SLOVENSKI STANDARD
SIST EN 14865-2:2006+A2:2011

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Železniške naprave - Maziva za ležaje kolesnih dvojic - 2. del: Preskusna metoda za ugotavljanje mehanske stabilnosti pri vozilih za hitrosti do 200 km/h

Railway applications - Axlebox lubricating greases - Part 2: Method to test the mechanical stability to cover vehicle speeds up to 200 km/h

Bahnanwendungen - Schmierfette für Radsatzlager - Teil 2: Prüfverfahren für mechanische Stabilität bei Schienenfahrzeugen bis zu Geschwindigkeiten von 200 km/h

Applications ferroviaires - Graisses lubrifiantes pour boîtes d'essieux - Partie 2: Méthode d'essai de stabilité mécanique pour des vitesses de véhicules allant jusqu'à 200 km/h

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Foreword

This document (EN 14865-2:2006+A2:2010) 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of an identical text or by endorsement, at the latest by April 2011, and conflicting national standards shall be withdrawn at the latest by April 2011.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 2009-02-24 and Amendment 2 approved by CEN on 2010-09-14.

This document supersedes ▌A1⟩ EN 14865-2:2006+A1:2009 ⟨A1▌.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ▌A1⟩ ⟨A1▌ and ▌A2⟩ ⟨A2▌.

▌A2⟩ 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. ⟨A2▌

EN 14865 consists of the following parts, under the general title *Railway applications — Axlebox lubricating greases*:

— *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

A test method is standardized, which is referred to in EN 12081.

This European Standard standardizes a test method and acceptance criteria for the demand in EN 12081 for testing the mechanical stability of axlebox lubricating greases. It addresses the issue of mechanical stability 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 bearings from corrosion and to give good longevity. For lubricating grease there is a further demand: the product needs to be mechanically stable in use. Currently several common lubricating grease shear stability tests are available to industry, but the procedure in this European Standard is the most severe. It has been available for many years and it is used to discriminate between lubricating greases of different stabilities.

1 Scope

This European Standard specifies a test method and sets the acceptance criteria for the determination of the mechanical stability of lubricating greases intended for the lubrication of axlebox bearings according to EN 12081. In the test, impacts are applied to the lubricating grease so that only very stable lubricating greases will perform acceptably. The method is used in a discrimination process for finding lubricating greases of such mechanical stability that they are considered accepted lubricating greases for more extensive performance tests according to EN 12082.

For purposes of quality assurance and quality control, this test method is also used for batch testing of lubricating greases.

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 referenced document (including any amendments) applies.

EN ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness) (ISO 868:2003)*

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

EN ISO 4259:1995, *Petroleum products — Determination and application of precision data in relation to methods of test (ISO 4259:1992/Cor 1:1993)*

ISO 2137:1985, *Petroleum products — Lubricating grease and petrolatum — Determination of cone penetration*

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 and thickened with soaps or other thickeners, and may also contain other ingredients, imparting special properties (additives)

3.2
lubricating grease mechanical stability
resistance to breakdown of the lubricating grease structure under shear, causing the product to become softer

3.3
lifting device
hoist, block and tackle suitably supported, a traverse or other device suitable to support and safely manoeuvre the axlebox and its components

4 Testing principle

A typical type of railway axlebox with a labyrinth seal and two spherical roller bearings is packed with test lubricating grease. The axlebox axle is first rotated for 72 h at 500 r/min (52,4 rad/s) while the axlebox is subject to vibrational accelerations. The vibration is brought about by hitting the axlebox every second with a hammer with a falling height of 4,5 mm. The second part of the test continues in the same way for another 72 h, but the rotational speed of the axle is increased to 1 000 r/min (104,7 rad/s). The weight of lubricating grease lost from the axlebox is recorded as a measure of mechanical stability.

5 Reagents and materials

Use only reagents of recognised analytical grades (e.g. white spirit according to BS 245 specification).

6 Apparatus[1)]

The following V2F test rig and equipment are used in the test:

a) test rig as described in Annex A and detailed in Annex B;

b) lifting device suitable for supporting and manoeuvring the assembled axlebox (approximately 100 kg);

c) spatula;

d) balance;

e) thermocouple.

7 Sampling

The following measures shall be taken when taking samples:

a) unless otherwise specified, samples shall be taken in accordance with one of the procedures specified in EN ISO 3170;

b) laboratory samples shall be examined for homogeneity before taking the test portion.

NOTE How lubricating grease samples are to be taken after the test procedure is described in 8.10;

1) Information about suitable equipment is available from SKF Quality Technology Centre, A-4400 Steyr, Austria.

c) samples shall be stored at a temperature between 0 °C and 30 °C, for at least 24 h, before use.

8 Testing procedure

8.1 General

The procedure is described assuming that the apparatus is disassembled. If this is not the case, then disassemble the apparatus and bearings, as described in 8.10 and 8.11, before proceeding.

8.2 Preparation of the apparatus

Make sure that the test rig is earthed and that the electrical wiring is correct. When starting the machine, carefully check that the eccentric cam rotates in the correct direction.

8.3 Washing procedure

All parts of the axlebox shall be washed and thoroughly dried before any running test is carried out. White spirit or a similar non-aqueous solvent should be used for the washing and the parts may be dried using clean and dry compressed air.

The bearings shall be disassembled before washing according to the method described in 8.11.

8.4 Assembly of the bearings

The rollers shall be placed into the pockets in the two cage halves, with the exception of 12 rollers, 6 from each side of the bearing, i.e. 3 cage pockets are left empty on each side of each cage half to allow assembly.

The cage halves and the guide ring are then placed over the inner ring. The inner ring assembly is fitted into the outer ring and swung out so that it is possible to press the remaining rollers into position.

8.5 Volume and distribution of the test lubricating grease

A total volume of 1 370 cm^3 lubricating grease shall be used for the test and this volume of lubricating grease is split up in 5 portions – 132 cm^3, 174 cm^3, 700 cm^3, 174 cm^3 and 190 cm^3. These portions are to be prepared to an accuracy of ± 0,5 cm^3.

If the density of the lubricating grease is known, the weight of the lubricating grease instead of the volume can be used.

NOTE Previous trials have proven that following the specified volumes is essential for the accuracy of the testing.

8.6 Assembly of the box

The collar shall be pressed on the axle (Figure B.1, key 8). The first bearing (Figure B.1, key 6) is pressed on and the spacing ring (Figure B.1, key 5) mounted.

The bearing is filled with 174 cm^3 lubricating grease. This is done by applying the lubricating grease with a suitable spatula. The outer ring is swung out and about half of the lubricating grease volume is worked between the rollers. With the outer ring swung back into position, the rest of the lubricating grease is applied.

The second bearing (Figure B.1, key 4) is then pressed on and 174 cm^3 lubricating grease is applied in the same way as described for the first bearing.

The fixing plate (Figure B.1, key 3) is placed into position and the bolts drawn tight to keep the bearings in place.

A portion of the lubricating grease, 190 cm^3, is placed behind the labyrinth grooves (Figure B.1, lubricating grease portion D). No lubricating grease is placed in the labyrinth grooves.

Another portion of lubricating grease, 700 cm^3, is placed against the spacing ring and the bearings (Figure B.1, lubricating grease portion C).

The remainder of the lubricating grease, 132 cm^3, is placed against the second bearing and fixing plate (Figure B.1, lubricating grease portion A).

The axle assembly (i.e. axle fitted with bearings, etc.) is moved to a suitable workbench using the lifting device (see Clause 6, b)). The outer labyrinth seal/cover (Figure B.1, key 8), which is in two halves, is put into position and the two halves are bolted together.

The axlebox housing (Figure B.1, key 2) is then placed over the axle assembly. Make sure that the pressure inside and outside the housing is levelled in order to avoid lubricating grease being pressed into the labyrinth seal. The housing unit is held together by 4 bolts and the assembly is completed by screwing in the end plug (Figure B.1, key 1).

8.7 Assembly of the machine

The assembled axlebox shall be placed in the rig with the aid of the lifting device and bolted to the frame (Figure A.1, key 4) in the correctly established position. This fixing shall be carried out in such a way that the axlebox spatial position is consistently reproduced for every test. Care shall be taken that the axlebox, when it is mounted on the vertical frame is tightened in its lowest position. This is best facilitated by letting the hammer contact the axlebox with its full weight while fastening the bolts.

The drive pulley is bolted on to the axle, and the position of the electrical motor is adjusted so that the pullies are aligned and the belt tension is correct. The belt tension should be adjusted with the bolts to be sufficiently tight to prevent slippage.

The tray for collecting the leaked lubricating grease shall be weighed and put into position.

A thermocouple is connected to the axlebox and to a recording unit.

8.8 Calibrating the machine

The hardness of the rubber striking plate (Figure A.1, key 3) and the axlebox mounting rubbers (Figure A.1, key 6) shall be checked in accordance with EN ISO 868.

The rubber striking plate (Figure A.1, key 3) is made up of two rubber materials, each 5 mm thick, bonded together. The hardness shall be maintained in the range (80 ± 5) Shore A units for the upper and (60 ± 5) Shore A units for the lower rubber.

The hardness of the shock absorbing mounting rubbers (Figure A.1, key 6) shall be measured and recorded when new, and the hardness shall be maintained within 5 Shore A units of original measured values.

The rubber striking plate shall be checked annually or after operations where the equilibrium running temperature of the bearings has exceeded 100 °C. It is furthermore recommended that all rubber elements are replaced every 5 years regardless of their hardness.

It is important that the hammer block hits the top of the axlebox correctly, i.e. that contact is made between the hammer and the rubber shock absorbing plate at all points. This can easily be adjusted by loosening the adjustment bolts (Figure A.1, key 1), then lowering the hammer into the axlebox and re-tightening the adjustment bolts.

The bushings or bearings of the arm that lifts the hammer shall be well aligned and without clearance.

NOTE If the hammer does not fall correctly, vibrations will be affected and an incorrect result will be obtained. Check the position of the hammer impact by means of, for instance, carbon paper.

8.9 Running the test

The falling height of the hammer shall be carefully adjusted to (4,5 ± 0,1) mm.

To prevent pressure build up inside the axlebox, the end plug (Figure B.1, key 1) is loosened or a hole may be drilled to level the pressure.

The bearings are first run for one hour at 500 × (1 ± 5 %) r/min without hammer blows and then at the same speed for one hour with hammer blows. The lubricating grease leakage, if any, is removed and weighed but is not included in lubricating grease leakage after the test is finished.

The real test starts with a first run for 72 h ± 30 min at 500 × (1 ± 5 %) r/min and then for another 72 h ± 30 min at 1 000 × (1 ± 5 %) r/min. The rotational speed of the axle is altered by moving the position of the driving belt to the alternative pulley pair. Maximum stand still time between the test parts 500 r/min and 1 000 r/min is 30 min.

Measure the room temperature. During the test, the room temperature shall be kept between 18 °C to 25 °C.

The equilibrium test temperature of the bearings, i.e. the steady test temperature reached after some period of time, usually after 5 h, is recorded by use of the thermocouple (Figure B.1, key 9).

At least two tests shall be run for each test sample.

8.10 Dismantling the machine after testing

The hammer block is lifted with the help of the lifting device and fixed and secured by placing the support (Figure A.1, key 12) under the arm. The axlebox assembly, as shown in Figure B.1, is then removed from the machine, using the lifting device.

The axlebox is placed on a suitable bench and the end plug (Figure B.1, key 1) is removed. The axlebox is then turned, so that it stands on one end, with the end plug side of the axlebox downwards. Using the lifting device, the axle assembly is pulled out of the axlebox housing.

The axle assembly is kept hanging in the lifting device and the lubricating grease around and between the bearings removed. The fixing plate (Figure B.1, key 3) is removed. The axle assembly is placed on a suitable cylinder. The bearings and cover are pressed off in one operation. The outer labyrinth/cover (Figure B.1, key 7) is unbolted and removed in two halves. A sample of the worked lubricating grease is taken from the labyrinth seal by scraping off with the spatula. Using the largest scale apparatus possible, the sample penetration shall be determined according to ISO 2137.

8.11 Disassembly of the bearings

The bearings shall be disassembled by swinging out the inner ring assembly and pulling out 3 rollers, on opposite sides of each cage half, by using a soft metal clamp or lever. Each cage half will thus have 6 rollers removed. The inner ring assembly is then turned until the empty cage pockets are in position inside the outer ring raceway, and the swung out inner ring and cages can easily be taken out.

The cage halves are then removed from the inner ring, and the rollers can be taken out from the cage pockets.

After washing and drying, all parts are ready for the next test. All parts shall be preserved against corrosion during storage. The bearings shall be assessed according to the supplier's instructions for their suitability for reuse.

9 Evaluation

9.1 Recording

The following test related information shall be recorded:

— date of the test;

— identity of test rig(s);

— operator of test rig;

— quantity of lubricating grease leakage during the testing, in grams;

— room temperature;

— maximum and equilibrium running temperature of the bearings;

— penetration of the lubricating grease before the test;

— penetration of the lubricating grease sample taken from the labyrinth seal after the test;

— if any difference in appearance is shown, this should also be noted, e.g. strong darkening of the lubricating grease, change in texture or different deposits.

9.2 Leakage

The recorded weight of lubricating grease loss, in grams, is decisive for the outcome of the test. To pass the test, mechanically stable products are expected to result in less than 150 g total lubricating grease loss, excluding the recorded weight of the leakage during the first two hours of operation with and without hammering. Each of two tests run with lubricating grease from the same sample have to be accepted and fulfil the precision conditions in Clause 10.

If the initial leakage after two hours operation without and with hammering is > 25 g, the test shall be stopped, and a new test started after disassembly, cleaning and new filling of the lubricating grease, carefully following instructions.

9.3 Penetration

Compare the penetration of the lubricating grease before the test with the penetration of a lubricating grease sample taken from the labyrinth seal after the test. If the penetration has changed 20 units or more, the test indicates that the leakage is a result of mechanical degradation of the lubricating grease, which in turn is an indication that the mechanical stability of the lubricating grease really has been tested.

If the change of penetration is less than 20 units, the leakage may not depend on mechanical instability, and another test should be run with lubricating grease from the same sample.

10 Precision

10.1 General

The precision of the V2F test method has been determined by a Round Robin test, and the result is illustrated in Annex C.

The repeatability and reproducibility in the Round Robin test were found to vary with the obtained mean values of leaked lubricating grease for different tests. Therefore the repeatability and reproducibility limits, r_w