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Petroleum and related products — Determination of shear stability of lubricating oils containing polymers — Four ball method using a tapered roller bearing

Pétrole et produits connexes — Détermination da la stabilité au cisaillement des huiles lubrifiantes contenant des polymères — Essai quatre billes avec roulement à rouleaux coniques

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Proposer's preliminary Remarks:

This draft text is the basis for a NWIP.
The specified test method is close to identical to CETOP RP 112 H, DIN 51360-6, and CEC-L-45-A-99, which all three are well known and accepted, fully developed test methods. We would therefore respectfully propose to accept this text as a CD once the WI has been accepted.

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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.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO XXXXX was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*.

Petroleum and related products — Determination of shear stability of lubricating oils containing polymers — Four ball method using a tapered roller bearing

1 Scope

The method specified in this standard serves to determine the shear stability of polymer-containing lubricating oils, including pressure fluids, by the four-ball tester as specified in ISO 20623, but using a tapered roller bearing. The test results allow prediction of the in-service permanent viscosity loss.

2 Normative references

This standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the titles of the publications are listed below. For dated references, subsequent amendments to or revisions of any of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

ISO 3104, *Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity*

ISO 20623, *Petroleum and related products – Determination of the extreme-pressure and anti-wear properties of fluids – Four ball method (European conditions)*

3 Terms and definitions

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

3.1
percentage viscosity loss
R_V
the measure of shear stability used in this standard, calculated according to equation (1)

$$R_V = \frac{\nu_0 - \nu_1}{\nu_0} \cdot 100 \qquad (1)$$

where

ν_0 is the kinematic viscosity of the unsheared oil, in mm^2/s;

ν_1 is the kinematic viscosity of the sheared oil, in mm^2/s.

NOTE A small value indicates a high shear stability.

4 Principle

Using the splash lubrication method, a volume of 40 ml of the lubricating oil is tested at a constant temperature of 60 °C in a tapered roller bearing driven by the four ball tester. The test is carried out at constant speed and the load applied during a given running time is 5000 N. The kinematic viscosity of the lubricating oil is determined at a temperature of 100 °C before and after the test. The percentage viscosity loss, R_V , is calculated from these two viscosities.

5 Reagents and materials

Use solvents for cleaning appropriate to the material last tested. For mineral oils, light hydrocarbons and acetone are suitable. For some hydraulic fluids, a low molecular mass alcohol will assist in the first cleaning stage.

6 Apparatus

6.1 Four-ball tester, as specified in ISO 20623.

6.2 Tapered roller bearing, of type 32008X[1)].

6.3 Tapered roller bearing holder[1)], as shown in figure 1**.**

6.4 Temperature control device, for heating the tapered roller bearing holder to a temperature of (60 ± 1) °C, using a thermostat provided with external control.

6.5 Ubbelohde viscosimeter, as specified in ISO 3104.

7 Preparation

7.1 Preparing the tapered roller bearing holder

Prior to the test, clean the holder and the tapered roller bearing with a cleaning solvent (clause 5) and dry in a stream of dry air, or with a clean, dry, lint-free cloth.

7.2 Assembly of tapered roller bearing holder

7.2.1 Fit the cup of tapered roller bearing (12) in the cleaned housing (15) and fill in (40 ± 0,2) ml a test portion of the lubricating oil (3) to be tested.

7.2.2 Place the cleaned cone (6) into the seating (10).

7.2.3 Fit the cone together with the rolling elements in the housing prepared as specified in clause 7.2.1 and secure using the locknut.

7.2.4 Using the shaft insert (7), place the tapered roller bearing holder so prepared into the four-ball tester and apply a load of 5000 N.

7.2.5 Connect the temperature probe and temperature control and check their function.

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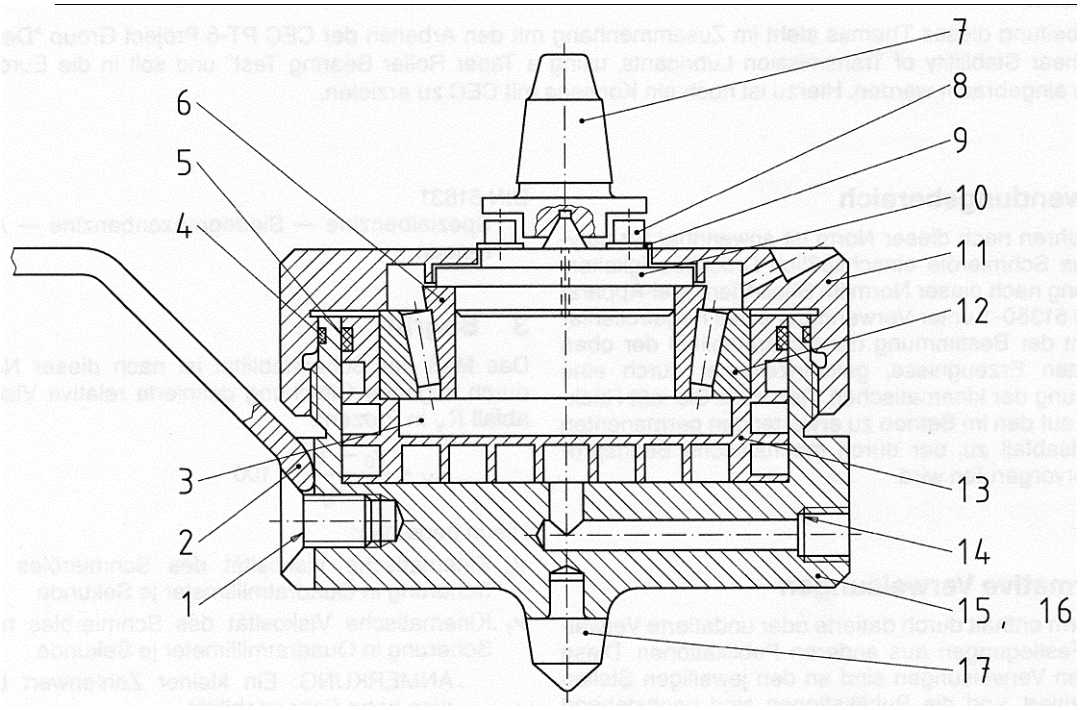
1) Information on sources of supply is obtainable from DIN-Bezugsquellen für normgerechte Erzeugnisse im DIN Deutsches Institut für Normung e.V., Burggrafenstraße 6, D-10787 Berlin.



Legend

1	Countersunk head screw	2	Measuring arm
3	Lubricating oil	4	O-ring
5	O-ring	6	Cone
7	Shaft insert	8	Cheese head screw
9	Spring lock washer	10	Seating of cone
11	Locknut	12	Cup
13	Heater	14	Locating hole for screwed-in socket
15	Housing	16	Parallel pin
17	Cone point		

Figure 1 — Shear stability testing apparatus

7.3 Test conditions

See table 1.

Table 1 — Test conditions

Test parameter	Test condition
Rotational motor speed	approx. 1450 rpm (min^{-1})
Lubricating oil temperature	(60 ± 1) °C
Lubricating oil test quantity	(40 ± 0,2) ml
Test load	5000 N
Test duration A	approx. 4 h, equivalent to 348 000 revolutions
Test duration B	approx. 8 h, equivalent to 696 000 revolutions
Test duration C	approx. 20 h, equivalent to 1 740 000 revolutions

NOTE The basis for specifying the test duration was a theoretical nominal rotational speed of 1450 min^{-1} for asynchronous motors. When motors with other rotational speeds are used, the test durations are to be corrected accordingly.

8 Procedure

8.1 After the check specified in 7.2.5, heat the tapered roller bearing holder to about 50 °C with the motor stopped.

8.2 Once the temperature specified in 8.1 has been reached, set the temperature control to (60 ± 1) °C and start the motor.

8.3 The test run shall be finished at the end of the given test duration (see table 1).

8.4 Determine the kinematic viscosity of the lubricating oil at 100 °C as specified in ISO 3104 before and after shearing. Calculate the percentage viscosity loss, R_V, according to equation (1).

9 Expression of results

Report the percentage viscosity loss, R_V , in %, rounded to the nearest 0,1 %, as specified in 8.4.

EXAMPLE 1 Using a tapered roller bearing (KRL), the percentage viscosity loss after a test run of four hours (A), equivalent to 348 000 revolutions of the motor, is 10,06 %.

R_V (KRL; test duration A) = 10,1 %

EXAMPLE 2 Using a tapered roller bearing (KRL), the percentage viscosity loss after a test run of 20 hours (C), equivalent to1 740 000 revolutions of the motor, is 29,55 %.

R_V (KRL; test duration C) = 29,6 %.

10 Precision

Use the following criteria to assess the precision of results.

10.1 Repeatability, r

The difference between two successive results, obtained by the same operator with the same apparatus under constant operating conditions on identical test material would, in the long run, in the normal and correct operation of the test method, exceed the value of 1,0 % (absolute) only in one case in twenty.

10.2 Reproducibility, R

The difference between two single and independent results, obtained by different operators working in different laboratories on identical test material would, in the long run, in the normal and correct operation of the test method, exceed the value of 5,0 % (absolute) only in one case in twenty.

11 Test report

The test report shall contain at least the following information:

a) a reference to this standard;

b) type and designation of the product tested;

c) expression of result as specified in clause 9;

d) any deviation, whether agreed or not, from this method;

e) date of testing.