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Lubricants — Determination of tribological quantities for oils and greases — Tribological test in the translatory oscillation apparatus

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 28, *Petroleum and related products from synthetic or biological origin*.

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Introduction

Liquid lubricants (oils) and consistent lubricants (greases) reduce friction and wear and/or prevent adhesive wear (scuffing, galling). In order to establish the tribological profile of a lubricant adequate tribometric, test methods are required. The test method described in this document can be regarded as an evaluation tool for the determination of the lubricant-related contribution to friction, wear, load carrying capacity and extreme pressure behaviour.

This test method is dedicated to a translatory oscillation apparatus which is fully computer controlled.

This test method harmonizes the following national test methods using the ball-on-disk contact geometry:

a) DIN 51834-2[1] (oil, coefficient of friction and wear);

b) ASTM D6425[2] (oil, coefficient of friction and wear);

ASTM D7421[4] (oil, pass load/O.K. load);

ASTM D5706[6] (grease, pass load/O.K. load);

ASTM D5707[8] (grease, coefficient of friction and wear);

c) SH/T 0721[9] (grease, coefficient of friction and wear);

SH/T 0784[7] (grease, pass load/O.K. load);

NB SH/T 0847[3] (oil, coefficient of friction and wear);

NB/SH/T 0882[5] (oil, pass load/O.K. load).

The harmonization is also related to the use of only one type of cleaning solvent.

Users of this test method should determine whether the results obtained from this method correlate with field performance or other applications.

It is the responsibility of the operator to ensure that all local legislative and statutory requirements are met.

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Lubricants — Determination of tribological quantities for oils and greases — Tribological test in the translatory oscillation apparatus

1 Scope

This document describes test methods based on a high-frequency, linear-oscillation test machine to determine tribological quantities like friction, wear, load carrying capacity and extreme pressure behaviour of liquid lubricants (oils) and consistent lubricants (greases) in the ball-on-disk contact geometry.

NOTE This method is technically equivalent to DIN 51834–2/ASTM D6425[1] (NB/SH/T 0847[3]) and ASTM D7421[4] (NB/SH/T 0882[5]) for oils, as well as ASTM D5706[6] (SH/T 0784[7]) and ASTM D5707[8] (SH/T 0721[9]) for greases.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 683-17, *Heat-treated steels, alloy steels and free-cutting steels — Part 17: Ball and roller bearing steels*

IEC 584-1, *Thermocouples — Part 1: Reference tables*

IEC 584-2, *Thermocouples — Part 2: Tolerances*

IEC 751, *Industrial platinum resistance thermometer and platinum temperature sensors*

ASTM D7755, *Standard Practice for Determining the Wear Volume on Standard Test Pieces Used by High-Frequency, Linear-Oscillation (SRV) Test Machine*

DIN 51631:1999-04, *Mineral spirits — Special boiling point spirits — Requirements*

DIN 51834-3, *Testing of lubricants — Tribological test in the translatory oscillation apparatus — Part 3: Determination of tribological behaviour of materials in cooperation with lubricants*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp/

3.1
wear volume
W_V
irreversible loss of volume to the ball or the disk (flat) at the end of test

Note 1 to entry: The determination of the wear volumes of ball and disk are described in DIN 51834–3 or ASTM D7755 or an equivalent National Standard.

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3.2
adhesive failure
particularly severe form of damage to the surface in which *seizure* (3.3) or welding together of surface areas occur

Note 1 to entry: Synonyms frequently used are “galling” (US) or “scoring” (UK). It has different meanings and macroscopic morphologies (see Annex A).

Note 2 to entry: The surface damages are usually material transfer, roughening and plastic flow, or all, as well as localized fusion of metal.

3.3
seizure
localized fusion of metal between the rubbing surfaces of the test pieces

Note 1 to entry: Seizure is usually indicated by a sharp increase in coefficient of friction, over steady-state, of delta >0,2 for over 20 s, or by unusual noise and vibration.

Note 2 to entry: In severe cases, a stoppage in the motor will occur.

Note 3 to entry: Under unlubricated oscillation, ball bearing steel 100Cr6 has coefficients of friction above 0,4.

3.4
pass load
O.K. load
last load during the extreme pressure test where no *adhesive failure* (3.2) or adhesive mechanisms were observed

3.5
load carrying capacity
geometric contact pressure at the end of the test

Note 1 to entry: The load carrying capacity of the tribocouple can be additionally calculated according to the following formula:

$$P_{\text{geom}} = \frac{4 \cdot F_{\text{n}}}{\pi \cdot WSD^2}$$

where

F_{n} is the normal force (synonym: test load);

P_{geom} is the geometric contact pressure;

WSD is the mean wear scar diameter of ball.

4 Principle

This test method is performed on a translatory oscillation apparatus using a test ball made in bearing steel mating the top of a flat stationary disk made in bearing oscillating each other, which can be operated under different sets of test parameters (test frequency, stroke length, temperature, load and test time). The general contact situation is shown in Figure 1.

NOTE It has been assumed by the compilers of this test method that anyone using the method will be familiar with the operation manual of the test machine, as well as either be fully trained and familiar with all usual engineering and laboratory practices, or will be under the direct supervision of such a person.

IMPORTANT — Protection against machine noise during testing is recommended.

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