



SLOVENSKI STANDARD
SIST EN 12080:2001
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Železniške naprave - Ohišja ležajev kolesnih dvojic - Kotalni ležaji

Railway applications - Axleboxes - Rolling bearings

Bahnanwendungen - Radsatzlager - Wälzlager

Applications ferroviaires - Boîtes d'essieux - Roulements

Ta slovenski standard je istoveten z: EN 12080:1998

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ICS:

21.100.20	Kotalni ležaji	Rolling bearings
45.040	Materiali in deli za železniško tehniko	Materials and components for railway engineering

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EUROPEAN STANDARD

EN 12080

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 1998

ICS

Descriptors: railway equipment, railway rolling stock, axlebox, rolling bearing, definition, manufacturing, material, dimensions, mechanical properties, physical properties, reliability, approval procedure, inspection, delivery, packaging, marking

English version

Railway applications - Axleboxes - Rolling bearings

Applications ferroviaires - Boîtes d'essieux - Roulements

Bahnanwendungen - Radsatzlager - Wälzlager

This European Standard was approved by CEN on 22 February 1998.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword	3
Introduction	3
1 Scope	3
2 Normative references	3
3 Definitions	4
4 Information and requirements to be agreed and documented	4
4.1 General	4
4.2 Information to be supplied by customer	5
4.3 Optional requirements	5
4.4 Requirements for agreement	5
5 Quality systems	5
6 Manufacture	5
6.1 Steel manufacturing	5
6.2 Heat treatment	5
6.3 Traceability	5
7 Material properties	6
7.1 Steel for rings and rolling elements	6
7.2 Materials of other components (cages, spacers, seals, etc)	6
8 Geometry and dimensions	6
8.1 Dimensions and tolerances	6
8.2 Rolling bearing internal clearance before mounting	6
9 Mechanical properties: Inner ring expansion ability	6
10 Physical properties	7
10.1 Visual aspect	7
10.2 Soundness of rings and rolling elements	7
10.3 Case depth	7
10.4 Surface hardness	8
11 Marking	8
12 Inspection	8
12.1 Inspection plan	8
12.2 Sampling	9
13 Quality records	9
14 Approval	9
15 Delivery and packaging	10
15.1 Greasing of rolling bearings	10
15.2 Rust protection	10
15.3 Packaging	10
Annex A (normative) Ultrasonic inspection of rolling bearing rings	11
Annex B (normative) Magnetic particle inspection of ring surfaces	15
Annex C (normative) Eddy current inspection of the raceways of the rollers	16
Annex D (informative) Cages of polymeric material	18
Annex E (normative) Approval procedures	20
Annex F (informative) Criteria to determine the extent of approval procedures	21

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 256 "Railway applications", the secretariat of which is held by DIN.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of the following EU Directives:

- Council Directive 96/48/EEC of 23 July 1996 on the interoperability of the European high-speed train network¹⁾
- Council Directive 93/38/EEC of 14 June 1993 coordinating the procurement procedures of entities operating in the water, energy, transport and telecommunications sectors²⁾
- Council Directive 91/440/EEC of 29 July 1991 on the development of the Community's railways³⁾

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 September 1998, and conflicting national standards shall be withdrawn at the latest by September 1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard has been drawn up with the purpose of aiming at optimum performance in rail transportation. Performance implies a certain quality level of the vehicle running gear, which every railway company may require, notably by imposing procedures in approval and requesting the existence of a quality assurance system for the supply of rolling bearings intended for rolling stock operating on its network or other networks in Europe.

1 Scope

This European Standard defines the quality parameters of axlebox rolling bearings, required for reliable operation of trains on European networks. It covers metallurgical and material properties as well as geometric and dimensional characteristics. It also defines methods for quality assurance and conditions for approval of the products.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 473	Qualification and certification of NDT personnel - General principles
EN 12081	Railway applications - Axleboxes - Lubricating greases
EN 12082	Railway applications - Axleboxes - Performance testing
EN ISO 9001	Quality systems - Model for quality assurance in design/development, production, installation and servicing (ISO 9001 : 1994)

¹⁾ Official Journal of the European Communities No L 235 of 17.9.96

²⁾ Official Journal of the European Communities No L 199 of 9.8.93

³⁾ Official Journal of the European Communities No L 237 of 24.8.91

Page 4

EN 12080:1998

EN ISO 9002	Quality systems - Model for quality assurance in production, installation and servicing (ISO 9002 : 1994)
ISO 281	Rolling bearings - Dynamic load ratings and rating life
ISO 307	Plastics - Polyamides - Determination of viscosity number
ISO 492	Rolling bearings - Radial bearings - Tolerances
ISO 683-17	Heat treated steels, alloy steels and free-cutting steels - Part XVII: Ball and roller bearing steels
ISO 1183	Plastics - Methods for determining the density and relative density of non-cellular plastics
ISO 1218	Plastics - Polyamides - Determination of "melting point"
ISO 2639	Steel - Determination and verification of the effective depth of carburized and hardened cases
ISO 4967	Steel - Determination of content of non-metallic inclusions - Micrographic method using standard diagrams
ISO 6507-1	Metallic materials - Hardness test - Vickers test - Part 1: HV 5 to HV 100
ISO 6508	Metallic materials - Hardness test - Rockwell test (Scales A-B-C-D-E-F-G-H-K)

3 Definitions

For the purposes of this standard the following definitions apply:

- 3.1 customer:** railway company, manufacturer or buyer of railway rolling stock or subassemblies, or their representative.
- 3.2 railway company:** organisation or its representative, whatever status it has, which is responsible for the registration of rolling stock
- 3.3 supplier:** supplier of axlebox rolling bearings manufactured under his responsibility.
- 3.4 network:** the infrastructure, on which any railway company can operate rolling stock.
- 3.5 axlebox:** assembly of box housing, rolling bearings, sealing and grease.
- 3.6 rolling bearing:** bearing, operating with rolling motion between the parts supporting load and moving in relation to each other.
- 3.7 cartridge bearing:** rolling bearing with two or more rows of rolling elements within a single outer ring, greased and equipped with integral seals.
- 3.8 ring:** annular part of a rolling bearing incorporating one or more raceways.
- 3.9 rolling elements:** cylindrical, tapered or convex rollers or balls.
- 3.10 cage:** component, which partly surrounds the rolling elements and moves with them.
- 3.11 grease:** semi-solid lubricant, which consists of a thickener and additives dispersed in a lubricating oil.
- 3.12 sealing:** component that protects the bearings against ingress of water and dust and retains the grease in the rolling bearings.
- 3.13 box housing:** structural component which contains rolling bearings, sealing and grease.

4 Information and requirements to be agreed and documented

4.1 General

The following information shall be fully documented by the supplier. Both the requirements specified throughout this European Standard and the following documented requirements shall be satisfied before a claim of compliance with this Standard can be made and verified.

4.2 Information to be supplied by customer

The following information are to be supplied by customer and shall be fully documented:

- interface drawing showing mounting conditions; all dimensions of the space available for the rolling bearings; dimensions, tolerances and materials of shaft and box housing;
- load spectra;
- ambient temperatures in operation;
- if required special steel composition, cleanliness and soundness class (see 7.1 and 10.2);
- approval procedure type and conditions to be applied (see clause 14 and Annex E);
- special conditions for quality records and traceability (see 6.3 and clause 13).

4.3 Optional requirements

If the customer wishes to take up any of the optional requirements given in 8.2, 10.2.1, 10.3, 10.4, clause 11, clause 12 and 15.2, such requirements shall be specified and documented.

4.4 Requirements for agreement

The following requirements to be agreed between the contracting parties, which are specified in the clauses referred to, shall be fully documented:

- boundary dimensions and interface tolerances of the rolling bearing (see clause 8);
- internal clearance values before and after mounting (see clause 8);
- references to standards and special requirements (see clause 7 and 10.2);
- use of steel of special composition, manufacture or metallurgical quality (see 7.1);
- soundness class, 1 or 2, and the test methods to be used (see 10.2);
- type of heat treatment to be applied and methods of testing (see 6.2, 10.3, 10.4 and 12.2);
- the marking (see clause 11);
- the inspection plan (see 12.1);
- for cartridge bearings grease designation, quantity and distribution (see 15.1);
- for non-sealed bearings, grease designation and compatibility with preservatives (see 15.2).

5 Quality systems

The supplier shall operate a quality system according to EN ISO 9001 or EN ISO 9002. Personnel responsible for non destructive testing shall be qualified and certified in accordance with EN 473.

6 Manufacture

6.1 Steel manufacturing

The process of steel manufacture in mass production shall be such that the metallurgical characteristics are the same as those of the rolling bearings submitted for the approval procedure.

NOTE: The choice of manufacturing procedures is left to the discretion of the supplier.

6.2 Heat treatment

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The heat treatment processes for the rolling bearing components shall be such that the hardness values specified in 10.3 and/or 10.4 are respected. The heat treatment processes shall be such that all the rolling bearings produced in a production batch are treated uniformly.

6.3 Traceability

At the customers request, the supplier shall set up and maintain a system of identification and traceability of finished products (see clause 4), which allows the detection, based on an identification mark, of the following elements:

- material origin including the chemical analysis of every heat and steel manufacturing batch;

- heat treatments;
- inspection of boundary dimensions as well as inspection of soundness;
- batch number.

7 Material properties

The grades and qualities of materials used shall conform to the following requirements.

7.1 Steel for rings and rolling elements

7.1.1 Grades

Steels should be selected from the grades specified in ISO 683-17. For particular applications (high rotational speed, reliability, etc.) it may be requested that the rolling bearings are made from steel with special composition, metallurgical quality or manufacturing processes (see clause 4).

7.1.2 Inclusion content

The inclusion content shall be determined according to ISO 4967, method A, plate II. The microinclusion content shall meet the requirements of ISO 683-17.

For the acceptance limits, the values in table 1 apply:

Table 1: Microinclusion content

Type A		Type B		Type C		Type D	
thin	heavy	thin	heavy	thin	heavy	thin	heavy
2,5	1,5	2,0	1,0	0,5	0,5	1,0	1,0

For steel with special composition, metallurgical quality or manufacturing processes, the inclusion content shall be documented in accordance with clause 4.

7.2 Materials of other components (cages, spacers, seals, etc)

The materials of each one of these components shall be documented in accordance with clause 4 and endorsed by the customer at the time of approval. For cages of polymeric material, if not otherwise specified, refer to Annex D.

8 Geometry and dimensions

8.1 Dimensions and tolerances

The boundary dimensions shall be agreed and documented in accordance with 4.4.

Applicable tolerances shall be those given in ISO 492, normal tolerance class, unless otherwise agreed and documented in 4.4.

8.2 Rolling bearing internal clearance before mounting

Rolling bearing internal clearance, axial and/or radial, depending on the type of rolling bearing, shall conform to the values documented in accordance with 4.4.

The methods for radial and/or axial clearance inspection can be agreed and documented in accordance with 4.3.

9 Mechanical properties: Inner ring expansion ability

With the exception of case-hardened rings and bainite hardened rings, an expansion test shall be performed to guarantee that the inner rings can withstand an increase of the bore diameter without causing fracture in service. This test shall be performed before the inspection for surface soundness. The value of this diameter increase shall not be less than 0,0015 times the diameter. The rings shall neither rupture nor show any traces of cracks (see

10.2.3). This expansion test shall be made with an expandable mandrel that is inserted in the bore of the inner ring. The expansion shall be achieved progressively in a few seconds.

10 Physical properties

10.1 Visual aspect

10.1.1 Rings and rolling elements

Rings and rolling elements shall be free of any defects, especially on working surfaces, that may be harmful to their function (such as burrs, scratches, rust stains, nicks and dents).

10.1.2 Cages

Rolling bearing cages shall exhibit no defects that might affect their function (such as burrs, scratches, rust). To avoid crack initiation, the connection between the cage bars and the annular body shall be smooth and conform to the rounding-off shown on the detail drawing.

If not otherwise documented in accordance with clause 4, the requirements for cages of polymeric material shall be as given in Annex D.

10.2 Soundness of rings and rolling elements

10.2.1 General rules

Rings and rolling elements shall have no internal defects, nor any form of surface defect that may be harmful to their function. The soundness shall be inspected by the manufacturer. The methods are described in Annexes A, B and C. Any alternative methods to be used, which give equivalent results, shall be agreed and documented in accordance with 4.4.

Two soundness classes are defined:

- Class 1, with the highest demands,
- Class 2.

The classification only concerns the ring internal soundness (see Annex A).

10.2.2 Internal soundness of rings

The reference method for the inspection of internal soundness of rings is described in Annex A.

When tested, no ring shall exhibit defect indications on the raceway, or in a section of 4 mm depth below the raceway, with the amplitude equal to or greater than that observed with the master defect corresponding to the soundness class in question in accordance with Annex A. Larger defects are tolerated deeper than this section, though the defect indications shall not be more than twice the amplitude of that observed with the master defect.

10.2.3 Soundness of ring surfaces

The reference method for the inspection of surface soundness of rings is described in Annex B.

When tested, no evidence of defects shall be observed on any of the ring surfaces.

10.2.4 Soundness of roller raceway surfaces

The reference method for the inspection of the raceway surface soundness of rollers is described in Annex C.

When tested no roller shall exhibit defect indications on its raceway, with an amplitude equal to or greater than that observed with the master defect as defined in Annex C.

10.2.5 Grinding burns

There shall be no grinding burns during the different grinding operations.

10.3 Case depth

For rolling bearings manufactured of case-hardening steel, the effective depth of the hardened case shall be documented in accordance with clause 4. The depth of the hardened case is determined as a function of the change in hardness of the transversal cross section of a test piece or a prepared sample. The hardness is measured in accordance with ISO 6507-1 and ISO 2639 or another process agreed and documented in accordance with 4.4. At this depth, the Vickers hardness shall be at least 550 HV1.

10.4 Surface hardness

Rings and rolling elements shall have a Rockwell hardness (HRC) between 57 HRC and 66 HRC. Moreover, the manufacturers shall comply with the following:

- a) Rings: there will be no more than 4 HRC difference between the values measured on all the rings of one rolling bearing.
- b) Rolling elements: there will be no more than 4 HRC difference between the values measured on all the rolling elements in one rolling bearing.

Surface hardness shall be inspected according to the Rockwell method, referred to in ISO 6508. For case-hardened steel rolling bearings, surface hardness may be measured by the Vickers HV 30 method, referred to in ISO 6507-1, or by another equivalent method agreed and documented in accordance with 4.4.

11 Marking

The supplier shall mark rolling bearings visibly and indelibly outside of any surfaces in contact with spacers, thrust rings, etc. Should this not be possible, the marking area shall be agreed and documented in accordance with 4.4.

The supplier is responsible for selecting the marking process.

Where marking punches are used, these shall not have any sharp edges.

Marking by electric pencil (spark erosion) is prohibited.

If no other indications are given, the following marking is compulsory:

- supplier's trade mark and country of origin,
- production plant code, if there is more than one plant,
- rolling bearing designation, including a reference to this European Standard and the soundness class,
- date of manufacture in clear or coded form.

NOTE: When rolling bearing components or sub-assemblies are not allowed to be interchanged, they shall be marked with a unique identification number.

12 Inspection

12.1 Inspection plan

If not otherwise documented in accordance with 4.4, the sampling plan and the number of inspections to be undertaken by the supplier shall be in accordance with table 2.

The results shall be documented.

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Table 2: Inspection plan

Nature of inspections	Number of inspections to be performed for a batch of N components or bearings					
	N ≤ 10	10 < N ≤ 50	50 < N ≤ 100	100 < N ≤ 250	250 < N ≤ 500	N > 500
Visual aspect	100%	100%	100%	100%	100%	100%
Functional dimensions ¹⁾	100%	100%	100%	100%	100%	100%
Surface soundness ²⁾	100%	100%	100%	100%	100%	100%
Internal soundness ³⁾	100%	100%	100%	100%	100%	100%
Case depth ²⁾	1	1	2	3	4	5
Hardness ²⁾	1	2	3	5	7	10
Internal clearance ⁴⁾	100%	100%	100%	100%	100%	100%
Inner ring expansion ability ⁵⁾	100%	100%	100%	100%	100%	100%
Marking	100%	100%	100%	100%	100%	100%

¹⁾ In accordance with 4.4.
²⁾ On outer and inner rings, on rolling elements and on loose ribs and thrust collars.
³⁾ On outer and inner rings.
⁴⁾ Radial clearance for cylindrical and spherical roller bearings; axial clearance for cartridge bearings and matched pairs of tapered roller bearings.
⁵⁾ Except case-hardened rings and bainite hardened rings.

If a component or a bearing is found to be faulty:

- the whole batch shall be rejected, if inspection by sampling;
- the faulty component or rolling bearing shall be rejected, in case of 100% inspection.

12.2 Sampling

A sample consists of rolling bearings or components taken from one batch and selected at random.

When the heat treatment is continuous, the sampling plan shall be agreed and documented in accordance with 4.4. If the sampling is made by the customer, samples are taken at random from each batch of the rolling bearings chosen by the customer for inspection.

For the checking of hardness and case depth of rings, one or more sectioned parts of rings from the same furnace batch may be used. Alternative samples may be used after agreement with the customer.

13 Quality records

Independent of other regulations, the requirements for the archiving of all records of control of quality, providing proof of product conformity to this European Standard, and to the special terms of the order, shall be defined by the customer and documented in accordance with 4.2.

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14 Approval

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Rolling bearings shall pass an approval procedure as agreed and documented in accordance with clause 4.

Every new type of rolling bearing or new application (see Annex F) shall be submitted to the customer for approval. This procedure shall be specified by the customer in accordance with the criteria presented in Annex E.

After approval, the customer shall be notified of any changes of design and specification which may influence the function, as well as transfer to a different manufacturing plant. The customer may require a new approval procedure; guidelines are given in the Annexes E and F.