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TO: EOEC Mailing List

SUBJECT: Addition of Passenger Car Elastomers
Editorial Corrections

The Engine Oil Elastomer Compatibility Surveillance Panel approved the addition of five new elastomers to Test Method D 7216. These elastomers are used in passenger car, spark ignition engines and are required by ILSAC/Oil for GF-5.

The elastomers are included in a new Annex A2. In addition, Sections 1.1, 1.4, 1.7, and 4.1 have been revised appropriately and new Sections 2.2 and 3.2.4 have been added.

Arising from the earlier addition of VAMAC (Information Letter No. 07-1 of Aug. 27, 2007), the Surveillance Panel also approved editorial changes to Sections 7.4.1, 8.5.2, the title of Table A1.1, and the title and contents of Table 1.

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

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Attachment

c: ftp://ftp.astmtmc.cmu.edu/docs/bench/eoec/procedure_and_ils/il08-01.pdf

Distribution: Email

Revisions to Test Method D7216-08

1.1 This test method covers quantitative procedures for the evaluation of the compatibility of automotive engine oils with several 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 reference elastomer formulations specified in this test method were chosen to be representative of those used in both heavy-duty diesel engines and passenger-car spark-ignition engines (the latter are covered in Annex A2). 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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Add new Section 2.2

2.2 SAE Standard[4]:

SAE J2643 Standard Reference Elastomers (SRE) for Characterizing the Effect of Liquids on Vulcanized Rubbers

Insert new Footnote 4 and renumber all subsequent footnotes accordingly.

[4] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001.

In Section 3.2, insert new definition 3.2.4.

3.2.4 tensile stress at 50 % elongation, n—the stress required to stretch the uniform cross section of a test specimen to 50 % elongation.

4.1 Measurements of initial volume, hardness (Durometer A) and tensile properties are made on specimens of specified dimensions cut from sheets of reference elastomers.

4.1.1 Table 1 shows the types of elastomers involved, typical of those used in heavy-duty diesel engines.

7.4.1 Table A1.1 shows the formulations and typical properties of some of the reference elastomers (typical of those used in heavy-duty diesel engines) listed in 7.4; these data are provided for information purposes only.

8.5.2 Set the heating block/bath temperature to the appropriate value for the elastomer under test. (Table 1 shows the immersion test temperatures and immersion times to be used for the reference elastomers listed in 7.4.) When the test temperature has been attained, insert the test tubes into the heating block/bath.

A1. FORMULATIONS AND PHYSICAL PROPERTIES FOR REFERENCE ELASTOMERS TYPICALLY USED IN HEAVY-DUTY DIESEL ENGINES

Change the title of Table A1.1:

Table A1.1 Formulation Data and Typical Properties for Four of the Reference Elastomer Materials in 7.4

Revise title of Table 1 and inserting VAMAC information:

TABLE 1 Immersion Temperatures and Times for the Reference Elastomers [A]

Elastomer	Immersion Test Temperature, °C	Immersion Test Time, h
Nitrile (NBR)	100 ± 1	336.0 ± 0.5
Polyacrylate (ACM)	150 ± 1	336.0 ± 0.5
Fluoroelastomer (FKM)	150 ± 1	336.0 ± 0.5
Silicone (VMQ)	150 ± 1	336.0 ± 0.5
VAMAC	150 ± 1	336.0 ± 0.5

[A] Some lubricant specifications may require immersion times other than 336 h. For times < 70 h the tolerance is ± 0.25 h and for times ≥ 70 h the tolerance is ± 0.5 h (see also 1.4).

Annex A2
(Mandatory Information)

A2. TEST PROCEDURE FOR REFERENCE ELASTOMERS TYPICALLY USED IN SPARK-IGNITION ENGINES

A2.1 Overview—The test procedure described in this annex uses five elastomer seals typical of those used in passenger-car, spark-ignition engines. Table A2.1 shows the types of elastomers involved. They differ from those described in Table 1 and Section 7.4 which are more commonly used in heavy-duty diesel engines. The apparatus and the TMC 1006-1 reference oil testing are identical to those described in Sections 6 and 10, respectively. The procedure described in this annex differs, however, from that in Section 8 in that the tensile stress change at 50 % elongation is also determined. In all other respects, the procedure is identical to that described in Section 8.

TABLE A2.1. Immersion Temperatures and Times for the Reference Elastomers[A]

Elastomer	Immersion Test Temperature, °C	Immersion Test Time, h
Hydrogenated Nitrile (HNBR-1)	100 ± 1	336.0 ± 0.5
Polyacrylate (ACM-1)	150 ± 1	336.0 ± 0.5
Fluoroelastomer (FKM-1)	150 ± 1	336.0 ± 0.5
Silicone (VMQ-1)	150 ± 1	336.0 ± 0.5
Ethylene acrylate (AEM-1)	150 ± 1	336.0 ± 0.5

[A] Some lubricant specifications may require immersion times other than 336 h. For times <70 h the tolerance is ± 0.25 h and for times ≥70 h the tolerance is ± 0.5 h (see also 1.4).

A2.2 Reference Materials:

A2.2.1 The reference materials are identical to those described in Section 7 with the exception of 7.4 and 7.4.1 which are replaced by A2.2.2 and A2.2.2.1, respectively:

A2.2.2 Reference Seal Elastomers—The specific reference elastomers described in this annex are a hydrogenated nitrile rubber (HNBR-1), a polyacrylate rubber (ACM-1), a fluoroelastomer rubber (FKM-1), a silicone rubber (VMQ-1) and an ethylene acrylate rubber (AEM-1). Obtain cured prepared sheets of the reference seal elastomers from the Parts Distributor (PD)[5]. The sheets are at least 152 by 152 mm and have a uniform thickness of 2 ± 0.1 mm. The PD shall mark each elastomer sheet to designate the direction of grain.

NOTE A2.1—Elastomer sheets received from the PD are numbered in the following format: [TYPE][Batch]. TYPE = the elastomer type (e.g., FKM-1, ACM-1, VMQ-1, HNBR-1, or AEM-1); X = batch number for the particular formulation. For instance, HNBR-1BC-1.

A2.2.2.1 Information on the formulations for the reference elastomers listed in A2.2.2 is given in SAE J2643 (Appendix B for ACM-1, Appendix D for AEM-1, Appendix E for HNBR-1, Appendix F for VMQ-1, and Appendix H for FKM-1).

A2.3 Procedure–Follow the procedure described in Section 8 with the exception of 8.4.1, 8.5.2, 8.5.2.4, and 8.6.1 which are replaced by A2.3.1, A2.3.2, A2.3.2.1, and A2.3.3, respectively:

A2.3.1 Tensile Measurements–Using the procedure specified in Test Method D 412, test six dumbbells for each oil/elastomer combination, recording for each dumbbell the ultimate elongation, the tensile strength and the tensile stress at 50 % elongation. To eliminate effects of variations in ambient conditions such as temperature and humidity, measure the initial tensile properties in the same time frame as the final tensile proprieties, i.e., post-immersion (see A2.3.3).

A2.3.2 Set the heating block/bath temperature to the appropriate value for the elastomer under test. (Table A2.1 shows the immersion test temperatures and immersion times to be used for the reference elastomers described in A2.2.2.) When the test temperature has been attained, insert the test tubes into the heating block/bath.

A2.3.2.1 Each tube shall be in the block/bath for the period specified in Table A2.1. The time starts when a tube is inserted in the heating block/bath, provided the latter is already at the correct temperature. If desired, as a check, insert a dummy tube containing an appropriate amount of oil and measure its temperature.

A2.3.3 Using the procedure described in A2.3.1, measure the tensile strength, the tensile stress at 50 % elongation and ultimate elongation of both the pre- and post-immersion specimens.

A2.4 Calculations–In addition to the calculations described in Section 9, carry out the following:

A2.4.1 Tensile Stress Change at 50 % Elongation:

$$\Delta TS_{50} = 100\ [(TSf_{50} - TSi_{50})/TSi_{50}] \qquad \text{(A2.1)}$$

where:

ΔTS_{50} = tensile stress change at 50 % elongation, %

TSi_{50} = initial tensile stress at 50 % elongation, MPa, and

TSf_{50} = final tensile stress at 50 % elongation, MPa.

A2.5 Report–Report as described in Section 11 with the following addition:

A2.5.1 Percent tensile stress change at 50 % elongation including the six individual values, the arithmetic mean and the standard deviation. Report percent tensile stress change at 50 % elongation to one decimal place.

A2.6 Precision and Bias–Section 12 applies with the exception of 12.1.1 which is replaced by A2.6.1:

A2.6.1 Test data from which intermediate precision and reproducibility for the elastomers described in A2.2.2 can be determined are currently being accumulated by the TMC. The Surveillance Panel will establish the test precision for these elastomers as soon as possible.