 2009 Sequence VI Surveillance Panel conference call, the panel agreed to revise the calibration periods for stand/engine calibrations. Sections 10.1.1.2 through 10.1.1.4 have been revised to reflect the revised number of tests and engine hours. This change is effective May 13, 2009.
2. At the April 22, 2009 Sequence VI Surveillance Panel Meeting, the panel approved the application of an adjustment to FEI results based on engine hours. The information in Table 6 has been moved to new Annex A12, and now includes the engine hour adjustment to FEI results. Old Table 6 has been deleted. Old Tables 7 and 8 have been renumbered as Tables 6 and 7. This change is effective April 22, 2009.
3. At the April 22, 2009 Sequence VI Surveillance Panel Meeting, the panel approved precision estimates based on the Sequence VID matrix. Table 7 has been updated to include these estimates and Section 14 has been revised to include statements about reproducibility. These changes are effective April 22, 2009.

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Attachment

c: ftp://ftp.astmtmc.cmu.edu/docs/gas/sequencevi/vid/procedure_and_ils/il09-1.pdf

Distribution: Email

(Revises Draft 6.0 of Sequence VID Procedure)

10.1.1.2 Following the initial calibration of a new stand/engine combination, conduct a minimum of one operationally valid, statistically acceptable reference oil test after four full-length non-reference oil tests or 700 engine hours or 100 days, whichever occurs first.

10.1.1.3 Following the initial calibration period of a stand/engine combination, conduct a minimum of one operationally valid, statistically acceptable reference oil test after six full-length non-reference oil tests or 1050 engine hours or 100 days, whichever occurs first. For subsequent calibration periods of a stand/engine combination, conduct a minimum of one operationally valid, statistically acceptable reference oil test after 10 full length non reference oil tests, or 1750 engine hours, whichever comes first.

10.1.1.4 If more than 100 days elapse between Sequence VID tests, EOT to SOT, on a stand/engine combination, a minimum of one operationally valid, statistically acceptable reference oil test is required.

Old Table 6 is deleted.

Old Tables 7 and 8 are renumbered as Tables 6 and 7.

14. Precision and Bias

14.1 *Precision*—Test precision is established on the basis of reference oil test results (for operationally valid tests) monitored by the TMC. The data are reviewed semi-annually by the Sequence VI Surveillance Panel. Contact the TMC for current industry data. Precision data for non-reference oils are reviewed semi-annually by the ASTM Sequence VI Surveillance Panel.

14.1.1 Test precision as established for the official acceptance of this procedure is shown in Table 7.

NOTE 4—Contact the TMC for up-to-date data.

14.1.2 *Intermediate Precision Conditions*— Conditions where test results are obtained with the same test method using the same test oil, with changing conditions such as operators, measuring equipment, test stands, test engines, and time.

NOTE 5—Intermediate precision is the appropriate term for this test method rather than repeatability, which defines more rigorous within-laboratory conditions.

14.1.2.1 *Intermediate Precision Limit (i.p.)*—The difference between two results obtained under intermediate precision conditions that would in the long run, in the normal and correct conduct of the test method, exceed the values shown in Table 7 in only one case in twenty. When only a single test result is available, the Intermediate Precision Limit can be used to calculate a range (test result \pm Intermediate Precision Limit) outside of which a second test would be expected to fall about one time in twenty.

14.1.3 *Reproducibility Conditions*—Conditions where test results are obtained with the same test method using the same test oil in different laboratories with different operators using different equipment.

14.1.3.1 *Reproducibility Limit (R)*—The difference between results obtained under reproducibility conditions that would, in the long run, in the normal and correct conduct of the test method, exceed the values in Table 7 in only one case in twenty. When only a single test result is available, the Reproducibility Limit can be used to calculate a range (test result \pm Reproducibility Limit) outside of which a second test would be expected to fall about one time in twenty.

14.2 *Bias*—Bias is determined by applying an acceptable statistical technique to reference oil test results and when a significant bias is determined, a severity adjustment is permitted for non-reference oil test results.

TABLE 7 Sequence VID Reference Oil Precision Statistics ^A

Variable	Intermediate Precision		Reproducibility	
	$s_{i.p.}^B$	i.p.	s_R^B	R
Fuel Economy Improvement, %				
at 16 h	0.14	0.39	0.22	0.62
at 100 h	0.16	0.45	0.23	0.64

^A These statistics are based on results obtained on Sequence VID matrix oils GF5A, GF5B, GF5C, GF5D and GF5X

^B s = standard deviation

Annex A12

Calculation of Test Results

1. Calculate each 5-minute BSFC measurement using the average speed, load, and fuel flow acquired during the stabilized BSFC measurement cycle as follows

$$\text{BSFC} = (\text{average fuel flow, kg/h})(9549.3)/(\text{average speed, r/min})(\text{average Torque, N}\cdot\text{m}) \quad (1)$$

- a. Ensure average speed is acquired to a minimum of one whole number (zero decimal places).
 - b. Ensure average torque is acquired to a minimum of two decimal places.
 - c. Ensure fuel flow is acquired to a minimum of three decimal places.
2. For Stage 1, steps 1 through 6, round and record the 5-minute BSFC measurements to 4 decimal places using ASTM rounding.
 3. Average the BSFC measurements of the six steps to 5 decimal places using ASTM rounding. Units for BSFC are kg/kW-h.
 4. Multiply the average by the nominal power, stage length, and weight factor (below) for Stage 1 and record the answer to 6 decimal places. The unit for this number is kg of fuel consumed.

Test Stage	Nominal Speed (r/min)	Nominal Power (kW)	Stage Length (h)	Weight Factor
1	2000	21.99	0.5	0.300
2	2000	21.99	0.5	0.032
3	1500	16.49	0.5	0.310
4	695	1.46	0.5	0.174
5	695	1.46	0.5	0.011
6	695	2.91	0.5	0.172

5. Perform calculation steps 1, 2, 3, and 4 for the remaining test stages (2 to 6) using the respective nominal power, stage length, and weight factors.
6. Total the mass fuel consumption values for all 6 stages.
7. Complete the total fuel consumed calculation detailed in Steps 1 to 6 above for the BL Before Test Oil 1, BL Before Test Oil 2, Test Oil Phase I, Test Oil Phase II, and BL After Test Oil.
8. Compute the test oil fuel economy improvement (FEI) as follows:

$$\% \text{ FEI Test Oil Phase I} = \{[(\text{BL Before 2} \times 80\%) + (\text{BL After} \times 20\%) - \text{Test Oil}] / [(\text{BL Before 2} \times 80\%) + (\text{BL After} \times 20\%)]\} \times 100 \quad (2)$$

$$\% \text{ FEI Test Oil Phase II} = \{[(\text{BL Before 2} \times 10\%) + (\text{BL After} \times 90\%) - \text{Test Oil}] / [(\text{BL Before 2} \times 10\%) + (\text{BL After} \times 90\%)]\} \times 100 \quad (3)$$

9. Adjust the FEI results for engine hours as follows:
Adjusted FEI1 = FEI1 + (0.28897 * (natural log(engine hours) – 7.377))
Adjusted FEI2 = FEI2 + (0.27207 * (natural log(engine hours) – 7.377))
10. Adjust the FEI engine hour adjusted result(s) on non-reference oil tests for the stand/engine severity in accordance with Annex A7.