



## Standard Test Method for Estimation of Deleterious Particles in Lubricating Grease<sup>1</sup>

This standard is issued under the fixed designation D 1404/D 1404M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This test method covers a procedure for the detection and estimation of deleterious particles in lubricating grease.

1.2 This test method is applicable to all lubricating greases. It can also be used to test other semi-solid or viscous materials. Grease fillers, such as graphite and molybdenum disulfide, can be tested for abrasive contaminants by first mixing them into petrolatum or grease known to be free of deleterious particles.

1.3 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system shall be used independently of the other. Combining values from the two systems could result in nonconformance with the 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 and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

D 235 Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)

D 785 Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials

D 4175 Terminology Relating to Petroleum, Petroleum Products, and Lubricants

### 3. Terminology

3.1 *Definitions*—See Terminology D 4175.

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

3.1.2 *lubricating grease, n*—a semi-fluid to solid product of a dispersion of a thickener in a liquid lubricant.

3.1.2.1 *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.

3.1.3 *thickener, n*—in lubricating grease, a substance composed of finely-divided particles dispersed in a liquid lubricant to form the product's structure.

3.1.3.1 *Discussion*—The solid thickener can be fibers (such as various metallic soaps) or plates or spheres (such as certain non-soap thickeners), which are insoluble or, at the 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.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *deleterious particles, n*—in lubricating grease, minute bits of solid material present as a contaminant and abrasive to acrylic plastic.

### 4. Summary of Test Method

4.1 A small portion of the lubricating grease sample is placed between two clean, highly polished acrylic-plastic plates held rigidly and parallel in metal holders. A pressure of 200 psi [1.38 MPa] is applied, and one plate is rotated 30° relative to the other. Particles harder than the plastic and exceeding in size the distance between the plates will imbed in the plates and cause characteristic, arc-shaped scratches in the plates.

4.2 The relative number of such solid particles can be estimated by counting the total number of arc-shaped scratches on the two plates.

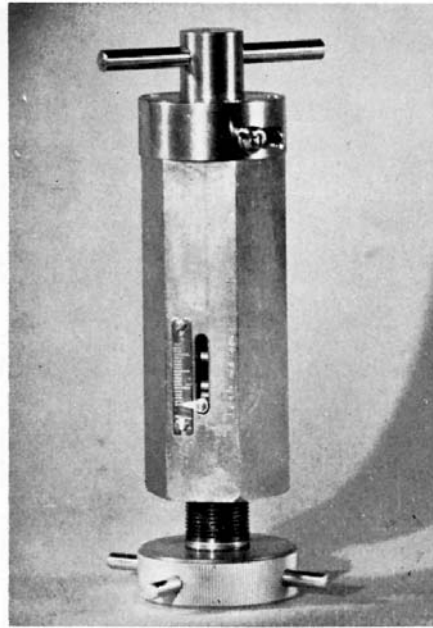
### 5. Significance and Use

5.1 The significance of the number of scratches as far as correlation with field performance is concerned has not been established. A particle which is abrasive to plastic will not necessarily be abrasive to steel or other bearing materials. Some correlation was obtained in that the contaminant used in Sample 3 (see 10.1.1) had a greater wear rate in a laboratory ball bearing abrasive wear test than the contaminant in Sample 2.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.G0 on Lubricating Grease.

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



(a) Assembled View



(b) Unassembled View

**FIG. 1 Apparatus for Determining Deleterious Particles in Lubricating Grease**

NOTE 1—The number of scratches obtained cannot be used to draw fine differences between greases, but rather, to group them into two or three general classes. One such possible division could be:

- 1 ... less than 10 scratches
- 2 ... 10 to 40 scratches
- 3 ... more than 40 scratches

5.2 An advantage of this test method is that each test takes only a few minutes to run.

5.3 This test method is used for quality control and specification purpose.

## 6. Apparatus

6.1 The test apparatus is shown in Figs. 1 and 2. As

illustrated in Fig. 2, the plastic test plates,<sup>3</sup> 1, are rigidly held in a parallel position in square recesses in parts 2 and 7. The holder, 7, is part of the cap assembly, 7 to 11, which can be removed as a unit from the body, 3, by removing four cap screws. The lower plate holder, 2, can slide along the axis of the main housing, but it is restricted from turning by keys

<sup>3</sup> Suitable, commercial acrylic plastic, produced in uniform, highly polished sheets, is available as Plexiglas and Lucite, manufactured respectively by Rohm and Haas Co. (Independence Mall, Philadelphia, PA) and E. I. du Pont de Nemours and Co. (Wilmington, DE). Sized test plates are available from Koehler Instrument Co., Inc., 1595 Sycamore Ave., Bohemia, NY 11716.