



## Test Monitoring Center

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

TO: EOEC Mailing List

SUBJECT: Addition of VAMAC Elastomer  
Revision to Outlier Screening Criteria  
Revised Precision Statement  
Editorial Corrections

The Engine Oil Elastomer Compatibility Surveillance Panel approved the addition of the VAMAC elastomer to Test Method D 7216. Sections 1.1, 1.4, 7.4 and Note 4 have been revised accordingly.

During the July 18, 2006 teleconference, the panel approved a motion to revise the acceptable practice for outlier screening. Section 11.4 has been revised accordingly.

Revisions to the precision statement have also been made. A new Section 12 is attached.

Several editorial revisions have been made to the test method. References to TMC reference oil 1006 have been changed to reflect that 1006-1 is the only oil used for EOEC testing. In addition, Section 7.4.3 has also been revised to state more concisely that elastomers with seal cure dates older than 3 years are not to be used.

The updated sections of Test Method D 7216 are attached and are effective the date of this information letter.

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EOEC Surveillance Panel Chairman  
Southwest Research Institute

John L. Zalar  
Administrator  
ASTM Test Monitoring Center

Attachment

c: [ftp://ftp.astmtmc.cmu.edu/docs/bench/eoec/procedure\\_and\\_ils/il07-01.pdf](ftp://ftp.astmtmc.cmu.edu/docs/bench/eoec/procedure_and_ils/il07-01.pdf)

Distribution: Email

**(Revises Test Method D 7216-05)**

Introduction Any properly equipped laboratory, without outside assistance, can use the test method described in this standard. However, the ASTM Test Monitoring Center (TMC)<sup>2</sup> provides a reference oil (TMC 1006-1) and an assessment of the test results obtained with this oil and the reference elastomers. By these means, the laboratory will know whether their use of the test method gives results statistically similar to those obtained by other laboratories.

1.1 This test method covers quantitative procedures for the evaluation of the compatibility of automotive engine oils with five reference elastomers typical of those used in the sealing materials in contact with these oils. Compatibility is evaluated by determining the changes in volume, Durometer A hardness and tensile properties when the elastomer specimens are immersed in the oil for a specified time and temperature.

1.4 The five reference elastomer formulations specified in this test method were chosen to be representative of those used in heavy-duty diesel engines. The procedures described in this test method can, however, also be used to evaluate the compatibility of automotive engine oils with different elastomer types/formulations or different test durations and temperatures to those employed in this test method.

1.7 This test method is arranged as follows:

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Formulations and Physical Properties for the Reference Elastomers	Annex A1

5.2 This test method requires that non-reference oil(s) be tested in parallel with a reference oil, TMC 1006-1, known to be aggressive for some parameters under service conditions. This relative compatibility permits decisions on the anticipated or predicted performance of the non-reference oil in service.

7.1 Reference Oil—The reference oil is maintained and distributed by the (TMC). The reference oil designation is TMC 1006-1. In order to receive this reference oil, individual

laboratories shall agree to furnish the TMC with immersion test results obtained with the reference oil.

7.4 Reference Seal Elastomers—Obtain cured prepared sheets of the reference seal elastomers from the Parts Distributor (PD). The sheets are at least 152 by 152 mm (6 by 6 in.) and have a uniform thickness of  $2 \pm 0.1$  mm ( $0.079 \pm 0.004$  in.). The specific reference elastomers described in this test method are a fluoroelastomer (FKM), a polyacrylate material (ACM), a silicone rubber (VMQ), a nitrile rubber (NBR), and a VAMAC (MAC).

NOTE 4 Elastomer sheets received from the PD are numbered in the following format: [type] X. Type = the elastomer type (for example, FKM, ACM, VMQ, NBR, or MAC), and X = batch number for the particular formulation.

7.4.3 Store the reference elastomers in a location shielded from light, where the relative humidity is in the range of 40 to 55 % and the temperature in the range of 10 to 25°C. Under these conditions the shelf life of the reference elastomers is three years from the date of cure provided by the PD. Do not use any elastomer with a seal cure date older than three years.

10. TMC 1006-1 Reference Oil Testing

10.1 As specified in 8.1, the reference oil TMC 1006-1 is evaluated simultaneously with each set of non-reference oil tests.

10.2 Prior to conducting a reference oil test, procure a supply of TMC 1006-1 directly from the TMC. Each reference oil sample is identified using a unique set of identification codes on the container labels.

**Delete Note 6 and renumber subsequent notes accordingly.**

10.3 Report the results of the TMC 1006-1 reference oil tests to the TMC (see Section 11).

10.4 Evaluation of Reference Oil Test Results—Upon receipt of the transmitted test results for TMC 1006-1, the TMC will review the test for operational adherence to the published test method.

11.4 Outliers—Report all data generated that was successfully measured. Do not apply any statistical measure for outlier screening. If any of the six individual values for any parameter were not measured successfully because of 1) grip slippage, 2) specimen breakage outside the test area, 3) a nick to the test specimen, or 4) an obvious material flaw (such as an air bubble), then record an asterisk (\*) for that particular measurement and provide a description of the problem in the comment section of Form 7 of the test report. Compute the arithmetic mean and standard deviation using the remaining individual values. If more than two individual values for any of the four parameters need to be reported as an asterisk (\*), the test is invalid.

Replace Section 12 with the following:

- 12 Precision and Bias
- 12.1 Test precision is established on the basis of reference oil test results (for operationally valid tests) monitored by the ASTM Test Monitoring Center. The data are reviewed semi-annually by the Engine Oil Elastomer Compatibility Surveillance Panel. Contact the ASTM TMC for current industry data.
- 12.1.1 Tables 2 through 6 summarize reference oil intermediate precision and reproducibility of the test. The tabulated values are current as of August, 2007. The Surveillance Panel updates these values as necessary.
- 12.1.2 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 equipment, and time.
- NOTE 9 Intermediate precision is the appropriate term for this test method rather than repeatability which defines more rigorous within-laboratory conditions.
- 12.1.2.1 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 Tables 2 through 6 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 result would be expected to fall about one time in twenty.
- 12.1.3 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.
- 12.1.3.1 Reproducibility Limit (R)—The difference between two results obtained under reproducibility conditions that would, in the long run, in the normal and correct conduct of the test method, exceed the values shown in Tables 2 through 6 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 result would be expected to fall about one time in twenty.
- 12.1.4 Bias—No estimate of the bias for the procedure is possible because the performance results for an oil are determined only under the specific conditions of the test and no absolute standards exist.

**TABLE 2 FLUOROELASTOMER Reference Oil Precision Data**

NOTE—These statistics are based on results obtained on Test Monitoring Center reference oils between August 23, 2001 and August 9, 2007.

Variable	S <sub>i.p.</sub>	i.p.	S <sub>R</sub>	R
Volume Change, %	0.15	0.42	0.18	0.50
Hardness Change, Points	1.39	3.89	2.00	5.60
Tensile Strength Change, %	4.10	11.48	4.61	12.91
Elongation Change, %	6.27	17.56	8.85	24.78

**TABLE 3 NITRILE Reference Oil Precision Data**

NOTE—These statistics are based on results obtained on Test Monitoring Center reference oils between August 23, 2001 and August 10, 2007.

Variable	S <sub>i.p.</sub>	i.p.	S <sub>R</sub>	R
Volume Change, %	0.68	1.90	0.71	1.99
Hardness Change, Points	1.48	4.14	1.71	4.79
Tensile Strength Change, %	7.48	20.94	7.79	21.81
Elongation Change, %	6.34	17.75	6.41	17.95

**TABLE 4 POLYACRYLATE Reference Oil Precision Data**

NOTE—These statistics are based on results obtained on Test Monitoring Center reference oils between August 23, 2001 and August 8, 2007.

Variable	S <sub>i.p.</sub>	i.p.	S <sub>R</sub>	R
Volume Change, %	0.70	1.96	0.73	2.04
Hardness Change, Points	1.64	4.59	1.65	4.62
Tensile Strength Change, %	7.22	20.22	7.26	20.33
Elongation Change, %	8.99	25.17	9.12	25.54

**TABLE 5 SILICONE Reference Oil Precision Data**

NOTE—These statistics are based on results obtained on Test Monitoring Center reference oils between August 23, 2001 and August 7, 2007.

Variable	S <sub>i.p.</sub>	i.p.	S <sub>R</sub>	R
Volume Change, %	1.86	5.21	2.07	5.80
Hardness Change, Points	1.17	3.28	2.22	6.22
Tensile Strength Change, %	4.80	13.44	4.84	13.55
Elongation Change, %	7.28	20.38	7.50	21.00

**TABLE 6 VAMAC Reference Oil Precision Data**

NOTE—These statistics are based on results obtained on Test Monitoring Center reference oils between November 17, 2003 and August 10, 2007.

Variable	s <sub>i.p.</sub>	i.p.	s <sub>R</sub>	R
Volume Change, %	1.99	5.57	2.29	6.41
Hardness Change, Points	1.05	2.94	1.05	2.94
Tensile Strength Change, %	6.86	19.21	7.22	20.22
Elongation Change, %	9.22	25.82	9.71	27.19

Legend:

- s<sub>i.p.</sub> = intermediate precision standard deviation.
- i.p. = intermediate precision.
- s<sub>R</sub> = reproducibility standard deviation.
- R = reproducibility.