SLOVENSKI STANDARD
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Železniške naprave - Maziva za ležaje kolesnih dvojic - 1. del: Preskusna metoda za ugotavljanje zmožnosti mazanja

Railway applications - Axlebox lubricating greases - Part 1: Method to test the ability to lubricate

Bahnanwendungen - Schmierfette für Radsatzlager - Teil 1: Prüfung der Schmierfähigkeit

Applications ferroviaires - Graisses lubrifiantes pour boîtes d'essieux - Partie 1: Méthode d'essai d'aptitude à lubrifier

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 14865-1:2009+A1:2010) has been prepared by Technical Committee CEN/TC 256 “Railway Applications”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2011, and conflicting national standards shall be withdrawn at the latest by April 2011 .

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

This document includes Amendment 1, approved by CEN on 2010-09-14.

This document supersedes EN 14865-1:2009.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ⟨A1⟩ ⟨A1⟩.

⟨A1⟩ This document has been prepared under a mandate given to CEN/CENELEC/ETSI by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document. ⟨A1⟩

This series of standards EN 14865 "*Railway applications – Axlebox lubricating greases*" consists of the following parts:

— *Part 1: Method to test the ability to lubricate;*

— *Part 2: Method to test the mechanical stability to cover vehicle speeds up to 200 km/h*.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

This European Standard standardizes a test method and acceptance criteria for the demand in EN 12081 for testing the ability of greases to lubricate axlebox bearings. It addresses the issue of lubricating ability of lubricating greases operating under severe conditions.

All lubricants have three main functions: to form a lubricating film that separates rolling elements and raceways, to protect the bearing from corrosion and give good longevity. For lubricating greases in axleboxes there is also the demand that the product must keep the lubricating ability, sometimes without relubrication, during very long periods of time under arduous operating and environmental conditions.

The testing procedure in this European Standard is severe and is used to discriminate between lubricating greases of different lubricating ability.

1 Scope

This European Standard specifies a testing method and sets the acceptance criteria for the determining of the lubrication ability of lubricating greases intended for the lubrication of axlebox bearings. The lubricating ability, primarily related to the capability of lubricating greases to protect against wear, is determined in a roller bearing lubricant test rig. Wear of the rolling bearing rollers, the frictional behaviour and temperature during the test are used to discriminate between lubricating greases.

NOTE 1 The testing method is referred to in EN 12081.

The method described is carried out in order to test axlebox greases for ordinary-speed vehicles, with speeds up to 200 km/h, and for greases intended for high-speed vehicles, with speeds up to 300 km/h. The method is a discriminating process, and those greases that pass will be subject to more extensive performance tests.

NOTE 2 In EN 12082 a more extensive rig performance test is described in detail. This rig performance test will check the satisfactory function of the assembly of box housing, bearing, sealing and grease during a simulated journey.

For purpose of quality assurance and quality control, this test method is also used for batch testing of greases intended for use in axleboxes.

For light rail and tramway applications other standards or documents agreed between the customer and the supplier may be applied.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the document (including any amendments) applies.

EN ISO 3170, *Petroleum liquids — Manual sampling (ISO 3170:2004)*

EN ISO 4259:2006, *Petroleum products — Determination and application of precision data in relation to methods of test*

ISO 5725-1:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

ISO 5725-2:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

ISO 5725-6:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 6: Use in practice of accuracy values*

3 Terms and definitions

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

3.1
lubricating grease
semi-solid product consisting of a mixture of liquid lubricant thickened with soaps or other thickeners, and may also contain other ingredients, imparting special properties (additives)

3.2
grease lubricating ability
lubricating ability of the grease during the stressing duration of the test, see 3.3, determined as the mean rolling elements wear rate from tests with four tapered roller bearings

NOTE In the FE8 test, the lubricating ability of grease is determined by wear and not by the service life of the grease.

3.3
stressing duration
period of time, t, during which the lubricating grease sample is stressed dynamically and thermally until the test is terminated by the first failure of the test bearings or by the end of the testing period, see 3.4

3.4
testing period
time required for testing, t_p, until failure occurs of one of the test bearings or 500 hours if a test run without interruption

NOTE For approval, the required time for a test is always 500 hours (plus an initial operation during 24 hours at 750 r/min in the 1 500 r/min test). If a bearing will fail earlier, the test is failed.

3.5
frictional moment
torque acting as a mechanical resistance to rotation, resulting from bearing friction

3.6
frictional moment of the test bearing arrangement
torque, M_r, required for driving the two test bearings, see Figure 1, obtained by measuring the force for retaining the bearing housing when the shaft is rotating

3.7
frictional moment of the test bearing arrangement at start
torque, M_{rs}, of the test bearing arrangement immediately after starting the test

3.8
run-in period
period of time, E_p, from the start of the test until the steady-state is reached

NOTE 1 During the run-in period, the grease is distributed and run-in wear occurs. Due to the smoothing of the contacting areas, the ratio of the lubricant film thickness to the sum of the roughness of the contact areas increases, thereby increasing the separating effect of the lubricant film. Depending on the smoothing of the contacting surfaces, the frictional moment is continuously reduced during the run-in process.

NOTE 2 For the test run at 1 500 r/min, there is a special run-in period of 24 hours before the real test starts. This run-in is carried out with the lower speed 750 r/min and with the axial load F_a = 10 kN.

3.9
frictional moment of the test bearing arrangement at steady-state
torque, M_{rb} is obtained after the run-in period and is reached when the frictional moment stabilizes at a fairly constant value (variation can be 20 %)

3.10
steady-state temperature
temperature, θ_B, obtained at the end of the run-in period

3.11
test temperature
temperature, θ, measured at the outer ring of the spring-side test bearing

NOTE Owing to better heat dissipation, the bearing at the drive side may be 2 °C to 5 °C cooler.

3.12
rolling element wear
wear loss in weight, m_w, during the stressing period due to wear caused by rolling and sliding movements in the rolling element raceway contacts and rolling element wear from cage contacts

3.13
mean rolling element wear
mean rolling element wear in weight, m_{wm}, from two tests according to this European Standard, each with two bearings, carried out in the same test rig and with lubricating grease from the same sample

3.14
combined mean rolling element wear from repeatability tests
mean rolling element wear in weight, m_r, from four or more tests, each with two bearings, carried out in the same test rig and with lubricating grease from the same sample

3.15
combined mean rolling element wear from reproducibility tests
mean rolling element wear in weight, m_R, from tests, each with two bearings, carried out with two or more tests in different laboratories and with lubricating grease from the same sample

3.16
test speed
operating speed, n, of the test bearing arrangement

3.17
test load
axial load, F_a, constant in magnitude and acting on the test bearings in axial direction

3.18
outlier
a deviating test value that is not fulfilling the statistical criteria specified in ISO 5725-2

4 Symbols

For the purposes of this European Standard, the following symbols apply:

E_p run-in period, in hours

F_a test load, in newtons

M_r frictional moment of the test bearing arrangement, in newton metres

M_{rb} frictional moment of the test bearing arrangement at steady-state, in newton metres

M_{rs} frictional moment of the test bearing arrangement at start, in newton metres

m_R combined mean value of rolling element wear from tests in different laboratories for establishing reproducibility, in milligrams

m_r combined mean rolling element wear from tests in one test rig for establishing repeatability, in milligrams

m_w rolling element wear, in milligrams

m_{wm} mean value of rolling element wear from four tested bearings, in milligrams

n test speed, in revolutions per minute

R_w reproducibility limits, in milligrams

r_w repeatability limits, in milligrams

s_r repeatability standard deviation, in milligrams

s_R reproducibility standard deviation, in milligrams

t stressing duration, in hours

t_p testing period, in hours

μ_R permissible variation of reproducibility, in milligram

μ_r permissible variation of repeatability, in milligram

θ test temperature, in degrees Celsius

θ_B steady-state temperature, in degrees Celsius

5 Testing principle

The testing process evaluates component wear. The two tapered roller bearings installed in the test rig as testing elements are filled with a defined amount of the grease to be tested. The bearings are axially loaded with the test load F_a and driven with the test speed n.

After a short run-in period E_p, a practically constant frictional moment, called steady-state moment M_{rb}, is obtained for the duration of the test.

The steady-state temperature θ_B depends on frictional energy from the bearings. The steady-state temperature can be controlled by separate heating or cooling and maintained at a specific value independent of variation of bearing friction. A bearing failure due to lubrication break-down causes a progressive increase of the frictional moment M_r to a multiple of the steady-state frictional moment.

Even if a failure does not occur during the testing period t_p, the lubrication capacity of the grease may be inadequate and by that bring about moderate to severe abrasive of wear of the bearing components. The resulting loss in weight of the rolling elements m_w is used for assessing the wear-inhibiting capability, or in other words the lubricating ability of the lubricating grease.

6 Reagents and material

Use only reagents of recognised analytical grades, e.g. white spirit according to BS 245 [3].

7 Test equipment[1]

7.1 Test rig FE8

Figure 1 shows the basic layout of the test head for grease testing with the FE8 test rig. The test head is coupled to a drive unit via the tapered end (Key 7) of the test head shaft (Key 6). The test head is supported by the drive unit via the test head shaft (Key 6). The tapered end (Key 7) is attached to a tapered bore of the driving shaft of the drive unit before starting a test and detached when the test is finished. The driving shaft of the drive unit is driven directly by an electric motor or by a gear.

Various speeds between 7,5 and 3 000 r/min can be chosen. The test bearings (Keys 3 and 4) are installed in the head. The bearings are axially loaded by means of Belleville springs (Key 1). The width of the spacer ring (Key 2) and the deflection characteristic of the selected springs determine the magnitude of the load and have to be calibrated according to the maintenance plan. Instead of a spacer ring (Key 2) it is possible to use a load cell to bring about the correct load.

The test head is provided with inserted thermocouples for measuring the outer ring temperature of the bearings (Key 5).

The frictional moment of the bearings is measured. This is carried out by means of a force transducer (beam with strain gauges) that transmits the holding force of the housing (Key 8) to a data capture system. The holding force prevents the housing from rotating due to the frictional moment from the bearings.

7.2 Test bearings

For the test, two tapered roller bearings 31312 are mounted in the test head.

NOTE Bearings of this design, specially adapted for the FE8 test are available[2].

New bearings are required for each test.

1 Information about suppliers can be obtained from Fachausschuss Mineralöl- und Brennstoffnormung, FAM, (technical committee for mineral oil and fuel standardization), Überseering 40, DE-22297 Hamburg, Germany.

2 Information about suppliers can be obtained from Fachausschuss Mineralöl- und Brennstoffnormung, FAM, (technical committee for mineral oil and fuel standardization), Überseering 40, DE-22297 Hamburg, Germany.