INTERNATIONAL STANDARD

ISO 26422

First edition
2011-03-15

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

Pétrole et produits connexes — Détermination de la stabilité au cisaillement des huiles lubrifiantes contenant des polymères — Méthode avec roulement à rouleaux coniques

Reference number
ISO 26422:2011(E)

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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 26422 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*.

ISO 26422 is based on DIN 51350-6, which has also been adopted by the Coordinating European Council (CEC) as CEC-L-45-99.

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

WARNING — The use of this International Standard may involve hazardous materials, operations and equipment. This International Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this International Standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.

1 Scope

This International Standard specifies a method of determining 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.

NOTE Other International Standards exist which evaluate viscosity loss of polymer-containing oils. The method specified in this International Standard subjects fluids to a higher shear rate than, for example, the diesel injector nozzle shear test in ISO 20844. It is particularly appropriate for lubricants being used in high shear applications, such as components with gears and roller bearings. In such applications, the shear rate in the ISO 20844 test method can be too low to generate a realistic permanent shear of the fluid.

2 Normative references

The following referenced documents are indispensable for the application 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 355, *Rolling bearings — Tapered roller bearings — Boundary dimensions and series designations*

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
measure of shear stability calculated in accordance with the following equation:

$$R_V = \frac{\nu_0 - \nu_1}{\nu_0} \times 100$$

where

ν_0 is the kinematic viscosity at 100 °C of the unsheared oil, expressed in mm^2/s;

ν_1 is the kinematic viscosity at 100 °C of the sheared oil, expressed in mm^2/s

NOTE 1 A small value indicates a high shear stability.

NOTE 2 The tapered roller bearing test is also known in the industry as the KRL (Kegelrollenlager) principle.

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 5 000 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.

NOTE Other temperatures to determine shear loss, such as 40° C, can be requested by some classification systems.

5 Reagents and materials

5.1 Cleaning solvents, 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, metric series 32008 X, in accordance with ISO 355. The single row tapered roller bearing assembly consists of an inner race with cage and roller assembly and an outer race.

NOTE 1 It is advisable that the inner and outer races be considered to be a matched pair when obtained from the supplier and these components not be interchanged with those of other sets of bearings.

NOTE 2 Precision has only been evaluated on SKF 32008 X/Q bearings (Q for optimized contact geometry and bearing surfaces).

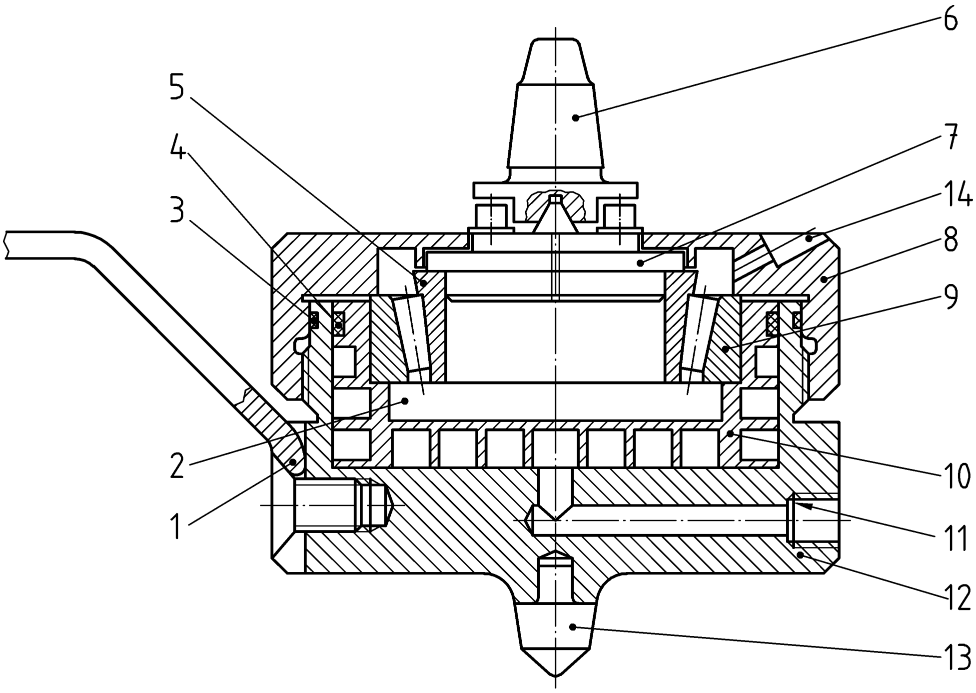
NOTE 3 The adapter shown in Figure 1 is available from several producers. It is advisable only to use adapters that have been proven in tests run in accordance with CEC-L-45-99.

6.3 Shear stability testing apparatus[1], as shown in Figure 1.

6.4 Temperature control device, for controlling the temperature of the oil to a temperature of 60 °C ± 1 °C, using a temperature measuring device located in the shear stability test apparatus.

6.5 Viscometer, an appropriate glass capillary viscometer meeting the requirements of ISO 3105 or a suitable automated viscosimeter should be used for the determination of kinematic viscosity in accordance with ISO 3104.

1) Information on suitable products available commercially can be obtained from DIN-Bezugsquellen für normgerechte Erzeugnisse im DIN Deutsches Institut für Normung e.V., Burggrafenstraße 6, D-10787 Berlin, Germany. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of these products.



Key

1 torque reaction arm
2 test lubricant
3 O-ring
4 O-ring
5 inner race
6 drive spindle
7 drive assembly for inner race
8 tightening nut
9 outer race
10 temperature control device
11 coolant inlet
12 housing
13 conical mounting point
14 location of temperature probe

Figure 1 — Shear stability testing apparatus

7 Preparation

7.1 Preparing the tapered roller bearing and testing apparatus assembly

7.1.1 Prior to the test, clean the housing, housing cover and tapered roller bearing inner and outer race with a cleaning solvent (see 5.1) and dry in a stream of dry air or with a clean, dry, lint-free cloth.

7.1.2 Inspect the O-rings (See Figure 1, items 3 and 4) fitted to the housing and housing cover to ensure that they are properly located and free from damage.

7.1.3 The bearing inner and outer race should be carefully inspected for evidence of mechanical damage, surface deposits, corrosion and thermal staining. Normal wear of the cup and rollers is indicated by a matt grey surface with light circumferential scratching. If damage due to pitting, scoring or surface staining is observed, the cup and cone should be replaced as an assembly. If surface deposits cannot be removed by the procedure detailed in this subclause (7.1), the bearing assembly should be discarded and replaced.

7.2 Assembly of the shear stability testing apparatus

NOTE The numbers in parentheses in this subclause correspond to the items in Figure 1.

7.2.1 Fit the outer race (9) into the cleaned housing (12) and fill with (40 ± 0,5) ml of the test sample.

7.2.2 Press the cleaned inner race (5) onto the drive assembly (7) for the inner race and ensure that it is seated correctly.

7.2.3 Place the inner race and inner race drive assembly into the prepared housing, ensuring that the rollers are fully seated in the outer race. Screw the housing cover into position and fully tighten it using hand pressure only.

7.2.4 Locate the assembled testing apparatus into the four-ball tester, ensuring that the drive spindle (6) engages with the drive assembly (7) for the inner race. Apply a load of (5 000 ± 200) N.

7.2.5 Connect the temperature probe (located at 14) and temperature control device (10) and check their function.

7.2.6 Running in the tapered roller bearing

Before starting the test, ensure that the SKF 32008 X/Q bearing has been run in in accordance with the running-in procedure shown in Figure 2.

NOTE The specified fluid RL 181 is becoming obsolete. Therefore, the CEC group is developing a new running-in and reference procedure, using RL 209 and RL 210.

7.3 Test conditions

The test conditions are specified in Table 1.

Table 1 — Test conditions

Test parameter	Test condition
rotational motor speed	approximately (1 475 ± 25) min^{-1}
lubricating oil temperature	(60 ± 1) °C
lubricating oil test quantity	(40 ± 0,5) ml
test load	(5 000 ± 200) N
test duration	1 740 000 revolutions, equivalent to approximately 20 h

For some applications, longer test runs may be appropriate. 200 h tests can correlate well with some high severity conditions in manual transmissions or axles.

The basis for specifying the test duration is a theoretical nominal rotational speed of 1 450 min^{-1} for asynchronous motors. When motors with other rotational speeds are used, the test durations should be adjusted accordingly.

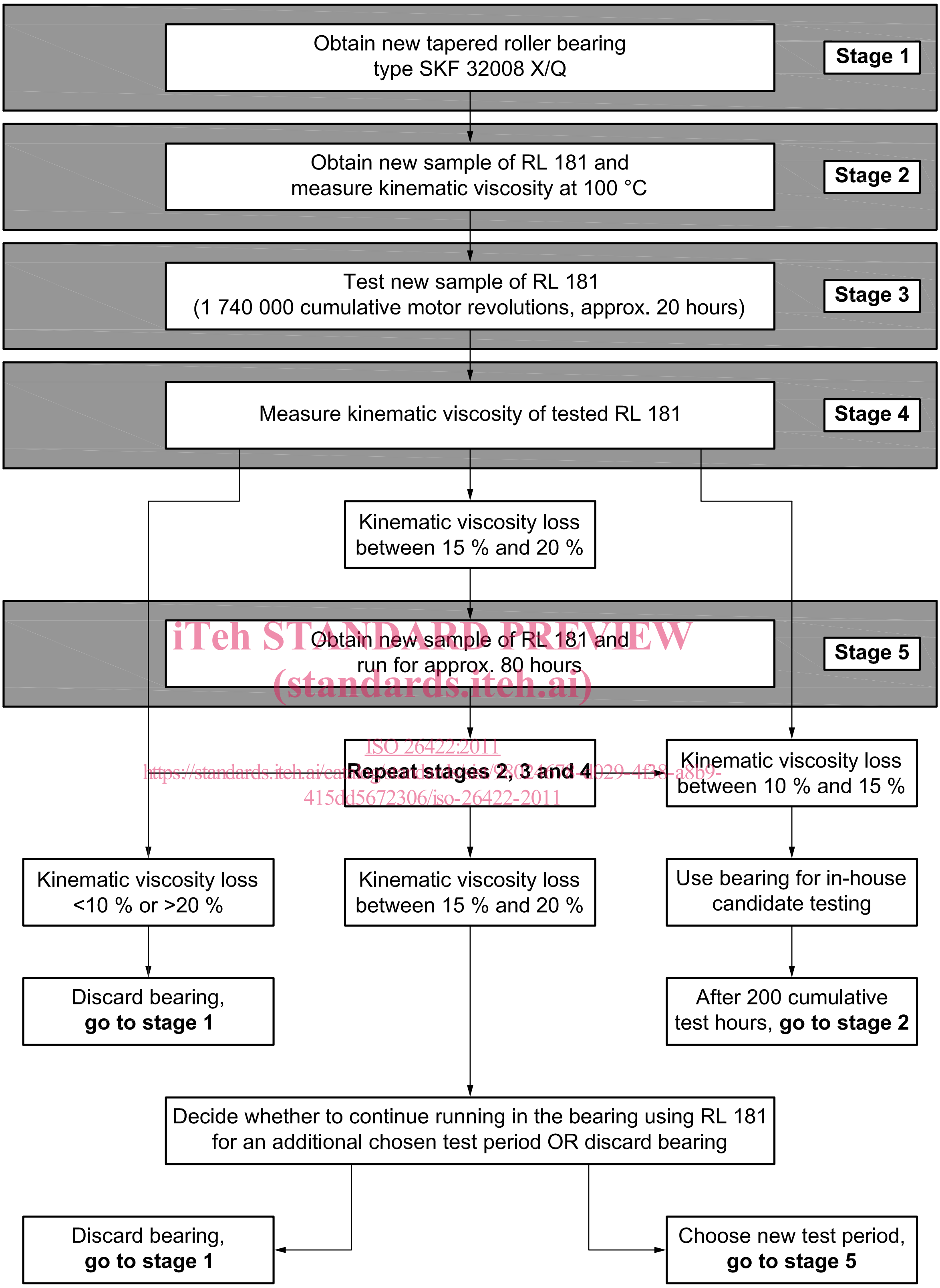


Figure 2 — Running-in procedure chart (see Clauses 5 to 8 for details)