SWEDISH STANDARDS INSTITUTE

BEKRÄFTELSE

SS 3653

SIS/TK 254

Fastställd 1997-08-22

Datum 2004-08-19

Utgåva 1

Järnvägar – Rullningslager i axelboxar – Provning av smörjfetts mekaniska stabilitet

Railways – Rolling bearings for axleboxes – Test of the mechanical stability of lubricating greases

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SVENSK STANDARD SS 3653

Handläggande organ	Fastställd	Utgåva	Sida
SVENSK MATERIAL- & MEKANSTANDARD, SMS	1997-08-22	1	1 (9)

Railways – Rolling bearings for axleboxes – Test of the mechanical stability of lubricating greases

Contents

Introduction

This standard has been drawn up on the basis of a proposal for European Standard from CEN/ TC 256 Railway applications, WG12: Rolling bearings and lubricants. It addresses the issue of grease stability under severe operating conditions. All lubricants have three main functions (to separate, protect and last), but for a grease there is a further demand, the product must be stable in use. Currently several common grease shear stability tests are available to industry, but this procedure is the most severe and has been shown to correlate with industrial application. Furthermore this test has been available to industry for many years and it is extensively relied upon to discriminate between greases of different stabilities where customers´ applications are discerning.

ICS 45.040.00; 75.100.00

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Tryckt i december 1997

1 Scope

This standard specifies a method for the determination of the mechanical stability of a grease. This test applies a vibration to the grease so that only very stable greases will perform acceptably. The procedure will not discriminate between relatively unstable greases.

This method is applicable to all grease products, i.e. thickened lubricating oil products.

2 Normative references

The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ISO 2137:1985 Petroleum products – Lubricating grease and petrolatum – Determination of cone penetration

ISO 3170:1988 Petroleum liquids – Manual sampling

BS 245:1976 Specifications for mineral solvents (white spirit and related hydrocarbon solvents) for paints and other purposes.

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1 lubricating grease: semi-solid product consisting of a stabilized mixture of liquid lubricant with soaps or other thickeners, that may contain other imparting special properties.

3.2 grease mechanical stability: the resistance to breakdown of the grease structure under shearing forces, causing the product to become more liquid.

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

4 Principle

A typical railway axlebox (> 500000 units in service) with a labyrinth seal and two spherical roller bearings, is packed with test grease. The axlebox axle is rotated for 72 h at 500 r/min (16,6 rad/s) while the axlebox is subject to vibrational accelerations which are developed by hitting it with a hammer every second to impart an acceleration of (120-150) m/s^2. If the grease leakage is less than 50 g during this first part of the test, a second part is conducted. The second part of the test involves increasing the rotational speed of the axle to 1000 r/min (33,3 rad/s) for a further 72 h. The loss of grease from the axlebox during both parts of the test is recorded as a measure of mechanical stability.

5 Reagents and materials

Use only reagents of recognised analytical grades.

5.1 White spirit, to BS 245 specification.

6 Apparatus [1)]

6.1 Test rig as described in annex A, and detailed in annex C.

6.2 Calibration equipment; example as described in annex B.

6.3 Lifting device suitable for supporting and manoeuvring the assembled axlebox (approximately 100 kg).

6.4 Spatula

6.5 Balance

6.6 Thermocouple

7 Sampling

7.1 Unless otherwise specified, samples shall be taken in accordance with one of the procedures specified in ISO 3170 or an equivalent national standard.

7.2 Laboratory samples shall be examined for homogeneity before taking the test portion. Grease samples to be taken after the test procedure are described in section 8.10.

7.3 Samples shall be stored at a temperature of between 0 °C and 30 °C before use.

8 Procedure

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

8.1 Preparation of the apparatus

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

8.2 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, dry compressed air.

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

8.3 Assembly of the bearings

The rollers shall be placed into the pockets in the two cage halves, all accept 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.

1) A list of suppliers of suitable equipment is available from SMS, S-115 83 STOCKHOLM, TP +46 8 459 56 00, TF +46 8 667 85 42.

8.4 Weighing of the grease

The grease shall be weighed on a suitable balance; 1300 g of grease is required. 5 portions of grease are prepared as follows (165 g,. 165 g, 230 g, 665 g and 75 g), these portions will be prepared to an accuracy of ± 0,5 g. The total amount of grease corresponds to a filling of about 60 % of the axleboxes devices.

Note: This procedure has been developed for, and the precision determined on, simple lithium soap mineral oil based grease. If greases with different density are to be tested these and the weights need to be adjusted accordingly.

8.5 Lubrication of the bearings

The bearings shall be filled with 165 g of grease each. This is done by applying the grease with a suitable spatula. The inner ring assembly is swung out and half the grease is worked between the rollers.

The inner ring assembly is swung back into position and the rest of the grease is applied.

8.6 Assembly of the box

The collar shall be be pressed on the axle (annex C part 1). 230 g of the grease is placed into the collar labyrinth, and the labyrinth grooves are completely filled with this portion of grease (annex C grease portion D).

The first bearing (annex C part 2) is pressed on with the spacing ring (annex C part 3). A bank of grease (665 g) is placed against the spacing ring and on top of the first bearing (annex C grease portion C). The second bearing (annex C part 4) is then pressed on. The fixing plate (annex C part 5) is placed into position and the bolts drawn tight to keep the bearings in place. The remainder of the grease (75 g) is placed on top of the second bearing against the end-ring (annex C grease portion A).

Alternatively both bearings (annex C part 2 and 3) can be mounted on shaft and then the grease package applied as stated above.

The axle assembly (i.e. axle fitted with bearings, etc.) is moved from the press table to a suitable workbench using the lifting device (6.3). The outer labyrinth seal/cover (annex C part 7), which is in two halves is placed into position and the two halves are bolted together.

The axlebox housing (annex C part 8) is then placed over the axle assembly. This is held in position by 4 bolts and the assembly is completed by screwing in the plug (annex C part 6).

8.7 Assembly of the machine

The assembled axlebox shall be placed into position in the rig with the aid of the lifting device (6.3) and bolted to the frame. This fixing shall be be carried out in such a way that the axlebox spacial position is consistently reproduced. It has been reported that in some cases small spacial errors, in the region of 1,5 mm at the striking plate, affect the test result.

The hammer can then be lowered.

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 will be adjusted with the bolts to be sufficiently tight to prevent slippage.

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

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