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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Test Method for Determining Extreme Pressure Properties of Lubricating Greases Using A High-Frequency, Linear-Oscillation (SRV) Test Machine[1]

This standard is issued under the fixed designation D 5706; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers a procedure for determining extreme pressure properties of lubricating greases under high-frequency linear-oscillation motion using the SRV test machine. This test method can also be used for evaluating extreme pressure properties of lubricating fluid.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 217 Test Method for Cone Penetration of Lubricating Grease[2]

D 4175 Terminology Relating to Petroleum, Petroleum Products, and Lubricants[3]

G 40 Terminology Relating to Wear and Erosion[4]

2.2 *Other Standard:*

DIN 17230 Roller Bearing Steels[5]

3. Terminology

3.1 *Definitions:*

3.1.1 *break-in, n—in tribology*, an initial transition process occurring in newly established wearing contacts, often accompanied by transients in coefficient of friction or wear rate, or both, which are uncharacteristic of the given tribological system's long-term behavior. **G40**

3.1.2 *coefficient of friction, μ or f, n—in tribology*, the dimensionless ratio of the friction force (*F*) between two bodies to the normal force (*N*) pressing these bodies together. **G40**

3.1.3 *Hertzian contact area, n*—the apparent area of contact between two nonconforming solid bodies pressed against each other, as calculated from Hertz' equations of elastic deformation. **G40**

3.1.4 *Hertzian contact pressure, n*—the magnitude of the pressure at any specified location in a Hertzian contact area, as calculated from Hertz' equations of elastic deformation. **G40**

3.1.5 *lubricant, n*—any material interposed between two surfaces that reduces the friction or wear, or both, between them. **D 4175**

3.1.6 *lubricating grease, n*—a semifluid to solid product of a dispersion of a thickener in a liquid lubricant. **D 217**

3.1.6.1 *Discussion*—The dispersion of the thickener forms a two-phase system and immobilizes the liquid lubricant by surface tension and other physical forces. Other ingredients are commonly included to impart special properties.

3.1.7 *thickener, n—in lubricating grease*, a substance composed of finely divided solid particles dispersed in a liquid lubricant to form the grease structure. **D 217**

3.1.7.1 *Discussion*—The thickener can be fibers (such as various metallic soaps) or plates or spheres (such as certain non-soap thickeners) which are insoluble or, at most, only very slightly soluble in the liquid lubricant. The general requirements are that the solid particles be extremely small, uniformly dispersed, and capable of forming a relatively stable, gel-like structure with the liquid lubricant.

3.1.8 *Ra, n*—in measuring surface finish, the arithmetic average of the absolute distances of all profile points from the mean line for a given distance.[6]

3.1.9 *Rz (DIN), n*—in measuring surface finish, the average of all *Ry* values (peak to valley heights) in the assessment length.[7]

3.1.10 *Ry, n*—in measuring surface finish, the vertical

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[2] *Annual Book of ASTM Standards*, Vol 05.01.

[3] *Annual Book of ASTM Standards*, Vol 05.02.

[4] *Annual Book of ASTM Standards*, Vol 03.02.

[5] Available from Beuth Verlag GmbH, Burggrafenstrasse 6, 1000 Berlin 30, Germany.

[6] Amstutz, Hu, "Surface Texture: The Parameters," Bulletin MI-TP-003-0785, Sheffield Measurement Division, Warner and Swasey, 1985, p. 21.

[7] Amstutz, Hu, "Surface Texture: The Parameters," Bulletin MI-TP-003-0785, Sheffield Measurement Division, Warner and Swasey, 1985, pp. 31, 29.

FIG. 1 SRV Test Machine

distance between the top of the highest peak and the bottom of the deepest valley in one sampling length.[8]

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *extreme pressure, adj—in lubrication*—characterized by metal surfaces in contact under high-stress rubbing conditions.

3.2.2 *seizure, n*—localized fusion of metal between the rubbing surfaces of the test pieces.

3.2.2.1 *Discussion*—In this test method, seizure is indicated by a rise in the coefficient of friction, over steady state, of greater than 0.2. In severe cases, a stoppage in the motor will occur.

3.2.3 *SRV, n*—Schwingung, Reibung, Verschleiss (German); oscillating, friction, wear (English translation).

4. Summary of Test Method

4.1 This test method is performed on an SRV test machine using a steel test ball oscillating against a steel test disk with lubricant between them. Test load is increased in 100-N increments until seizure occurs. The load, immediately prior to the load at which seizure occurs, is measured and reported.

NOTE 1—Test frequency, stroke length, temperature, and ball and disk material can be varied to simulate field conditions. The test ball yields point-contact geometry. To obtain line or area contact, test pieces of differing configurations can be substituted for the test balls.

[8] Amstutz, Hu, "Surface Texture: The Parameters," Bulletin MI-TP-003-0785, Sheffield Measurement Division, Warner and Swasey, 1985, p. 25.

5. Significance and Use

5.1 This laboratory test method can be used to quickly determine extreme pressure properties of lubricating greases at selected temperatures specified for use in applications where high-speed vibrational or start-stop motions are present with high Hertzian point contact. This test method has found wide application in qualifying lubricating greases used in constant velocity joints of front-wheel-drive automobiles. Users of this test method should determine whether results correlate with field performance or other applications.

6. Apparatus

6.1 *SRV Test Machine*[9], illustrated in Fig. 1 and Fig. 2.

7. Reagents and Materials

7.1 *Test Balls*[9], 52100 steel, 60 ± 2 Rc hardness, 0.025 ± 0.005-µm *Ra* surface finish, 10-mm diameter.

7.2 *Lower Test Disk*[9], 52100 steel, 60 ± 2-Rc hardness, 0.45 to 0.65-µm *Rz* lapped surface, 24-mm diameter by 7.85 mm thick.

NOTE 2—Test pieces made to 100 Crb steel (DIN 17230) are equivalent.

[9] The sole source of supply of the apparatus known to the committee at this time is Optimal Instruments GmbH, Friedenstrasse 10, D-81671 Munich, Germany. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.