Designation: D8316 – 20a (Reapproved 2025)

Standard Test Method for Measuring Friction and Wear Properties of Extreme Pressure (EP) Lubricating Oils with the Roller-Disk Geometry Using SRV Test Machine[1]

This standard is issued under the fixed designation D8316; 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.

INTRODUCTION

This test method represents the transformation of DIN 51834-4:2020.

1. Scope

1.1 This test method covers an extreme pressure (EP) lubricating oil's coefficient of friction and its ability to protect against wear when subjected to high-frequency, linear oscillation motion. The test utilizes a roller-on-disc geometry, where the roller is inclined/deflected by 10° to the oscillating movement. The procedure is identical to that described in DIN 51834, Part 4.

1.2 This test method can also be used to determine the ability of a non-EP lubricating oil to protect against wear and its coefficient of friction under similar test conditions.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A295 Specification for High-Carbon Anti-Friction Bearing Steel

D235 Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)

D5182 Test Method for Evaluating the Scuffing Load Capacity of Oils (FZG Visual Method)

D5706 Test Method for Determining Extreme Pressure Properties of Lubricating Greases Using a High-Frequency, Linear-Oscillation (SRV) Test Machine

D6425 Test Method for Measuring Friction and Wear Properties of Extreme Pressure (EP) Lubricating Oils Using SRV Test Machine

D7421 Test Method for Determining Extreme Pressure Properties of Lubricating Oils Using High-Frequency, Linear-Oscillation (SRV) Test Machine

E45 Test Methods for Determining the Inclusion Content of Steel

G40 Terminology Relating to Wear and Erosion

2.2 *DIN Standards:*[3]

DIN EN ISO 683-17 Heat-treated steels, alloy steels and free-cutting steels – Part 17: Ball and roller bearing steels

DIN 5402-1 Rolling bearings – Parts of rolling bearings – Part 1: Cylindrical rollers

DIN 51631:1999 Mineral Spirits – Special Boiling Point Spirits – Requirements

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.L0.11 on Tribological Properties of Industrial Fluids and Lubricates.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from Deutsches Institut für Normung e.V.(DIN), Am DIN-Platz, Burggrafenstrasse 6, 10787 Berlin, Germany, http://www.din.de.

DIN 51834-4 Tribological Test in the Translatory Oscillation Apparatus (Part 4: Determination of friction and wear data for lubricating oils with the cylindrical roller-disk geometry)

DIN EN ISO 13565-2:1998 Geometrical Product Specifications (GPS) – Surface Texture: Profile Method; Surfaces Having Stratified Functional Properties – Part 2: Height Characterization using the Linear Material Ratio Curve (replacement of DIN 4776:1990)

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, that are uncharacteristic of the given tribological system's longterm behavior. (*Synonym*: **run-in, wear-in**) **G40**

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

$$\mu = (F_f / F_n) \quad (1)$$

3.1.3 *EP lubricating oil, n*—a liquid lubricant containing an extreme pressure (EP) additive.

3.1.4 *extreme pressure (EP) additive, n—in a lubricant*, a substance that minimizes damage to metal surfaces in contact under high stress rubbing conditions.

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

3.1.6 *Hertzian contact pressure, n*—the magnitude of the pressure at any specified location in a Hertzian contact area, as calculated from Hertz's equations of elastic deformation. **D7421**

3.1.6.1 *Discussion*—The Hertzian contact pressure can also be calculated and reported as maximum value P_{max} in the center of the contact or as $P_{average}$ as average over the total contact area.

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

3.1.8 P_{geom}, *n*—geometric contact pressure describes the load carrying capacity at test end (see 9.3.6).

3.1.9 *Ra (C.L.A.), n—in measuring surface finish*, the arithmetic average of the absolute distances of all profile points from the mean line for a given distance.[4]

3.1.10 *Rpk, n*—reduced peak height according to DIN EN ISO 13565-2:1998; half the Rpk value is the mean height of the peak sticking out above the core profile section.

3.1.11 *Rvk, n*—reduced valley height according to DIN EN ISO 13565-2:1998; Rvk is the mean depth of the valley reaching into the material below the core profile section.

3.1.12 *Rz, (DIN), n—in measuring surface finish*, the average of all *Ry* values (peak to valley heights) in the assessment length.[4]

3.1.13 *wear, n*—damage to a solid surface, generally involving progressive loss of material, due to relative motion between that surface and a contacting substance or substances. **G40**

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *seizure, n*—localized fusion of metal between the rubbing surfaces of the test pieces. **D5706**

3.2.1.1 *Discussion*—In this test method, seizure is indicated by a sharp rise in the coefficient of friction, over steady state, of greater than 0.2 for over 20 s. In severe cases, a stoppage in the motor will occur.

3.3 *Abbreviations:*

3.3.1 *FZG, n*—commonly referred to Forschungstelle für Záhnräder und Getriebebau (German); Research Site for Gears and Transmissions) Visual Method (English translation) **D5182**

3.3.2 *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 test roller oscillated at constant frequency and stroke amplitude and under constant load (F_n), against a test disk that has been wetted with the lubricant specimen. The movement of the roller is inclined/deflected by 10° to the oscillating axis (see Fig. 1). The test disk receiving block to which the test disk is attached is held at a constant temperature.

NOTE 1—The frequency of oscillation, stroke length, test temperature, test load, test duration, and test roller and disk material can be varied from those specified in this test method. The test roller yields Hertzian line contact geometry. To obtain point or area contact, test pieces of differing configurations can be substituted for the test roller.

4.2 The friction force, F_f, is measured by a piezo-electric device in the test disk assembly. Peak values of coefficient of friction, *f*, are determined and recorded as a function of time.

4.3 After the preset test period, the test machine and data acquisition are stopped and the wear scar widths on the roller

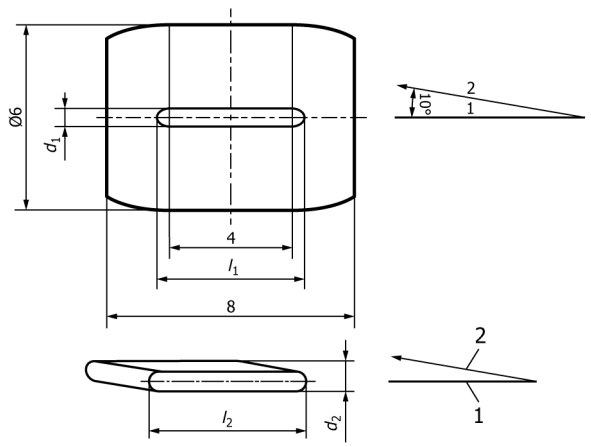

FIG. 1 Schematics on the Roller Designs, the Wear Quantities, and the Wear Scar Width d_1 on Roller (top) and Wear Track Width d_2 on Disk (bottom)

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