

# ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

## ISO RECOMMENDATION R 1160

ROLLING BEARINGS

ROLLING BEARINGS FOR RAILWAY AXLE-BOXES

ACCEPTANCE INSPECTION

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## ROLLING BEARINGS

## ROLLING BEARINGS FOR RAILWAY AXLE-BOXES

## ACCEPTANCE INSPECTION

**1. SCOPE**

This ISO Recommendation 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 ISO Recommendation :

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

Bearings may have either cylindrical or tapered bore.

**2. PROPERTIES, REQUIREMENTS AND TOLERANCES****2.1 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 should be compulsorily checked by the supplier, possibly in the presence of the customer.

**2.1.1 Dimensions and appearance****2.1.2 Functioning****2.2 Sampling inspection**

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

**2.2.1 Appearance.** All essential portions of the roller bearings should 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,

should be smooth.

**2.2.2 Dimensions, radial runout and radial internal clearance.** The following dimensions and properties are 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 runout of inner and outer rings in the assembled bearing;
- radial runout of inner and outer ring raceways (this is inspected only if runout 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 should be as stated on the drawings or, failing these, in accordance with national standards or ISO Recommendations.

The dimensional deviations, as well as the radial runout and the radial internal clearance, should be within the limits stipulated on the drawings or, failing these, according to national standards or ISO Recommendations.

**2.2.3 Defects detectable by magnetic particle testing.** When subjected to magnetic particle testing, the rings and the rollers should not show any signs of cracks or other harmful defects.

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

**2.2.4.1 RINGS.** The hardness values measured on one ring should not differ by more than 3 HRC units.

**2.2.4.2 ROLLERS.** The hardness values measured on three rollers of one bearing should not differ by more than 3 HRC units.

**2.2.5 Expansion resistance of inner rings.** After completion of the expansion test, the ring should show no signs of fracture.

**2.2.6 Structure and carburization.** The fractured sections should 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 should be in accordance with the specifications.

**2.2.7 Inclusions**

(Reserved)

**2.2.8 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, e.g. 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 should correspond to the chemical composition stipulated in the order.

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

**2.3 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 should be determined by special agreement between customer and supplier.

**3. SAMPLING**

**3.1 Presentation of the delivery**

On completion of manufacture the bearings are 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.

**3.2 Sampling procedure**

Each bearing is subjected to the general inspection stipulated in clause 4.1. The customer then selects, at random from each lot presented, the bearings intended for the sampling inspection described in clause 4.2 and marks them indelibly. The number of sample bearings is indicated in the table below.

The bearings selected for sampling inspection should 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.

**4. INSPECTION METHODS**

**4.1 General inspection**

4.1.1 *Inspection of dimensions and appearance.* This inspection is carried out according to the supplier's usual methods.

4.1.2 *Functioning test.* The functioning of bearings is tested according to a method agreed upon between customer and supplier.

**4.2 Sampling inspection**

4.2.1 *Place of inspection.* Inspection of the bearings is carried out at the supplier's premises, except for the examination of inclusions and the chemical analysis, which, unless otherwise specified, are carried out in the customer's laboratory.

4.2.2 *Inspection of appearance.* The examination is carried out visually (without magnification).

4.2.3 Inspection of dimensions, radial runout and radial internal clearance

4.2.3.1 GENERAL

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

*Gauges.* The gauges operating by contact (dial gauges) should 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 should 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 should designate the reference side on the bearing drawing.

4.2.3.2 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 Fig. 1 and 2).

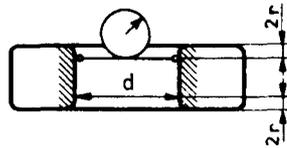


FIG. 1

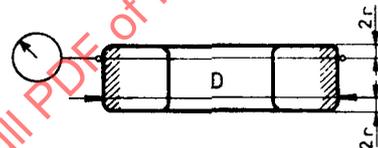


FIG. 2

The measurements are 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 are 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

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

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

4.2.3.3 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 is checked using a measuring instrument with two points of contact. At every point the distance should be within the stipulated limits.

4.2.3.4 INNER RING WIDTH VARIATION. The bearing is placed on three equidistant supports which are in contact only with the inner ring (see Fig. 3).

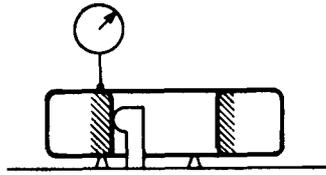


FIG. 3

A dial gauge is applied to the middle of the inner ring side face directly above one of the supports. A guide centres the bearing.

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

4.2.3.5 RADIAL RUNOUT OF INNER AND OUTER RINGS IN THE ASSEMBLED BEARING

*Cylindrical roller and self-aligning roller bearings*

The bearing is mounted without clearance or deformation on a tapered\* mandrel set horizontally between centres. (See Fig. 4).

*Tapered roller bearings*

The bearing is mounted without clearance or deformation on a tapered\* mandrel set vertically between centres. (See Fig. 5).

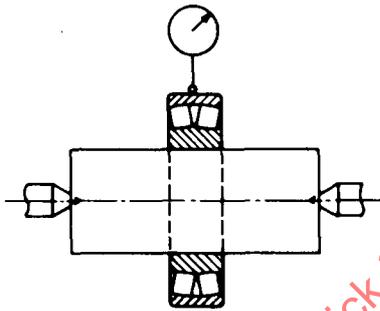


FIG. 4

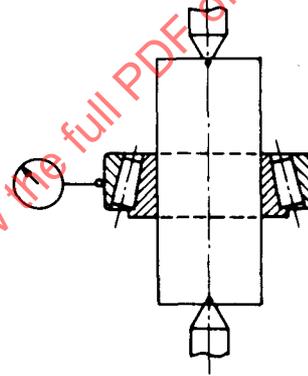


FIG. 5

A dial gauge is 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 should be guided laterally.

- (a) *Radial runout of inner ring* (all bearing types). The radial runout 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 runout of outer ring* (all bearing types). The radial runout 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.

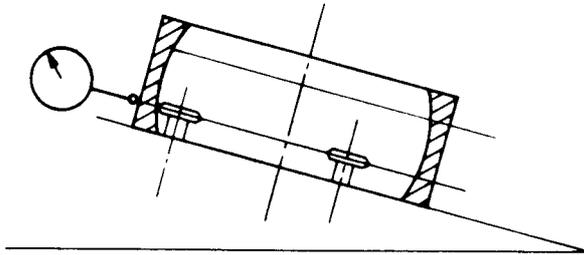
4.2.3.6 RADIAL RUNOUT OF INNER AND OUTER RING RACEWAYS. The ring is placed on an inclined plane surface and is guided in its bore at two points situated in a plane parallel to the supporting surface and containing the middle of the roller raceway. A dial gauge is applied to the outside surface of the ring in line with one of the internal guides (see Fig. 6).

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

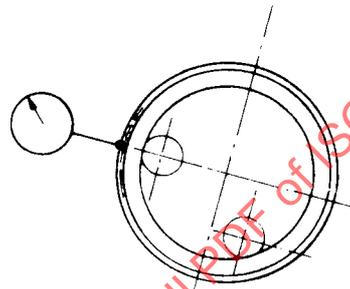
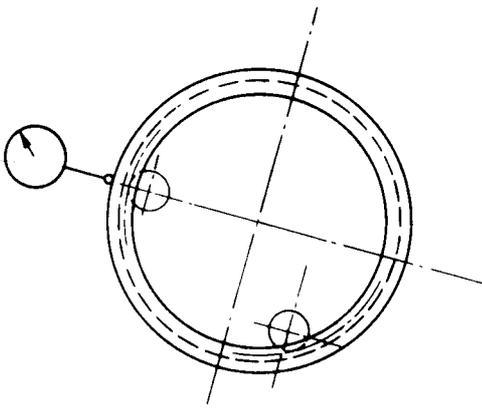
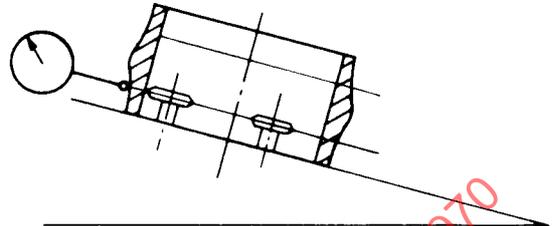
\* Taper of about 0.03 mm on diameter per 100 mm length. If the bore is slightly tapered, its taper should be positioned in the same direction as that of the mandrel. Beforehand, the radial runout of the mandrel should be measured and located, and the readings of the dial gauge corrected, if necessary.

Double row roller bearings

Outer ring

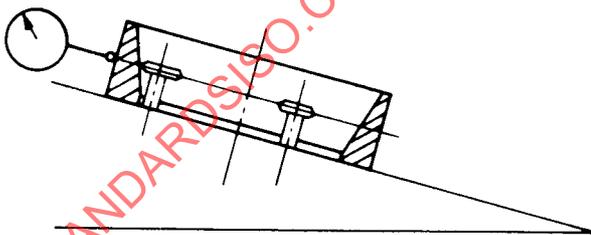


Inner ring



Single row roller bearings

Outer ring



inner ring

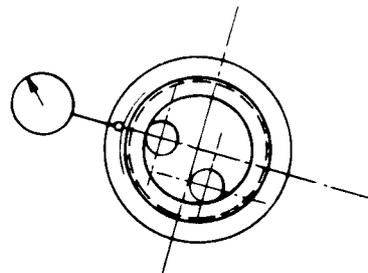
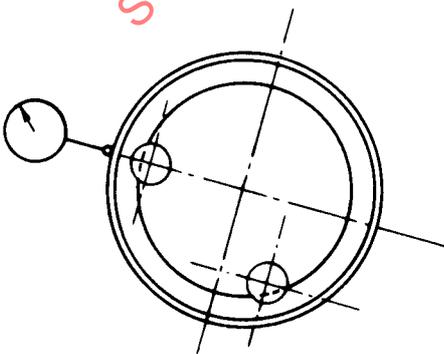
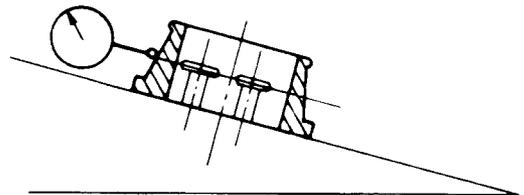


FIG. 6