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Designation: **326/83 (88)**

## Standard Test Method for Measurement of Load-Carrying Capacity of Lubricating Grease (Timken Method)<sup>1</sup>

This standard is issued under the fixed designation D 2509; 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. ~~This test method was adopted as an ASTM-IP Standard.~~

### 1. Scope

1.1 This test method covers the determination of the load-carrying capacity of lubricating greases by means of the Timken Extreme Pressure Tester.

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. For specific precautionary statements see Note 1, Note 2, and Note 4. For specific warning statements, see 7.1, 7.2, and 9.4.*

### 2. Referenced Documents

#### 2.1 ~~ASTM Standards:~~

~~D235 Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent) ASTM Adjuncts:  
Glossy Prints of Test Blocks Showing Various Types of Scar<sup>2</sup> D329 Specification for Acetone<sup>2</sup>~~

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *load-carrying capacity, of a lubricating grease, n*—the maximum load or pressure that can be sustained by a lubricating grease without failure of the sliding contact surfaces as evidenced by seizure or welding.

3.1.1.1 *Discussion*—The values of load carrying capacity of a lubricating grease vary according to test method.

3.1.2 *scoring, in tribology, n*—a severe form of wear characterized by the formation of extensive grooves and scratches in the direction of sliding.

3.1.2.1 *Discussion*—When the lubricant film is substantially maintained, a smooth scar is obtained on the test block, but when there is a breakdown of the lubricant film, scoring or surface failure of the test block takes place as shown in Fig. 1.<sup>2</sup> In its simplest and recognized form, scoring is characterized by a wide scar on the test block and by the transfer of metal from the test block to the contacting surface of the test cup. The form of surface failure more usually encountered, however, consists of a comparatively smooth scar, which shows local damage that usually extends beyond the width of the scar. Scratches or striations that occur in an otherwise smooth scar and that do not extend beyond the width of the scar are not considered scoring in this test method.

3.1.3 *seizure or welding, n*—localized fusion of rubbing metal, usually indicated by streaks of transferred metal, increased friction and wear, or unusual noise and vibration.

3.1.4 *wear, n*—the removal of metal from a rubbing surface by mechanical action, or by a combination of mechanical and chemical actions.

#### 3.2 Definitions of Terms Specific to This Standard:

<sup>4</sup> This method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.G on Lubricating Grease.

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<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.G0.04 on Functional Tests - Tribology.

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This test method was adopted as an ASTM-IP Standard.

<sup>2</sup> Annual Book of ASTM Standards, Vol 06.04.

<sup>2</sup> Available from ASTM International Headquarters. Order Adjunct No. ADJD2509. Original adjunct produced in 1972.

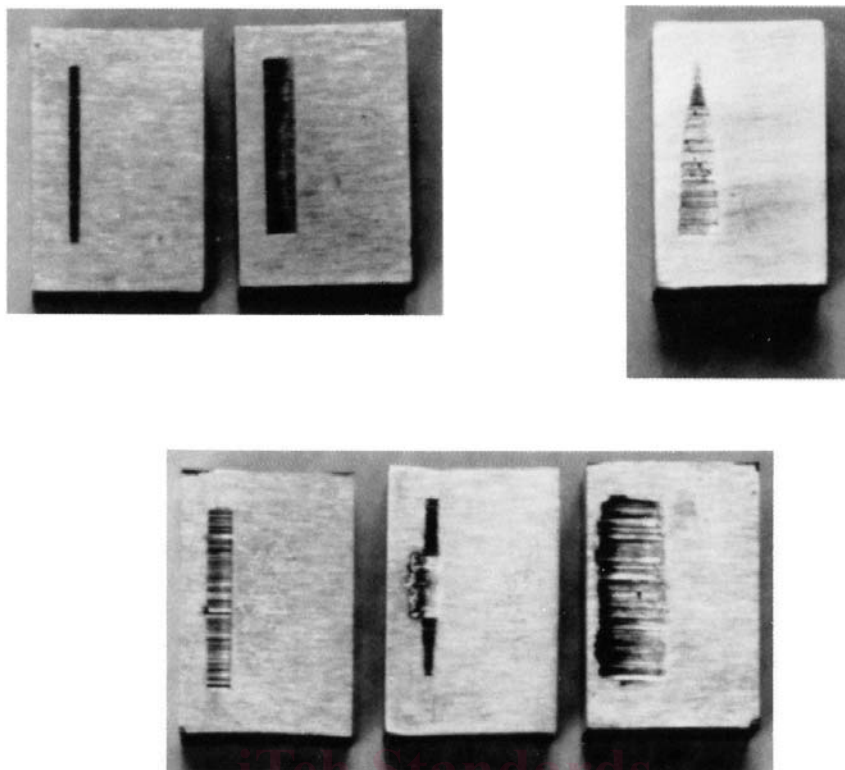


FIG. 1 Test Blocks Showing Various Types of Scar

3.2.1 *OK value, n*—the maximum mass (weight) added to the load lever mass (weight) pan, at which no scoring or seizure occurs.

3.2.2 *score value, n*—the minimum mass (weight) added to the load lever mass (weight) pan, at which scoring or seizure occurs.

#### 4. Summary of Test Method

4.1 The tester is operated with a steel test cup rotating against a steel test block. The rotating speed is  $123.71 \pm 0.77$  m/min ( $405.88 \pm 2.54$  ft/min) which is equivalent to a spindle speed of  $800 \pm 5$  rpm. Grease samples are brought to and applied at  $24 \pm 6^\circ\text{C}$  ( $75 \pm 10^\circ\text{F}$ ).

4.2 Two determinations are made: the minimum load (score value) that will rupture the lubricant film being tested between the rotating cup and the stationary block and cause abrasion; and the maximum load (OK value) at which the rotating cup will not rupture the lubricant film and cause abrasion between the rotating cup and the stationary block.

#### 5. Significance and Use

5.1 The test method is used widely for specification purposes and is used to differentiate between greases having low, medium, or high levels of extreme pressure characteristics. The results may not correlate with results from service.

#### 6. Apparatus and Materials

6.1 *Timken Extreme Pressure Tester*, described in detail in Annex A1 and illustrated in Fig. 2.

6.2 *Sample Feed Devices*, for supplying the test specimens with grease are described in Annex A1.

6.3 *Loading Mechanism*, for applying and removing the load mass (weight) without shock at the uniform rate 0.91 to 1.36 kg/s (2 to 3 lb/s). A detailed description is given in Annex A1.

6.4 *Test Cups*,<sup>3,4</sup> of carburized steel, having a Rockwell Hardness C Scale Number of 58 to 62, or a Vickers Hardness Number of 653 to 746. The cups have a width of  $13.06 \pm 0.05$  mm ( $0.514 \pm 0.002$  in.), a perimeter of  $154.51 \pm 0.23$  mm ( $6.083 \pm 0.009$  in.), a diameter of  $49.22 +0.025, -0.127$  mm ( $1.938 +0.001, -0.005$  in.), and a maximum radial run-out of 0.013 mm (0.0005 in.). The axial surface roughness should lie between 0.51 and 0.76  $\mu\text{m}$  (20 and 30  $\mu\text{in.}$ ) C.L.A.

<sup>3</sup>Glossy prints of Fig. 1 are available from ASTM. Request Adjunct No. ADJD2509.

<sup>3</sup>The sole source of supply of the test cups known to the committee at this time is Falex Corporation, 1020 Airpark Dr., Sugar Grove, IL, 60554-9585 under Part No. F-25061.

<sup>4</sup>Available from the Falex Corp. 1020 Airpark Dr., Sugar Grove, IL 60554 under Part No. F-25061.

<sup>4</sup>If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

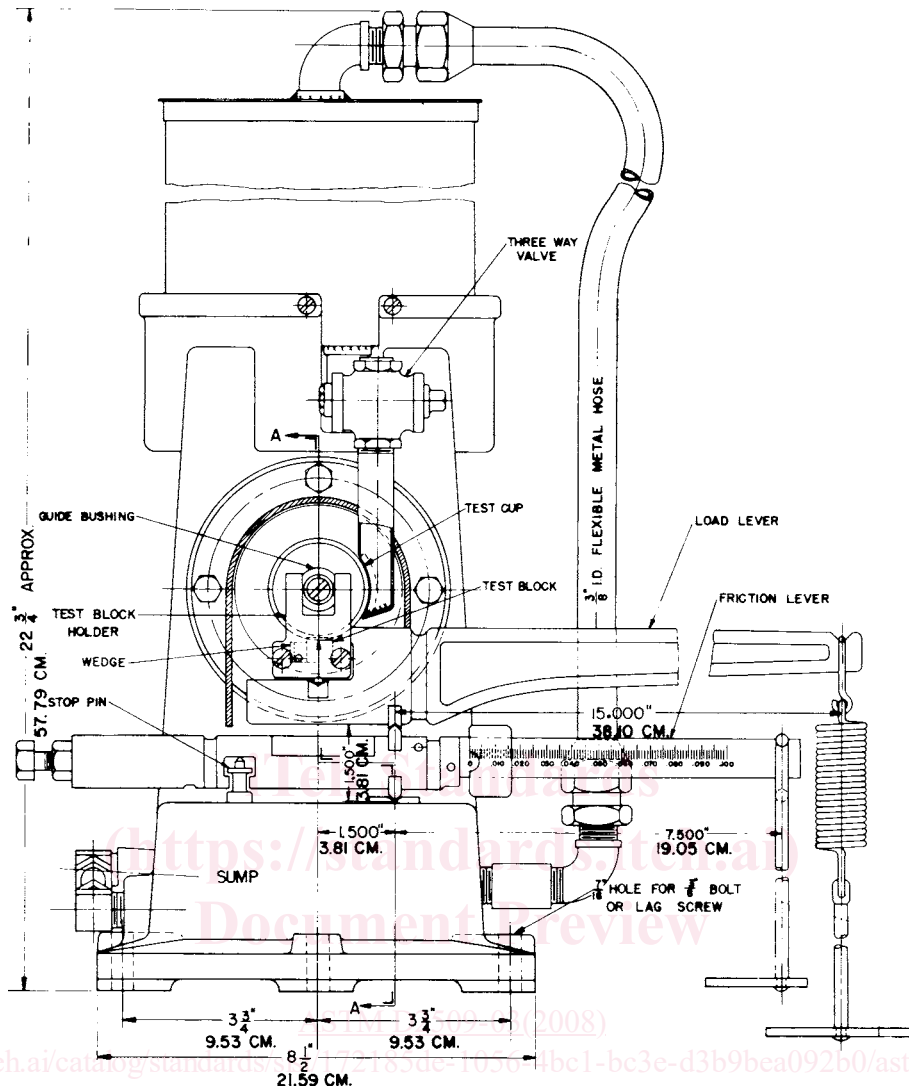


FIG. 2 Timken Tester

6.5 *Test Blocks*—Test Blocks<sup>4,5</sup> with test surfaces  $12.32 \pm 0.10$  mm ( $0.485 \pm 0.004$  in.) wide and  $19.05 \pm 0.41$  mm ( $0.750 \pm 0.016$  in.) long, of carburized steel, having a Rockwell Hardness C Scale Number of 58 to 62, or a Vickers Hardness Number of 653 to 746. Each block is supplied with four ground faces and the surface roughness should lie between 0.51 and 0.76  $\mu$ m (20 and 30  $\mu$ in.) C.L.A.

6.6 *Microscope*—<sup>4,6</sup> low-power ( $50\times$  to  $60\times$ ), having sufficient clearance under objective to accommodate the test block. It should be fitted with a filar micrometer so that the scar width may be measured with an accuracy of  $\pm 0.05$  mm ( $\pm 0.002$  in.).

6.7 *Timer*, graduated in minutes and seconds.

## 7. Reagents

7.1 *Acetone*, conforming to Specification D329.

Note 1—**Warning**: Extremely flammable. Vapors can cause flash fire.

7.2, *reagent grade, minimum purity*. (**Warning**—Extremely flammable. Vapors can cause flash fire.)

7.2 *Stoddard Solvent*, conforming to Specification D235. (White Spirit conforming to British Standard 245, Type I, is considered a functionally equivalent material.)

<sup>4</sup> Available from Falex Corp. under Part No. F-25001.

<sup>5</sup> The sole source of supply of the test blocks known to the committee at this time is Falex Corporation, 1020 Airpark Dr., Sugar Grove, IL, 60554-9585 under Part No. F-25001.

<sup>6</sup> Falex Corp. is a satisfactory source of supply.

<sup>7</sup> The sole source of supply of the apparatus known to the committee at this time is Falex Corporation, 1020 Airpark Dr., Sugar Grove, IL, 60554-9585.

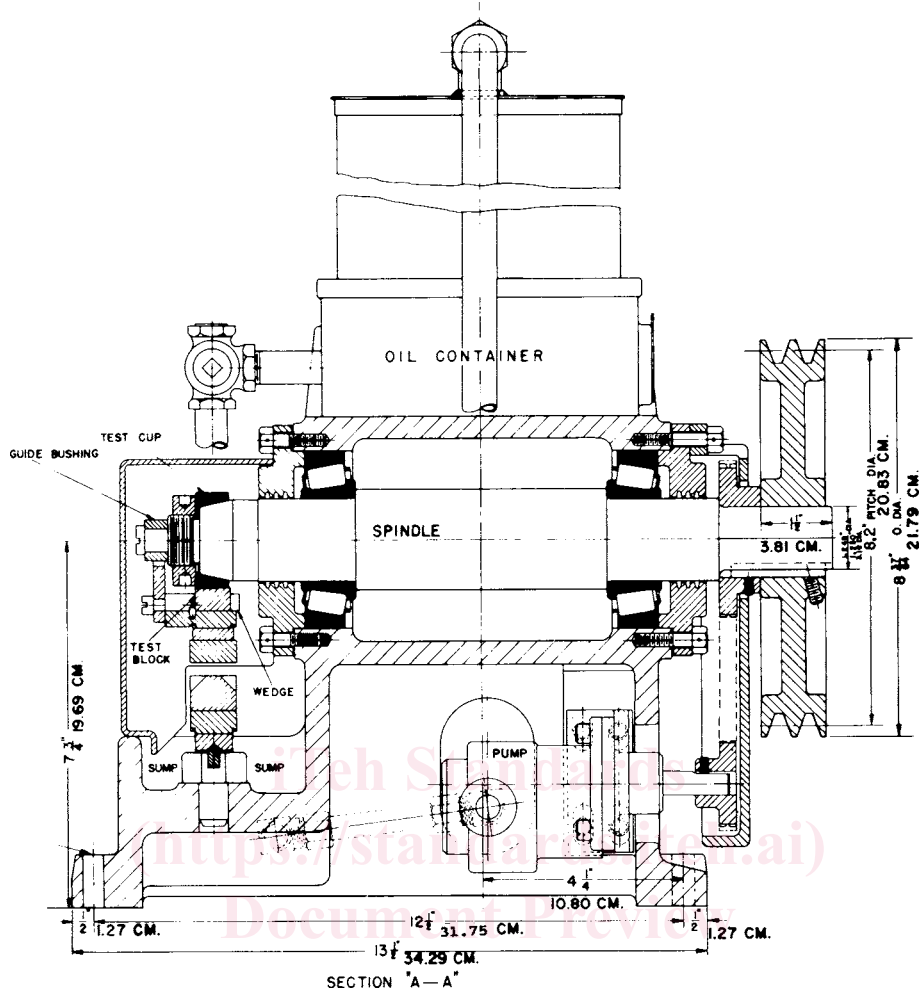


FIG. 2 Timken Tester (continued)

<https://standards.iteh.ai/catalog/standards/sist/172185de-1056-4bc1-bc3e-d3b9bea092b0/astm-d2509-032008>

NOTE 2—**Warning:** Combustible. Vapor harmful., also known as Mineral Spirits, reagent grade. (**Warning**—Combustible. Vapor harmful.)

## 8. Preparation of Apparatus

8.1 Clean the apparatus with Stoddard solvent (**Warning**—See Note 2 and acetone (see 7.1.) and acetone (**Warning**—See Note 7.2.)), and blow dry. Shield the sump outlet and disconnect the oil pump to eliminate wear on the unused pump. Replace the oil reservoir with the grease feed device.

8.2 Select a new test cup and block, wash with Stoddard solvent, and dry with a clean soft cloth or paper. Immediately before use rinse the test cup and block with acetone and blow them dry. Do not use solvents such as carbon tetrachloride or others that may inherently possess load-carrying properties which may affect the results.

8.3 Assemble the tester carefully (Fig. 3), placing the test cup on the spindle and making certain that it is well seated, drawing

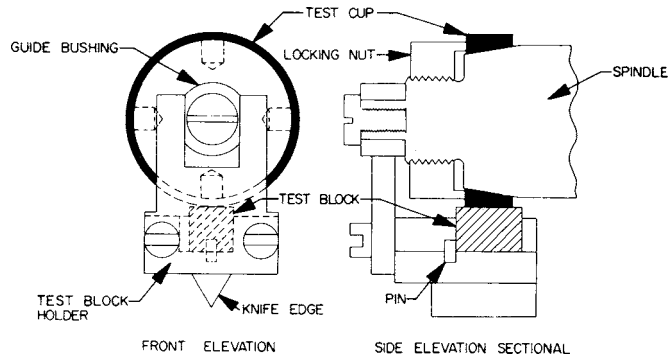


FIG. 3 Assembly of Tester Showing Test Pieces