TECHNICAL SPECIFICATION

ISO/TS 11007-2

First edition
2021-07

Petroleum products and lubricants — Determination of rust-prevention characteristics of lubricating greases —

Part 2: Method with water wash-out

Produits pétroliers et lubrifiants — Détermination des caractéristiques antirouille des graisses lubrifiantes —

Partie 2: Méthode avec délavage à l'eau

Reference number
ISO/TS 11007-2:2021(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 28, *Petroleum and related products, fuels and lubricants from natural or synthetic sources*.

This first edition of ISO/TS 11007-2, together with ISO 11007-1, cancels and replaces ISO 11007:1997, which has been technically revised.

The main changes compared to the previous edition are as follows:

— the document has been divided in two parts: part 1 on dynamic wet conditions and part 2 specifying the method with water wash-out;

— other water types and user-specified solutions have been introduced to the test procedure.

A list of all parts in the ISO 11007 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

ISO 11007-1 specifies a method for the evaluation of the corrosion protection properties of lubricating grease in the presence of non-flowing water; the test bearing is immersed partially in the test fluid.

In some industries (e.g. wet sections of paper mills, roll neck bearings of rolling mills) the bearings are submitted to flow of water, rolling emulsions, paper treatment liquors, etc. In case of seal damage of the bearings, the corrosion inhibitors present in the grease may be potentially washed out, hence impairing the corrosion protection properties.

This document describes a procedure using the flow of test fluid (wash-out) instead of the non-flow conditions described in ISO 11007-1[1].

This test method is commonly known as Emcor [1)] test in the industry.

A rolling bearing grease may be not suitable to lubricate plain bearings or gears.

The precision of the method described in this document has not yet been determined by an interlaboratory study.

1) Emcor stands for Emulsion corrosion.

Petroleum products and lubricants — Determination of rust-prevention characteristics of lubricating greases —

Part 2: Method with water wash-out

WARNING — The use of this document can involve hazardous materials, operations and equipment. This document does not purport to address all of the safety problems associated with its use. It is the responsibility of users of this document to take appropriate measures to ensure the safety and health of personnel prior to the application of the document, and to determine the applicability of any other restrictions for this purpose.

1 Scope

This document specifies a method for the determination of the rust prevention characteristics of lubricating grease in the presence of a flow of an aqueous test fluid.

This test method is used to assess the ability of a grease to prevent corrosion in rolling bearings operated in presence of water, synthetic sea water or any industrial aqueous pollutant, under wash out conditions.

NOTE For the purposes of this document, the term "% (*m*/*m*)" is used to represent the mass fraction.

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 15, *Rolling bearings — Radial bearings — Boundary dimensions, general plan*

ISO 648, *Laboratory glassware — Single-volume pipettes*

ISO 1998-1, *Petroleum industry — Terminology — Part 1: Raw materials and products*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 3838, *Crude petroleum and liquid or solid petroleum products — Determination of density or relative density — Capillary-stoppered pyknometer and graduated bicapillary pyknometer methods*

ISO 7120, *Petroleum products and lubricants — Petroleum oils and other fluids — Determination of rust-preventing characteristics in the presence of water*

ISO 23572, *Petroleum products — Lubricating greases — Sampling of greases*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1998-1 and the following apply.

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

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

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

3.1
corrosion
chemical reaction on metal surfaces, when (rolling bearing) steel is in contact with moisture, e. g. water or acid, that causes oxidation of surfaces

4 Principle

A test portion of grease is run in a specialized and carefully cleaned test rig under specified conditions, after introduction of an aqueous test fluid (distilled water, synthetic sea water, sodium chloride solution, user-specified solutions), for a period of approximately a week with a predetermined sequence of running and stopping. At the end of the test period, the apparatus is dismantled and the condition of the outer ring track of the bearing is examined and rated according to the degree of corrosion.

5 Sampling

Unless otherwise specified, sampling shall be conducted in accordance with ISO 23572. The sample shall be evaluated on a representative portion. Any drum, barrel, tanker compartment or any type of container delivered to the end user may be sampled and analysed at the discretion of the purchaser.

6 Apparatus and materials

6.1 Test bearings, double-row self-aligning ball bearings conforming to 1306 K of ISO 15 with a steel cage or polyamide cage, specially inspected and packed to prevent rust.

6.2 Test rig, as specified in Annex A.

6.3 Peristaltic pump, capable of delivering at a constant flow rate of 2,10 ml/min ± 0,2 ml/min (ca. 3 000 ml for the whole test which equals to 1 000 ml for every 8 h rotation of the test rig).

NOTE Multi-channel peristaltic pumps exist, up to 24 channels, allowing to feed the necessary number of plummer blocks.

6.4 Oven, capable of maintaining a temperature of 90 °C ± 2 °C to dry the bearing.

6.5 Dentist's mirror, no magnification.

6.6 Pipette, conforming to ISO 648, capacity of 10 ml.

6.7 Cloth, absorbent, lint free.

6.8 Protective gloves, smooth, clean polyvinyl chloride (PVC), or polyethylene, or nitrile, or latex.

6.9 Filter paper, any suitable absorbent grade.

7 Reagents

Use only reagents of recognized analytical grade.

7.1 Wash solvent, consisting of low-sulfur, low aromatic, low volatility hydrocarbon.

NOTE White spirit according to BS 245[3] or mineral spirit according to ASTM D235[2] (all classes) are suitable.

7.2 Water, conforming to grade 3 of ISO 3696, as wash solvent.

7.3 Test fluid, use one of the following types:

a) water conforming to grade 2 of ISO 3696, or

b) synthetic sea water conforming to the specification given in ISO 7120, or

c) a 0,5 mol/l solution of sodium chloride prepared using water conforming to grade 2 of ISO 3696, at a pH of 8,0 to 8,2, by titration with sodium hydroxide solution.

NOTE Water quality of water used as a test fluid is critical and therefore is a different grade from that specified in 7.2.

Other water types may be used in this test, although the precision when using other water types has not been determined. It is recommended that the pH of other water types is determined before use.

7.4 Propan-2-ol.

7.5 Ammonia solution, 3,2 % (m/m) (1,65 mol/l).

NOTE The ammonia solution is equivalent to a tenfold dilution of 35 % ammonia solution (ρ = 880 kg/m3) with water conforming to grade 3 of ISO 3696. This ammonia concentration is critical to the results of the test.

7.6 Solvent rinse solution, consisting of nine volumes of propan-2-ol (7.4) mixed with one volume of ammonia solution (7.5).

7.7 Silver nitrate solution, 0, 1 mol/l.

8 Preparation of the apparatus

8.1 Remove all traces of grease from previous tests by wiping the plummer blocks housing. Wash the plummer blocks housing and all other parts in solvent rinse solution (7.6) followed by water (7.2). Dry thoroughly using a cloth (6.7).

Where previous tests have been carried out with either synthetic sea water [7.3.b)] or salt water [7.3.c)], pour a few drops of silver nitrate solution (7.7) into the plummer block. Withdraw a sample of the silver nitrate solution using a clean pipette, and inspect for milkiness or a white precipitate. If a white precipitate appears, rinse the plummer block with hot water (7.2) and repeat this washing until a withdrawn sample is clear.

8.2 Wear protective gloves (6.8) for all subsequent handling. Use two new bearings for each test.

8.3 Number the bearings on the outside diameter of the outer ring but do not use acid etching.

A “vibro pen“ or etching marker may be used.

8.4 Wash the bearings in wash solvent (7.1) at 50 °C to 65 °C, to remove the rust-preventative (preservant or preservation fluid).

Repeat the wash using fresh portions of hot wash solvent until the rust-preventative has been completely removed. In cases of dispute, white spirit (see NOTE to 7.1) is the referee solvent.

IMPORTANT — The complete removal of the rust-preventative is critical to the precision of this method. Failure to remove the material wholly will invalidate results.

8.5 Transfer the bearings from the wash solvent to the solvent rinse solution (7.6) to remove any solvent remaining. Rinse the bearings and rotate the outer ring slowly relative to the inner ring, while the bearing is immersed in freshly made solvent rinse solution heated to a minimum of 65 °C.

CAUTION — The washing temperatures specified are significantly higher than the closed flash point of the solvent. Therefore, carry out the washing operations in a well-ventilated hood where no flames or other ignition sources are present.

8.6 Remove the bearings from the solvent rinse solution and place on a filter paper (6.9) or cloth (6.7) to drain thoroughly. Place the bearings in the oven (6.4) until they are completely dry. This requires a minimum of 15 min.

8.7 Remove the bearings from the oven and allow cooling to ambient temperature. Examine the surfaces to ensure that each bearing is corrosion-free and free-turning.

WARNING — Take care not to spin the bearings after cleaning and drying.

8.8 Inspect the outer ring tracks using a dentist's mirror (6.5). If etch spots or corrosion are evident, reject the bearing.

8.9 Determine the mass of grease, *m*, in grams, equivalent to 10,5 ml ± 0,1 ml using Formula (1):

$$m = \rho \cdot V \tag{1}$$

where

ρ is the density of the grease, in kg/m³;

V is the volume = 10,5 ml = 0,010 5 l.

If the density of the grease is not known, it shall be determined using a pycnometer method such as that given in ISO 3838, or another standardized procedure.

Distribute 10,5 ml ± 0,1 ml of grease evenly in each test bearing, as determined by the mass gain of the bearing. Take particular care to ensure that the outer raceway is completely coated.

8.10 Place the adaptor sleeves, bearings and V-ring seals in position on the shaft and finger-tighten the locknuts. Carry out the operation with the shaft suitably supported on the work bench.

8.11 Place the shaft complete with greased bearings in position in the rig, taking care that the bearings are central in the plummer blocks.

8.12 Place the top halves of the plummer blocks in position and finger-tighten the locking screws.

9 Test procedure

9.1 Carry out duplicate determinations at an ambient temperature of 15 °C to 25 °C.

9.2 Run the rig immediately after assembly for 30 min at 8,7 rad/s ± 0,5 rad/s (83 min^{-1} ± 5 min^{-1}) to uniformly distribute the grease.