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Rolling bearings for railway axle-boxes — Acceptance inspection

Roulements pour boîtes d'essieux de matériel ferroviaire — Contrôle de réception

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 4 has reviewed ISO Recommendation R 1160 and found it technically suitable for transformation. International Standard ISO 1160 therefore replaces ISO Recommendation R 1160-1970 to which it is technically identical.

ISO Recommendation R 1160 was approved by the Member Bodies of the following countries :

Australia	Hungary	Poland
Austria	India	Portugal
Belgium	Ireland	Romania
Brazil	Israel	Spain
Chile	Italy	Sweden
Czechoslovakia	Japan	Switzerland
France	Korea, Rep. of	Turkey
Germany	Netherlands	U.S.S.R.
Greece	Norway	Yugoslavia

The Member Body of the following country expressed disapproval of the Recommendation on technical grounds :

United Kingdom*

* Subsequently, this Member Body approved the Recommendation.

No Member Body disapproved the transformation of ISO/R 1160 into an International Standard.

Rolling bearings for railway axle-boxes – Acceptance inspection

1 SCOPE AND FIELD OF APPLICATION

This International Standard deals with the supply of rolling bearings for railway axle-boxes. It specifies technical requirements, properties and tolerances and provides the relevant inspection methods applicable to acceptance inspection. It excludes trade clauses in current use, such as guarantees, which are covered by agreements between customer and supplier.

Three types of rolling bearings for railway axle-boxes are considered in this International Standard :

- cylindrical roller bearings;
- tapered roller bearings;
- self-aligning roller bearings.

Bearings may have either cylindrical or tapered bore.

2 REFERENCE

ISO/R 80, *Rockwell hardness test (B and C scales) for steel*.

3 PROPERTIES, REQUIREMENTS AND TOLERANCES

3.1 General inspection

Independent of any other inspection considered necessary by the supplier to guarantee the quality of his product, the following properties of all bearings shall be compulsorily checked by the supplier, possibly in the presence of the customer.

3.1.1 Dimensions and appearance

3.1.2 Functioning

3.2 Sampling inspection

On each sample bearing the customer may inspect, at his discretion, all or some of the following properties :

3.2.1 Appearance

All essential portions of the roller bearings shall be clean and free from defects such as : porosity, burrs, hardening cracks, grinding marks, indentations, rust marks, etc.

Surfaces other than

- those portions of the roller faces which are not in contact with the ring ribs,
- the roller chamfers, and
- the reliefs at the ends of the outer and inner ring raceways

shall be smooth.

3.2.2 Dimensions, radial run-out and radial internal clearance

The following dimensions and properties shall be inspected :

- bore diameter (cylindrical bores);
- outside diameter;
- inner ring width;
- outer ring width (except for tapered roller bearings, for which the bearing width is measured);
- inner ring width variation;
- radial run-out of inner and outer rings in the assembled bearing;
- radial run-out of inner and outer ring raceways (this is inspected only if run-out is not inspected on the assembled bearing);
- radial internal clearance (except for tapered roller bearings);
- interchangeability of inner rings of cylindrical roller bearings (if stipulated).

The dimensions of the bearings shall be as stated on the drawings or, failing these, in accordance with national standards or International Standards.

The dimensional deviations, as well as the radial run-out and the radial internal clearance, shall be within the limits stipulated on the drawings or, failing these, according to national standards or International Standards.

3.2.3 Defects detectable by magnetic particle testing

When subjected to magnetic particle testing, the rings and the rollers shall not show any signs of cracks or other harmful defects.

3.2.4 Hardness

The rings and rollers shall have a Rockwell C hardness (HRC) of $57 \leq \text{HRC} \leq 66$.

3.2.4.1 RINGS

The hardness values measured on one ring shall not differ by more than 3 HRC units.

3.2.4.2 ROLLERS

The hardness values measured on three rollers of one bearing shall not differ by more than 3 HRC units.

3.2.5 Expansion resistance of inner rings

After completion of the expansion test, the ring shall show no signs of fracture.

3.2.6 Structure and carburization

The fractured sections shall not show any discontinuity, laminations, flaws, shrinkage cavities or other material defects. When case-hardening is one of the manufacturing operations, the thickness of the carburized layer shall be in accordance with the specifications.

3.2.7 Inclusions

(Reserved)

3.2.8 Chemical composition

The bearing supplier is usually not bound to use steels of a specific chemical composition. Nevertheless, the customer may either

- a) on agreement with the supplier, stipulate the chemical composition of the steels, or
- b) ask the supplier to inform him of the chemical composition of the steels he intends to use for the manufacture of the bearings.

For bearing components other than rings and rollers, for example the roller cages, the supplier may, on agreement with the customer, use non-alloyed steel or copper alloys, or even other materials.

The analysis results shall correspond to the chemical composition stipulated in the order.

3.2.9 Retouching

No retouching may be made without the customer's agreement. Any retouching with the purpose of concealing a defect is forbidden.

3.3 Significance of inspection findings

Any deviation from the stipulations found by inspection of a sample bearing may result in the rejection of the corresponding lot.

Where the customer is agreeable to repeat his tests, the number of bearings to be submitted for these further tests shall be determined by special agreement between customer and supplier.

4 SAMPLING

4.1 Presentation of the delivery

On completion of manufacture the bearings shall be presented for inspection ready for use. According to previous agreement between customer and supplier, bearings may be presented lubricated or unlubricated, packaged or unpackaged.

Bearings with the same designation, belonging to the same manufacturing batch and presented at the same time, constitute a lot.

4.2 Sampling procedure

Each bearing shall be subjected to the general inspection stipulated in 5.1. The customer shall then select, at random from each lot presented, the bearings intended for the sampling inspection described in 5.2 and shall mark them indelibly. The number of sample bearings is indicated in the table below.

The bearings selected for sampling inspection shall be degreased, if necessary.

TABLE – Number of samples

Number of bearings in the lot	Number of bearings to be selected for tests
up to 100	2*
from 101 to 250	3
over 250	4

* The number of bearings to be selected from a lot equal to or less than 50 bearings is subject to agreement between customer and supplier.

5 INSPECTION METHODS

5.1 General inspection

5.1.1 Inspection of dimensions and appearance

This inspection shall be carried out according to the supplier's usual methods.

5.1.2 Functioning test

The functioning of bearings shall be tested according to a method agreed upon between customer and supplier.

5.2 Sampling inspection

5.2.1 Place of inspection

Inspection of the bearings shall be carried out at the supplier's premises, except for the examination of inclusions and the chemical analysis, which, unless otherwise specified, shall be carried out in the customer's laboratory.

5.2.2 Inspection of appearance

The examination shall be carried out visually (without magnification).

5.2.3 Inspection of dimensions, radial run-out and radial internal clearance

5.2.3.1 GENERAL

Temperature

Measurements shall be carried out at ambient temperature. The gauges and measuring instruments and the parts to be inspected shall be stabilized at this temperature before any test is carried out.

Gauges

The gauges operating by contact (dial gauges) shall be provided with a plunger contact of spherical form, having a minimum curvature radius of 2,5 mm.

The force exerted by the dial gauge on the bearing shall not exceed 3,3 N (approximately 340 gf).

Reference side

The following are considered as reference sides :

- on symmetrical rings, the side opposite the bearing designation marking;
- on asymmetrical rings, the side intended as the thrust side.

If these criteria are not sufficient to identify the reference side, the supplier shall designate the reference side on the bearing drawing.

5.2.3.2 BORE DIAMETER d (CYLINDRICAL BORE) AND OUTSIDE DIAMETER D

For these measurements the bearing should preferably be placed on a substantially horizontal plane surface (see figures 1 and 2).

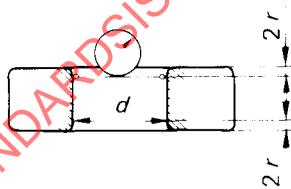


FIGURE 1

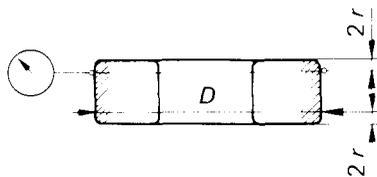


FIGURE 2

The measurements shall be made in two planes parallel to the sides and at a distance of $2r$ from the adjacent side (r = nominal ring chamfer dimension).

For both dimensions d and D , the smallest single diameter (d_{min} and D_{min}) and the largest single diameter (d_{max} and D_{max}) found in either of the two planes shall be determined, using a measuring instrument with two points of contact.

The mean diameter (d_m and D_m) of a ring is the arithmetical mean value of the smallest and the largest single diameter :

$$d_m = \frac{d_{min} + d_{max}}{2}$$

$$D_m = \frac{D_{min} + D_{max}}{2}$$

5.2.3.3 INNER RING WIDTH AND OUTER RING WIDTH (except for tapered roller bearings where the bearing width is measured)

For both rings, the distance between the side faces shall be checked using a measuring instrument with two points of contact. At every point the distance shall be within the stipulated limits.

5.2.3.4 INNER RING WIDTH VARIATION

The bearing shall be placed on three equidistant supports which are in contact only with the inner ring (see figure 3).

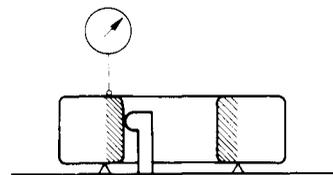


FIGURE 3

A dial gauge shall be applied to the middle of the inner ring side face directly above one of the supports. A guide shall centre the bearing.

The width variation is equal to the total variation of the dial gauge reading during one revolution of the inner ring.

5.2.3.5 RADIAL RUN-OUT OF INNER AND OUTER RINGS IN THE ASSEMBLED BEARING

Cylindrical roller and self-aligning roller bearings

The bearing shall be mounted without clearance or deformation on a tapered¹⁾ mandrel set horizontally between centres. (See figure 4.)

1) Taper of about 0,03 mm on diameter per 100 mm length. If the bore is slightly tapered, its taper shall be positioned in the same direction as that of the mandrel. Beforehand, the radial run-out of the mandrel shall be measured and located, and the readings of the dial gauge corrected, if necessary.

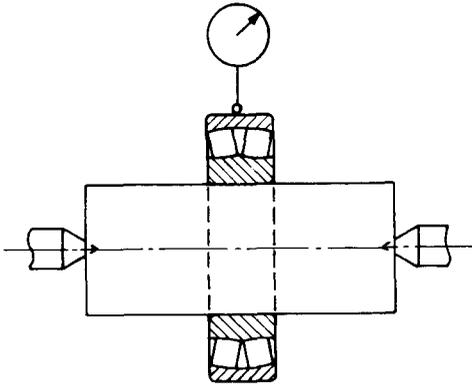


FIGURE 4

Tapered roller bearings

The bearing shall be mounted without clearance or deformation on a tapered¹⁾ mandrel set vertically between centres. (See figure 5.)

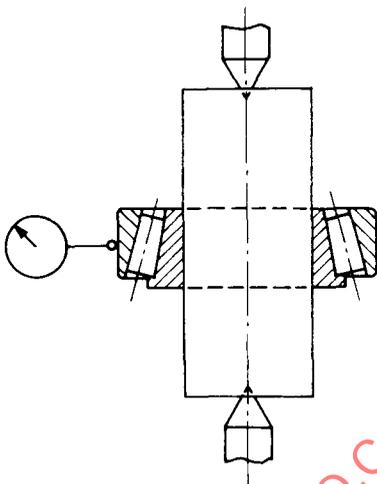


FIGURE 5

A dial gauge shall be placed in contact with the outer ring outside surface in the plane containing the middle of the raceway.

On cylindrical roller bearings without ribs, tapered roller bearings and self-aligning roller bearings, the outer ring shall be guided laterally.

a) *Radial run-out of inner ring* (all bearing types)

The radial run-out is equal to the difference between the maximum and the minimum reading of the dial gauge in contact with the outer ring, when rotating the mandrel and the inner ring through one revolution, the outer ring being stationary.

b) *Radial run-out of outer ring* (all bearing types)

The radial run-out is equal to the difference between the maximum and the minimum reading of the dial gauge in contact with the outer ring, when rotating this ring through one revolution, the inner ring being stationary.

For tapered roller bearings other equivalent methods may be used for this inspection.

5.2.3.6 RADIAL RUN-OUT OF INNER AND OUTER RING RACEWAYS

The ring shall be placed on an inclined plane surface and shall be guided in its bore at two points situated in a plane parallel to the supporting surface and containing the middle of the roller raceway. A dial gauge shall be applied to the outside surface of the ring in line with one of the internal guides (see figure 6).

The radial run-out is equal to the difference between the maximum and the minimum reading of the dial gauge when rotating the ring through one revolution.

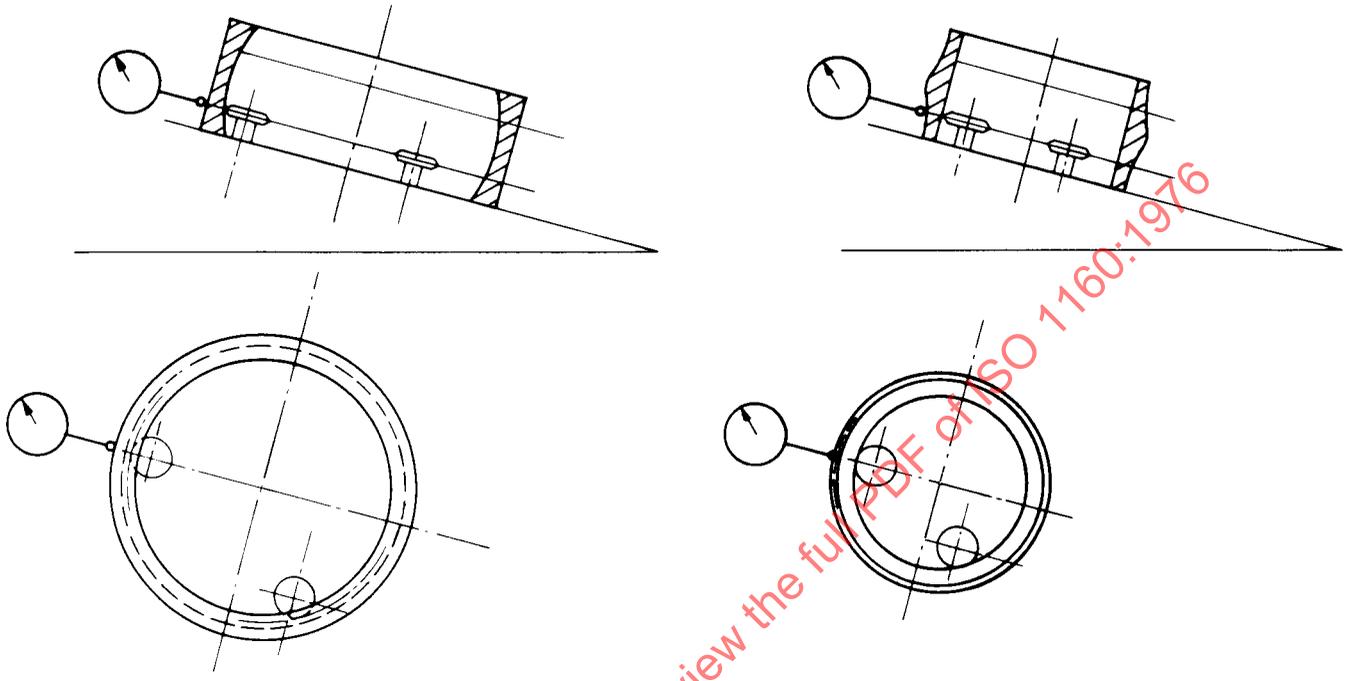
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1) Taper of about 0,03 mm on diameter per 100 mm length. If the bore is slightly tapered, its taper shall be positioned in the same direction as that of the mandrel. Beforehand, the radial run-out of the mandrel shall be measured and located, and the readings of the dial gauge corrected, if necessary.

Double row roller bearings

Outer ring

Inner ring



Single row roller bearings

Outer ring

Inner ring

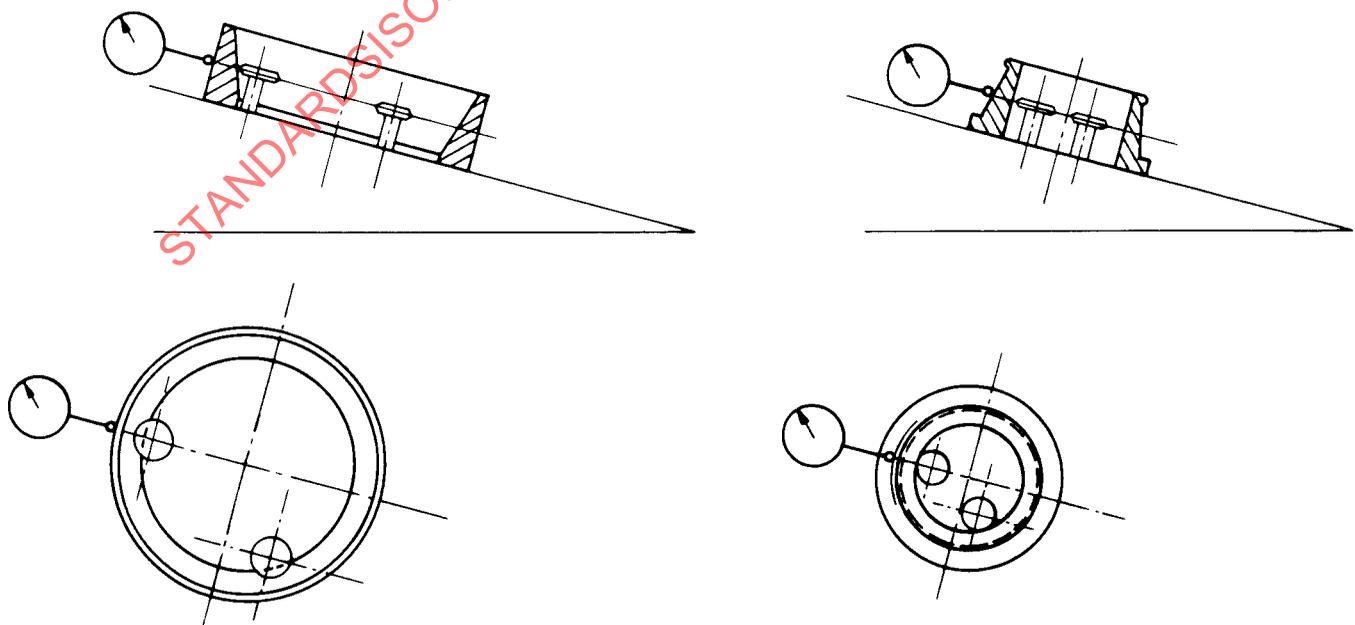


FIGURE 6

5.2.3.7 RADIAL INTERNAL CLEARANCE (except for tapered roller bearings)

With the bearing standing on a reasonably horizontal plane surface, the clearance in the upper part of the bearing, between the two rollers adjacent to the vertical plane and either the outer ring or the inner ring as applicable, shall be measured with feeler gauges of known thickness (see figure 7).

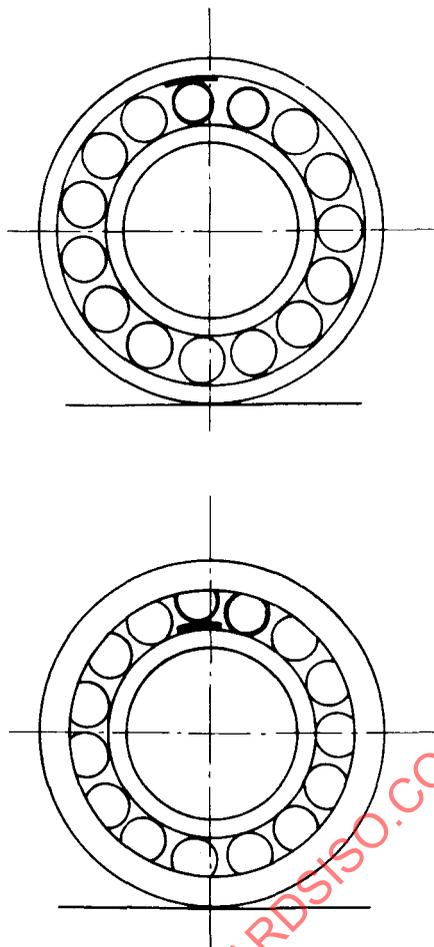


FIGURE 7

Three measurements shall be carried out, the outer ring being rotated through 120° between measurements while the inner ring is kept stationary.

The bearing clearance is the arithmetical mean value of the clearances measured.

For double row roller bearings these measurements shall be made on both rows.

5.2.3.8 INTERCHANGEABILITY OF INNER RINGS OF CYLINDRICAL ROLLER BEARINGS

In a given complete bearing the inner ring shall be changed and the radial internal clearance measured according to 5.2.3.7.

5.2.4 Magnetic particle testing

The test shall be made on both rings and three rollers of each bearing.

It shall be made according to a method agreed upon by the customer and the supplier.

5.2.5 Hardness testing

The test shall be carried out according to ISO/R 80.

5.2.5.1 RINGS

The test shall be made on both rings of each bearing. The Rockwell hardness shall be measured on one of the side faces of the ring at both ends of two diameters perpendicular to each other.

In each of the four checked areas two measurements, giving compatible results, shall be made.

5.2.5.2 ROLLERS

The test shall be made on three rollers of each bearing. The Rockwell hardness shall be measured at one point on the surface of one end of the roller.

In each checked area two measurements, giving compatible results, shall be made.

5.2.6 Expansion testing of inner rings

The test involves the expansion of the bore of the ring by means of a tapered mandrel.

The expansion shall be such that the bore diameter increase is 0,001 5 times the bore diameter.

The expansion shall be rapid. The use of an eccentric press is considered suitable and it is recommended that necessary precautions be taken during the test, since ejected fragments, if fracture occurs, may be dangerous.

Any equivalent method may be used.

5.2.7 Examination of structure and carburization

The examination shall be made on both rings and three rollers of each bearing.

The ring or the roller shall be fractured by a method chosen by the supplier to show the structure of a brittle fracture. A reagent may be used to permit accurate measurement of the thickness of the carburized layer.

The structure shall be examined visually (without magnification).

5.2.8 Examination of inclusions

(Reserved)

5.2.9 Chemical analysis

The chemical analysis shall be made on both rings and one roller from each bearing.

A piece of one of the fragments, having a minimum mass of 50 g, shall be analysed in accordance with the national standards of the customer.

6 MARKING, PROTECTION, PACKAGING AND LABELLING

6.1 Marking

Each bearing shall carry on the side face of one of its rings (of both rings, if the components are separable), visibly and indelibly, the following markings :

- supplier's trade-mark;
- complete designation of the bearing, defining the type, dimensions, radial internal clearance, etc.;
- year of manufacture.

6.2 Protection, packaging and labelling

The bearings shall be delivered greased or oiled and packaged to prevent corrosion or damage due to any reason.

The packages shall carry the following markings :

- supplier's trade-mark;
- complete designation of the bearing, defining the type, dimensions, radial internal clearance, etc.;
- manufacturing or packaging date.

In case non-interchangeable components of a bearing are packaged in different boxes, the latter shall be tied together so that they cannot be separated before the bearing is used. Additionally, the boxes shall carry any reference marks necessary to enable re-assembly of the bearing.

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