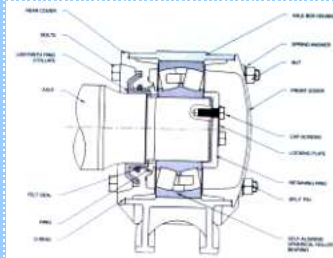




(Govt. of India)
(Ministry of Railways)

आई.सी. एफ. डिजाइन कोचेज में एक्सल बॉक्स बियरिंग
अनुरक्षण एवं हॉट एक्सल को कम करने हेतु दिशा निर्देश
हस्त पुस्तिका
Hand Book
On
Instruction on Axle Box Bearing Maintenance and
Guidelines to Minimize Hot Axle in ICF Design
Coaches



(For official use only)
IRCAMTECH/M/12-13/Axle Box/1.0

June 2012

अभ्यास RDS
रेल अग्रदूत Transforming Railways



Indian Railways
Centre for Advanced Maintenance Technology

MAHARAJPUR, GWALIOR -474005

महाराजपुर, ग्वालियर

प्राक्कथन/Foreward

This hand book covers introduction, constructional detail of bearing, instructions and precautions during inspection and maintenance, maintenance practices in shop as well as in open line, Type of Bearing failures & corrective measures to prevent them, important do's and don'ts have been covered in brief & lucid manner.

Wherever required sketches and colored photographs have been provided for better understanding.

I am sure that the handbook will be useful to the field staff to ensure trouble free service of the train operation by minimizing the cases of hot axles.

Technological up-gradation and learning is a continuous process. Hence feel free to write us for any addition / modifications or in case you have any suggestion to improve the Hand Book. Your contribution in this direction shall be highly appreciated.

Place: CAMTECH/GWL
Date: 30/06/2012

(A R Tupe)
Exe. Director

भूमिका/ Preface

Bearing plays a vital roll between two rotary moving parts. It works as an anti frictional element and reduce frictional losses. Roller bearing components are manufactured to very close tolerance.

The Main object to prepare this hand book is to provide detailed and standardized instructions for spherical roller bearings maintenance and guidelines to minimize the hot axle cases in ICF design Coaches.

This Book contains introduction, constructional detail of bearing, instructions and precautions during inspection and maintenance, maintenance practices in shop as well as in open line, Classification of Bearing damages and it's corrective measures & important do's and don'ts etc .

This hand book is aimed at assisting concerned staff and does not supersede any existing instructions from Railway Board, R.D.S.O. or IRCA etc. Most of the data and information mentioned here in are available in some form or the other in various books and manuals or other printed matters. If any changes are made, these will be issued in the form of correction slips. For convenience, this book includes a proforma for entering all correction slips serially.

Place: CAMTECH/GWL
Date: 30.06.2012

(K.P.Yadav)
Director(Mech)

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**Hand Book
On
Instruction on Axle Box Bearing
Maintenance and Guidelines to Minimize Hot
Axle in ICF Design Coaches**

आई.सी. एफ. डिजाइन कोचेज में
एक्सल बॉक्स बियरिंग अनुरक्षण एवं
हॉट एक्सल को कम करने हेतु दिशा
निर्देश हस्त पुस्तिका

1.0 परिचय/INTRODUCTION

Bearing plays a vital roll between two rotary moving parts. Bearing work as an anti frictional element and reduce frictional losses, heat produced and improves service life. Roller bearing components are manufactured to very close tolerance.

The spherical roller bearing consists of a cylindrical inner and an outer race along with rollers and cages. The cage while carrying no load, keep the rolling elements axially apart and also prevent the latter from falling out while handling. The inner ring is interference fit on the axle journal forming part of the axle when in place. The rollers are plain, straight, solid cylinders and are flat on both ends. The bearing parts are made of nickel - chromium alloy steels.

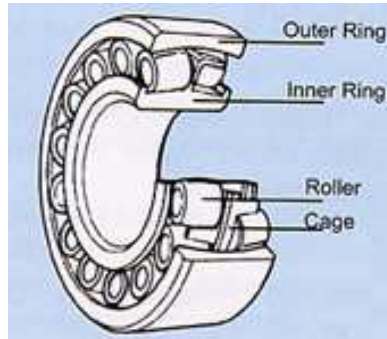


Fig.: 1.0

एक्सल बाक्स एसेम्बली /Axle Box Assembly

For spherical roller bearings, two types of axle box arrangements are commonly used. To take advantage of bearing's self aligning property, single bearing arrangement is used for higher load carrying capacity but without self aligning capability, double bearing arrangement is used.

In passenger coaches of Indian Railway system, only single bearing type axle box arrangement is used. The inner ring of the bearing is provided with either a cylindrical bore (Direct Mounted type) or with a tapered bore and withdrawal sleeve (Sleeve Mounted type). All new passenger coaches built by Indian Railways, use only direct mounted type spherical roller bearings.

2.0 स्फेरिकल रोलर बियरिंगों की बनावट /CONSTRUCTION FEATURE OF SPHERICAL ROLLER BEARING

Spherical roller bearing consist of an outer ring having a continuous spherical raceway within which it operates, two rows of barrel shaped rollers, which in turn are guided by an inner ring with two raceways separated by a centre rib. The spherical roller bearings have self-aligning properties and therefore can automatically adjust to any deviation in the centre line of the axle.

Spherical roller bearings have a large capacity for radial loads, axle loads in either direction, and complex loads. They are suited for the applications such as railway rolling stocks where vibrations and shock loads are encountered.

Roller Bearings are named according to the shape of rollers. Roller Bearings with spherical rollers are called as Spherical Roller Bearings (see Fig. 2.0 Spherical Roller Bearing and Axle Box Assembly)

Spherical Roller bearing no. 22326/C3 with **130 mm** parallel bore on the inner ring is being used on ICF type coaches. They are directly shrunk fit on the axle journals.

3.0 बियरिंग अवयव /BEARING COMPONENTS

3.1 आउटर रिंग /Outer ring

Outer ring for spherical roller bearings are manufactured from forged and rolled rings from bearing quality steel. It is through hardened and precision ground all over. The track or roller surface of bearing outer ring is spherical in shape for self-aligning.

3.2 इनर रिंग /Inner Ring

Inner ring for spherical roller bearing are also made from bearing quality steel which is forged and rolled. Inner rings are also precision machined heat-treated and precision ground. Inner rings have two rolling surface which are ground together with high accuracy.

3.3 रोलर /Roller

Roller are either forged or machined from bearing quality steel bars & then through hardened and ground to high degree of accuracies.

3.4 केज /Cage

Spherical roller bearings are fitted with machined brass cages. These cages are made from brass centrifugal castings and then precision machined. Brass cages have advantage of assuring positive lubrication and cooler running of the bearing therefore are best recommended for railway applications.

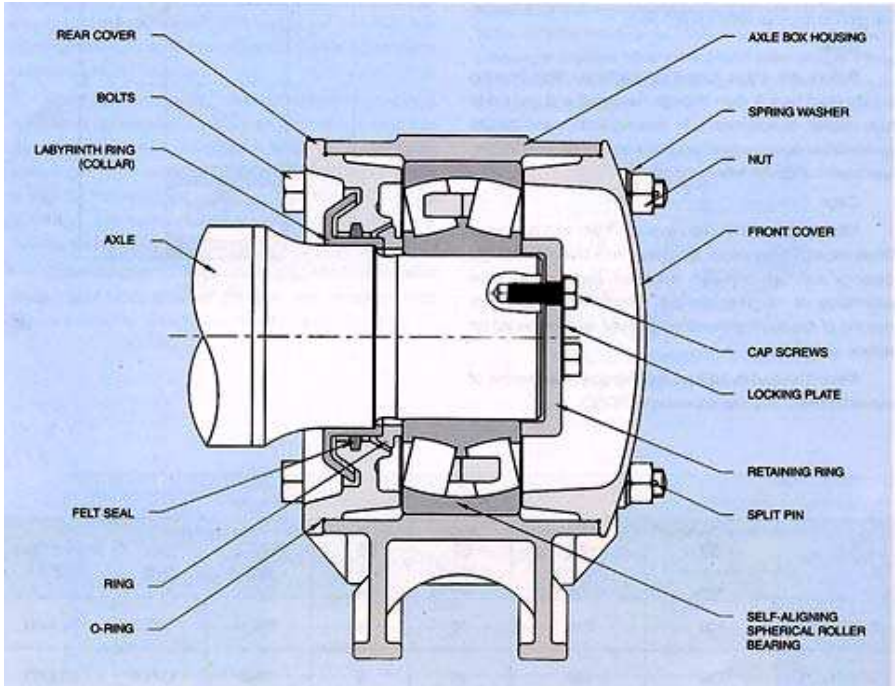


Fig.: 2.0 Spherical Roller Bearing and Axle Box Assembly

4.0 सामान्य निर्देश एवं सावधानिया /GENERAL INSTRUCTIONS AND PRECAUTIONS

Spherical roller bearings are manufactured with high degree of precision and therefore require utmost care during storage, handling, mounting and dismounting work. Without care, bearings may fail to fulfill its desired performance.

Following are some of the important instructions to be followed-

1. Do not drop the bearing.
2. Bearing should not be unpacked until it is ready for mounting.
3. All plastic wedges inserted between rollers to protect from any damage during transportation, must be removed prior to fitment on axle journal.
4. Spherical Roller bearings are designed, manufactured and assembled to provide a specific amount of radial clearance. Therefore, components of any spherical roller bearings should never be interchanged with other bearing. This can lead to poor performance or failure of the bearing.
5. Mounting, dismounting, inspection and maintenance work of bearings must be done by trained/ qualified persons as per laid down procedures/ specifications.
6. Use only recommended tools for mounting / dismounting and maintenance work.
7. Use only those parts, which are new or otherwise satisfactory to reach the next reconditioning interval after service.

c

8. Bearing parts of different roller bearing units or different manufacturers must never be mixed or interchanged. This can disturb the radial and axial clearances, which can lead to poor performance of the bearing during service.
9. Never mix two different brands of grease or used grease with fresh grease.
10. Lubricate both new and used cap screws prior to installation.
11. Be extremely careful about the conditions, such as under size journal diameter, oversize housing bore, absence of cap screw clamp load etc.
12. Any wear or damage on axle box component should be cause for renewal.
13. Electrical current must never be allowed to pass through roller bearings as it may cause arcing within the roller bearing causing damages. All welding should be done with ground cable attached so that circuit formed shall not allow electrical current to flow through roller bearing.
14. When cleaning passenger coaches or any part of it, care should be exercised not to direct steam jet or water jet spray toward sealing area of axle box. This may cause damage to the bearings.

15. Heating or cutting torch when used around roller bearing must never have heat directed on any portion of the roller bearing assembly.
16. Never use heating torch for removal of bearings from journal. Use only specified tools and equipments.
17. Use of abrasive cleaning material such as sand blasting, grit blasting etc. for cleaning any part of roller bearing is strictly prohibited.
18. Cotton waste must never be used to clean roller bearing. Use only clean towels free from lint.

5.0 बियरिंग की हैंडलिंग एवं रखरखाव /STORAGE AND HANDLING OF BEARINGS

Spherical roller bearings are coated with rust preventive oil prior to packing. Therefore, bearings must be stored in original packing. Following are some of instructions to be exercised during storage and handling of the bearing.

बियरिंग का रखना / Bearing storage

- The bearing should be stored in a clean and dry place and should be protected from heat, dust, moisture, direct sunlight, vibrations etc. Even microscopically small dirt may start bearing damage and premature failure.
- Store bearing in original packing on clean and dry racks away from wall and floor.
- Do not store any chemical / solvent in the bearing storage area, which that can cause corrosion due to chemical attack.
- Use older stock first.

हैंडलिंग और ट्रांसपोर्टेशन/Handling and transportation

Spherical Roller Bearings are properly packed in pallets before supply to customers. During transportation following precautions are necessary.

- Do not throw or drop the packed boxes while loading & unloading in the lorry/truck or any transportation vehicles.

- Use fork lift truck or crane for loading & unloading purpose.
- When using cranes, use proper slings to avoid any damage to the packing.
- As far as possible same size of the packed boxes should be stacked one over other.
- Do not transport any boxes containing oil, liquid, chemicals etc. in same transportation vehicle.
- Do not keep heavy iron articles on the pallets to avoid any damage to packing.
- Cover packed boxes with tarpaulin to protect from dust, rain, water etc.
- There should not be any transshipment. Material should be delivered at the consignee's work or godown.

माउन्टेड व्हील सैट की हेण्डलिंग एवं रखना/Storage and handling of mounted wheel sets

Wheel sets with mounted bearings must be handled carefully. Use appropriate lifting tackles to avoid any damage due to hitting of wheel flange on bearing, axle box or any other component.

Bearings fitted on wheel sets, must be wrapped in a clean plastic or polythene sheet, sealed with tape on wheel side. Renew the wrapping sheet regularly.

Wheel sets fitted with bearing and axle boxes should be stored in a dry and covered space. If wheel sets are to be stored for a long time, rotate axle boxes around the journals periodically.

असेम्बली ऐरिया / Assembly area

Installation of bearings on axle must be done in a clean and dust proof area. The assembly area must be spacious, clean and free from dust. No welding, metal cutting spray painting or compressed air cleaning should be permitted in the assembly area.

Tools, gauges & equipment being used must be clean and conveniently located. Use only specified tools. Gauges must be calibrated regularly. To accomplish this operation satisfactorily and adequately, following are required.

- Cleaning oil vessel with kerosene or light oil (two sets)
- Heating oil tank with wire mesh, mineral oil, thermometer (200° C) and heater or induction heater with temperature controller and timer.
- Recommended grease for lubrication.
- Pusher jig for labyrinth ring (collar) fitting.
- Dial or digital snap gauge with master.
- Cylindrical bore gauge with dial indicator and master for checking housing bore.
- Vernier caliper, scale, micrometer & precision surface plate / straight edge.
- Feeler gauge.
- Torque wrench (duly calibrated)
- Big and small hammer, vinyl hammer, spanner, monkey wrench, pincher, chisels, adjustable rib joint pliers.
- Clean wiping waste and oil papers.
- Crane or chain block.

6.0 कारखाने में रोलर बियरिंग का अनुरक्षण /ROLLER BEARING MAINTENANCE IN WORK SHOP

Roller Bearing Maintenance Shop should be well equipped with all the tools, equipments and facilities for careful bearing handling. It should have proper workflow for easy maintenance of roller bearings. Clean surroundings and dust free atmosphere should be maintained in the shop. It should have adequate equipment and facilities for cleaning, handling, dismounting/mounting, inspection, repair and storage of roller bearings.

Roller bearings are required to be inspected periodically at a pre-defined schedule in the workshops in a Roller Bearing Maintenance Shop well equipped with all the facilities and proper lay out. The period of maintenance specified is as follows:

रोलर बियरिंग के निरीक्षण की अवधि /Periodicity of Inspection of Roller Bearing

- . All roller bearings should be cleaned, inspected and re-lubricated with fresh grease during each attention to the wheel set /bearings in the workshop.
- The roller bearings should be dismantled from the wheel set during every alternate attention in the workshops for thorough inspection of the components, rear cover and renewal of the felt sealing ring. The wheel bearing should however necessarily be dismantled and overhauled in case of any warranted out of course of attention in the workshop.

(Railway Board letter No. 2004/M(C)/ 137/8 dated 29.08.2008).

6.1 वर्कशॉप को रोलिंग बियरिंग के माउन्टेड स्थिति के निरीक्षण /Inspection of the Roller Bearing in Mounted Position in Workshops

Whenever wheel set is received in workshop during IOH of the trolley, following procedure should be adopted for carrying out inspection of roller bearing in mounted position in workshops.

- Inspect the axle box housing visually and look for any symptoms of grease oozing, if grease oozing is noticed then dismount the bearing. If not, then follow remaining steps mentioned below.
- Clean the exterior of axle box, front cover, axle box housing.
- Remove axle box cover
- Examine the grease for consistency, colour, contamination with water, foreign particles, etc.
- If grease is burnt or discolored, then remove the bearing for thorough investigation & its overhauling.
- If grease is in good condition then remove old grease, clean the bearing with kerosene in position.
- Clearance should be measured in a mounted position with a long feeler gauge simultaneously over both the rows of roller (see fig). The blades of the feeler gauge should be inserted

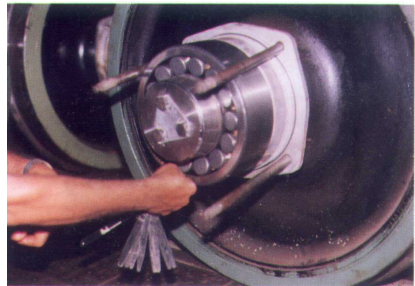


Fig: 3.0 Checking Bearing radial clearance in mounted condition

between the outer ring and the unloaded rollers. While measuring the radial clearance, the rollers should not be allowed to roll over the blade. The acceptable range of radial clearance for bearing in mounted position on journal for different makes of roller bearings is given in table.

Bearing make	Radial clearance in un-mounted condition. (mm)		Radial clearance in mounted condition. (mm)	
	New Bearings	In service bearings	New Bearings	In service bearings
FAG/NORMA	0.145–0.190	0.270 max.	0.080-0.160	0.220 max.
NEI/NBC	0.145–0.190	0.295 max.	0.080-0.160	0.245 max.

(RDSO letter No. M.C/RB/General Dated 14/11/2007)

- Then fresh grease of specified quantity should be packed between the rollers and the space between rear cover and the roller bearing. For this purpose, volumetric containers having unique shape and size, hence same to be used.
- The locking plate should be fitted in position, the end locking bolts tightened with a torque wrench to a correct torque value as given below:

11 to 12 kg-m. For M 16 bolts.

15 to 16 kg-m For M 20 bolts.

- The date, the month, and the year of attention and workshop code should be punched on the locking plate in case of retaining ring and on the annular nut in case of annular nut type arrangement (see fig. 4.0)

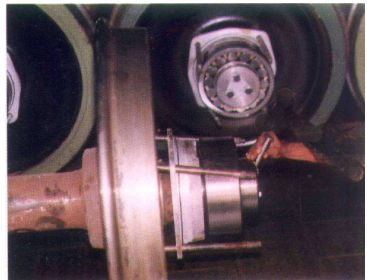


Fig: 4.0

- Bend all tabs of locking plate against the sides of the bolt using adjustable rib joint plier.
- Torque wrenches should be periodically checked for accuracy with torque wrench tester.
- The axle box housing, front cover and 'V' grooves on their faces should be thoroughly cleaned and checked for damages, distortion and trueness of dimensions. After filling the fresh grease in the grooves, the axle box housing should be carefully pushed on the bearing and the front cover tightened in position. The nuts of the axle box should be secured with the split pin. Month, year and workshop code should be stenciled on the front cover and the axle box sealed. The free rotation of the axle box should be checked by hand.
- If the condition of bearing is O.K., provide the axle box cover and make it ready for further use.

In case of grease oozing or bad condition of grease or grease is contaminated or last POH date is more than 18 months or wheel dia is at condemning limit or defect on rear cover, shoulder ring & axle housing bolts or any other visible defect observed in the bearing, remove the bearing from axle and follow the POH procedure for inspection and maintenance of the bearing.

6.2 वर्कशॉप में पी.ओ.एच. के दौरान स्पेरिकल रोलर बियरिंग का निरीक्षण / **Inspection of the Spherical Roller Bearing during POH in the Workshops**

Spherical roller bearing should be dismantled in the workshops after every 18 months periodicity (i.e. during POH) and following procedures should be followed for carrying out inspection and rejection in case of defects observed:

- Clean the exterior of axle box, front cover, axle box housing.
- Remove axle box with the help of mechanical screw type puller, by taking care to protect axle centre with the use of pad not allowing the screw to rest on the axle centre. The end locking plate should be removed.
- Remove old grease. Roller bearing and its components should be thoroughly washed and cleaned.
- All components viz., rollers, cage, outer and inner rings (races), roller track of outer ring should be examined after swiveling the outer ring.
- ***Bearing should be rejected for the following defects:***
 -
 - Pitted or flaked roller tracks and rollers.
 - Cracked or deformed or badly worn out cage.
 - Cracked inner or outer ring.
 - Scored or damaged outer surface of the outer ring.
 - Indentation on rings or rollers.

- Scoring of roller tracks or rollers.
- Rust/corrosion, damage or excessive fretting corrosion.
- Brinelling or false brinelling.
- Rings exhibiting deep straw or blue or purple colour indicating heat effect.
- Excessive or less radial clearance.

6.3 बियरिंग को खोलना /Dismounting of bearing

- For dismounting roller bearings, a special hydraulic dismounting equipment is used (see fig. 5.0). Following is the procedure for dismounting of roller bearing - Oil is injected between the journal and bore of the inner ring with high pressure, which expands inner ring resulting in breaking of interference. The bearing becomes loose on the journal and slides over it. The bearing is then removed from the journal and sent to the cleaning plant. Bearing after cleaning is thoroughly inspected for defects.
- All bearing components such as inner ring, outer ring, rollers, cage are examined for cracks, damage and breakage. Roller (track of outer ring) is examined by swiveling the outer ring. Roller track of inner ring is examined by mechanically pulling out a few rollers from the cage.
- Inspection of roller bearings should be carried out under sufficient light, using magnifying glass. If the bearing is found free from all the defects mentioned above, the radial clearance is measured with proper

feeler gauge and compared with the permissible limits prescribed by RDSO for different makes of roller bearings. If any of the components is found to be defective or radial clearance is not within prescribed limits, the bearing is rejected and discarded from service.

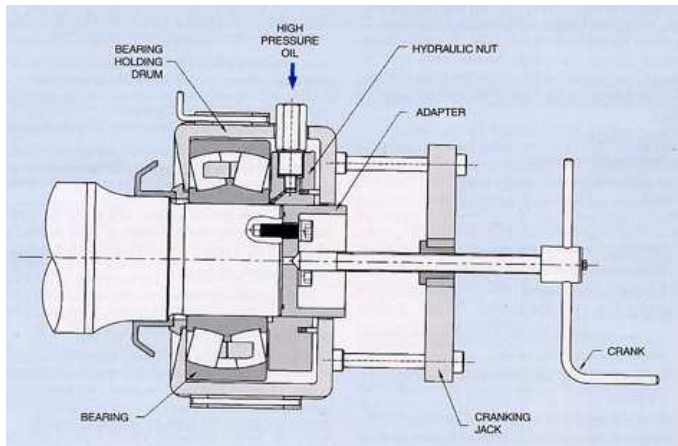


Fig: 5.0 Dismounting of Bearing

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Recommended limits of radial clearance for bearings in dismantled condition are as follows:

New Bearing	0.145 to .190 mm
Max. permissible clearance for bearing in service	
FAG/NORMA	0.270 max.
NEI/NBC	0.295 max.

6.4 कारखाने में रोलर बियरिंग के अवयवों का निरीक्षण **Inspection of other Roller Bearing Components in shop**

The following components other than roller bearing should be inspected during roller bearing maintenance in the workshop.

- *Axle end holes*
- *End locking plates*
- *End locking bolts*
- *Retaining Ring*
- *Collar*
- *Felt ring*
- *Rear and Front Cover*
- *Axle box housing*

i) एक्सल एण्ड होल्स /Axle end hole

The axle end holes should be checked with GO–NO-GO thread plug gauge for correct size and thread condition. If any of the tapped holes is worn out, a helical thread insert could be fitted in that hole for using the same size of bolt. The practice of blocking of worn out holes and drilling a new hole 60° away from old ones reduces the probing are on axle face for ultrasonic testing.

ii) एण्ड लॉकिंग प्लेट /End locking plate

End locking plates should be replaced every time its folds are opened to unscrew bolt.

iii) एण्ड लॉकिंग बोल्ट /End locking bolt

- The end locking bolts should be of high tensile steel of reputed brand/ RDSO approved

manufacturers. The condition of their threads should be checked with GO-NO GO thread ring gauges and worn out bolts replaced.

- The bolt head should be free from any damages and should have proper spanner grip. The length of the bolt should be less than that of tapped axle end holes. Bolts in service should not be reused unless they meet the above standards.
- Bolt while fitting should have no radial or axial play.

iv) रिटेनिंग रिंग /Retaining ring

The retaining ring should be cleaned and inspected for flatness and correct dimensions. The mating surfaces must be free from burr, sharp edge, rust or any other type of defect that will prevent proper seating with mating part.

v) लेब्रिन्थ रिंग (कालर) / Labyrinth Ring (Collar)

The collar should not be dismantled unless it is damaged or lost interference with the axle. Once dismantled, it should be invariably replaced.

vi) फेल्ट रिंग /Felt seal

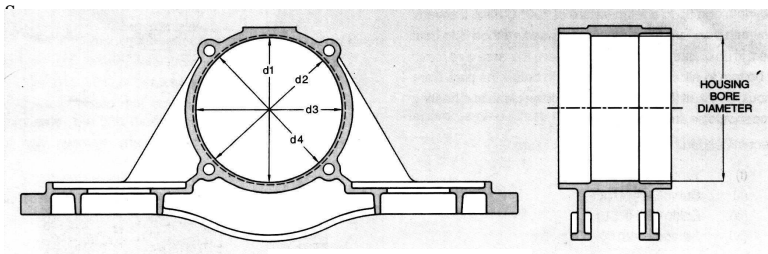
Whenever the rear cover is removed from the roller bearing axle box, the felt ring should be replaced. New felt ring should be soaked in warm cylinder oil to IS-1589-60 type I Gr. 3 heated to **40°C to 50°C for 30 minutes** and smeared with the same grease as used in the axle box before fitting in the rear cover.

vii) रियर एण्ड फ्रन्ट कवर /Rear and front cover:

The covers are generally made from aluminum die castings. These covers should be cleaned and inspected for any crack, mechanical damage, wear and correct dimensions and concentricity of bolt holes. The height should be **61+/- 0.1 mm** in the as cast condition and may be checked with the help of a gauge. In case the cover is worn out, it should be replaced. However the height of the shoulder from the face of both front cover and rear cover should be **60 ± 0.1 mm**.

viii) एक्सल बाक्स हाउसिंग /Axle box housing

The axle boxes should be thoroughly cleaned in the axle box cleaning plant and inspected. Check for any mechanical damage or distortion. The housing should be free from score marks, excessive corrosion and any wear. The dimensions of the bore and width should be within



e **Fig: 6.0**
 d tolerance limits. The axle box should be checked for distortion, particularly at the spring seat. Use cylindrical gauge fitted with dial indicator to check housing bore diameter at bearing seat (see fig. 6 & 7). Check the bore at several places and it must be within specified tolerances. Housings not conforming to the limits or otherwise found unsatisfactory must be rejected.

Axle box faces should be even.
The bore of the box should be $280 \begin{smallmatrix} +0.052 \\ +0.030 \end{smallmatrix}$ between faces. As per Axle Box Housing Drawing No. T.0.2.602 alt-4.

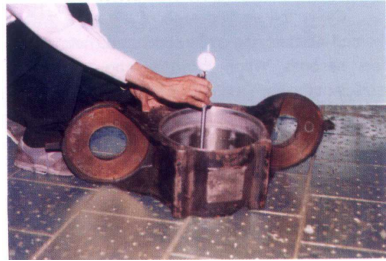


Fig: 7.0

अन्य अवयवों का निरीक्षण /Inspection of Other Components

All components of axle box must be cleaned and checked thoroughly prior to mounting. Inspect all parts visually and dimensionally. Mating surfaces must be free from burr, sharp edge, rust and other type of defect which may prevent proper seating of mating parts. Any crack, mechanical damage wear or distortion should be cause for renewal of the component.

Check cap screw visually for any mechanical damage, distortion, wear or rust and ensure that condition of bolt head is OK. Threads must be in good condition. Use thread gauge, if necessary. Use new cap screws as far as possible. Lubricate both new and used cap screws before installation, to ensure proper clamping of bearing inner ring.

6.5 बियरिंग माउन्टिंग /Bearing Mounting

Axle Preparation

Before mounting any part on the axle, it is very important to examine each axle journal thoroughly and to qualify for its correctness. Following procedure must be adopted for inspection and to ensure maximum reliability

1. Ensure that the axle journal is free from sharp edge, rust, burr, scratch or high spot. Clean the bearing seat area, fillet and shoulder thoroughly to remove dirt, swarf and rust if any prominence are observed, use only fine grade emery paper (180 grit or finer) to clean and polish. Use of file is strictly prohibited.

2. Check the axle journal for waviness along its length with the help of a high precision straight edge smeared with blue. Move the surface place forward and backward in axial direction several times to obtain the impression of blue. Repeat this procedure at a plane 90° apart on the same journal. (See Fig 8.0). If impression observed is continuous unbroken line, journal is even and suitable for use.

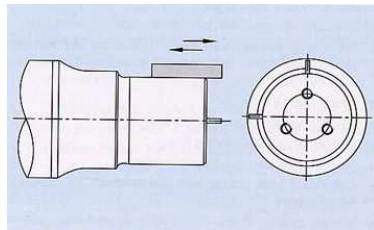


Fig. 8.0 Use of straight edge for checking journal

In case the impressions shows waviness (broken line), Check the journal diameter with a dial snap gauge at any unblued area (if found) and it must be within the specified tolerance limits.

3. Check the journal diameter on bearing seat at three different locations. Use dial or digital snap gauge for accurate measurement.

Set the dial digital snap gauge correctly over master. Apply the snap gauge on the journal at bearing seat area and rotate it around by 180° C in same location to obtain the maximum and minimum diameter readings. The average of maximum and minimum reading will indicate journal diameter at that location.



Fig: 9.0 Use of dial snap gauge for checking journal diameter

The average journal diameter at each location must be within limits as specified in table. Roundness and taper must also be within limits specified.

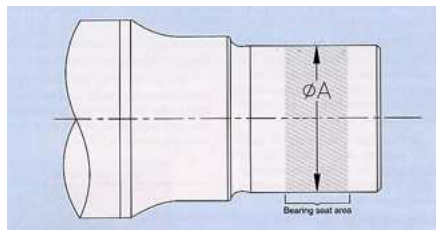


Fig. 10.0 Axle Journal

Journal Diameter ϕA (Max/Min)	Maximum permissible out of roundness (mm)	Maximum permissible taper (mm)
130.068 /130.043	0.015	0.015

4. Before mounting of the bearing, ensure that axle does not have any residual magnetism.
5. Examine condition of tapped holes in axle. Holes must be clean and free from dirt, rust, debris, burr, metal chip etc. Tap run through, if necessary. This is important to ensure maximum clamping of the bearing. The thread size of tapped holes should also be checked with suitable plug gauge. Lubricate tapped holes with oil before bearing installation.
6. The labyrinth ring has an interference fit with the axle therefore it is necessary to check shoulder diameter of each axle. The shoulder diameter must be within limits. Fillet area of journal should also be free from any defect.

Notes:

- Master, dial snap gauge and axle journal should be at same temperature.
- Be extremely careful about the conditions, such as over size or under size journal diameter. Such conditions could be potential cause for bearing failure during service.
- Be specially careful about the diameter of the axle journal where upsets (swelling) occur due to pressing of wheel disc on axle.
- All gauges and masters must be calibrated periodically
- Care must be taken when using a temperature compensating snap gauges that speed of rotation does not create sufficient heat, due to friction to effect the readings.
- If bearing is not to be mounted immediately, coat the axle journal with rust preventive oil and wrap Kraft paper.
- Use of heli-coils or thread inserts in tapped holes is strictly prohibited.

6.6 माउन्टिंग के पहले बियरिंग के रेडियल क्लीयरेंस का नाप Measurement of Bearing Radial Clearance before Mounting

During manufacturing of spherical roller bearings, highest quality standards are maintained. Bearings are checked thoroughly before supply, therefore no prior inspection is necessary, provided bearings are handled & stored properly. However, it is recommended to check both used & new bearings, visually for any defect.

Radial clearance (or diametric clearance) of each bearing must also be checked and verified for its correctness, before mounting on axle. Radial clearance must be within specified limits for satisfactory performance of the bearing. Following is the recommended method.

- (a) Place the bearing in an upright position with inner ring and outer ring faces parallel.

Place both thumbs on inner ring bore and oscillate inner ring two or three times, pressing down firmly (See fig 11.0). This action will seat the inner ring and rolling elements in a central position, and the individual roller assemblies will be positioned so that the roller at the top of



Fig: 11.0 Oscillate inner ring two or three times, pressing down firmly

the inner ring on both sides of the bearing has the maximum gap or clearance between the curved surface of the outer ring and top of the roller.

b) In the above position, rollers on upper side will be hanging loose and will obviously have a tendency to slide down towards the outer flange of the bearing inner ring and thus the gap created on the top will give the incorrect reading when a feeler is passed through the bearing.

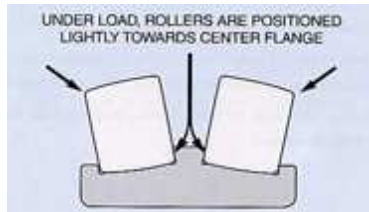


Fig: 12.0

c) In order that rollers are properly positioned, press the two top rollers (at apex positions) on the opposite rows of the bearing inward to ensure it is being in contact with central guide rib as well as make contact with bearing inner ring raceways.

(d) With the rollers in correct position, insert a thin blade of feeler gauge between the rollers. Move it carefully over the top rollers between the rollers and outer ring raceways. Repeat this process using progressively thicker feeler gauge blades until one is found that will not go through. The blade thickness that preceded the “not-go” blade is a measure of radial clearance of the bearing (See fig).



Fig: 13.0 Insert the feeler gauge between top rollers and outer race to check radial clearance.

(e) It will be preferred to let the feeler pass over both the roller of the two rows bearing simultaneously (See fig).



Fig: 14.0 Checking radial clearance over both rows of rollers simultaneously

6.7 स्फेरिकल रोलर बियरिंग एवं एक्सल बॉक्स अवयवों की माउन्टिंग Mounting of Spherical Roller Bearing and Axle Box Components

Mounting and maintenance work must be done by qualified personnel as per laid down procedures. When all necessary preparation has been made, proceed for bearing mounting in the manner described below –

लेब्रिन्थ रिंग कालर का माउण्टिंग/Mounting of Labyrinth Ring (Collar)

The labyrinth ring (collar) has an interference fit on the journal, and therefore requires heating for shrink fitting. Heat the labyrinth ring up to a temperature of 100⁰C max. If several labyrinth rings are to be mounted a good method is to heat them in an oil bath. Oil bath should have a coarse wire mesh at bottom to allow sediments to settle below the part. Care should be taken that heating oil should be clean and heating time should be around 30 minutes.

Recommended grades of oil for heating are

- (i) Yantrol 150 (HPCL)
- (ii) Servoline 150 (IOC)
- (iii) Enklo 68 (HPCL)
- (iv) Servo system 68 (IOC)

Alternatively, an induction heater can also be used, Heating time should be between 5-7 minutes.

Clean the seating area of the axle, and push the

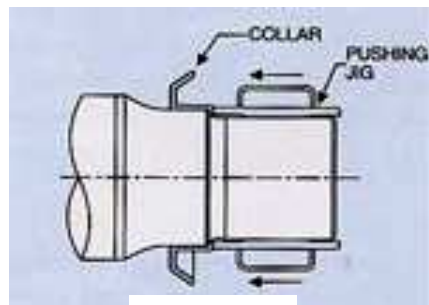


Fig: 15.0

heated labyrinth ring on the seating and hold it in position for few seconds. When labyrinth ring has been cooled sufficiently to have a fairly firm fit on its seating, drive it home against the shoulder by tapping it with pushing jig (See fig15.0), to avoid any possible gap. When tapping produces clear metallic sound, it shows that the part has seated correctly.

After cooling, coat the labyrinth ring with grease of recommended brand to prevent any damage due to moisture, dirt or other foreign matter.

रियर कवर, फेल्ट सील और ओ रिंग (कालर) की माउण्टिंग **Mounting of Rear Cover, Felt Seal & O-Ring**

Wipe and clean the rear cover and insert 4 nos. bolts. Fill “V” grooves of rear cover with grease and fit rubber O-Ring in it’s position.

Now soak the felt seal in warm cylinder oil (IS:1589 type 1 Grade 3), heated to 40⁰ C to 50⁰ C for about 30 minutes. Smear the felt seal by hand with same grease as used in axle box and fit into the groove at rear cover. Always use new felt seal of specified quality. Used felt seals must be discarded.



Fig.16.0

Slide and push in the rear cover in position against the labyrinth ring along with bolts and rubber O-ring. Fill approximately 50% of sealing collar cavity with grease.

Fill the space between rear cover and the neck of collar with grease and align.

रिंग की माउण्टिंग/Mounting of Ring

Clean and wipe the ring. Ensure that faces are parallel, flat and free from burr, rust etc. Insert the ring in its position. Fill grease in the cavity in the rear cover up to the face of the ring.

स्फेरिकल रोलर बियरिंग की माउण्टिंग/Mounting of Spherical Roller Bearing

New bearings should be taken out from original packing only just before mounting. Spherical roller bearings are coated with rust preventing oil prior to dispatch. There is no need to wash new bearings before installation.

All direct mounted spherical roller bearing for passenger coach have interference (tight) fit with axle journal, therefore requires heating and shrink fitting. Heating of bearings can be done either by using an oil bath or induction heater. Usually, temperature range of 100 to 120 degree centigrade give sufficient expansion for easy sliding of bearing over journal. However, while heating by either of these methods, ensure that temperature of bearing does not exceed 120 degree centigrade.

आयल बाथ विधि /Oil bath method

The oil bath method has advantage of gradual and uniform heating of bearings. When several bearings are to be mounted, all can be put in oil bath simultaneously to save time.

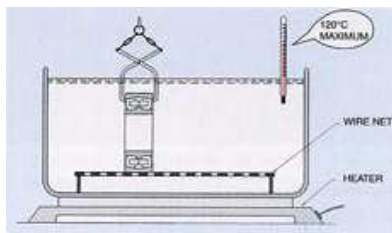


Fig: 17.0 Heating of Bearing in oil Bath

The oil bath should be equipped with suitable arrangement for electrical heating, temperature controlling system (Auto cut-off) and thermometer. A wirenet should be provided at bottom, under which impurity can settle.

Oil used in oil bath should be fortified with anti-oxidation, anti corrosion and anti- foaming additives.

Recommended oils for this purpose are :

Oil	Supplier
Enklo 68	HPCL
Servo system 68	IOC

Bearing should be suspended in heated oil by suitable hanger so that it can easily be lifted out. Heat the bearing for approximately 30 minutes to attain the temperature of 100°C to 120°C.

इण्डक्शन हीटिंग सिस्टम/Induction Heating System

Induction heating is quick, safe, energy saving and environment friendly process. In this system, due to principal of induction current, bearing is heated due to its electrical resistance and attains desired temperature.

The induction heater should be equipped with :

- Temperature and cycle time controllers
- Auto demagnetizer
- Temperature and cycle time indicator
- Audio alarm to indicate completion of cycle



Fig: 18.0

Heating time required in induction heating system largely depends upon the weight of the bearings. It is recommended to set the machine in such a way that it 5 to 7 minutes to attained the temperature of 120⁰C maximum. Overheating (beyond 120⁰C) or rapid heating may result in dimensional instability or change in material properties due to change in microstructure, which may initiate cracks in bearing races in due course.

Heated bearing should be handled with the help of hook, tong or asbestos gloves and mounted on the Journal. Push the heated bearing on the axle. The stamp face of bearing should be kept out wards, so that stamping can be seen during inspection. During mounting, installer must be careful to keep the bearing bore aligned with axle to avoid the scoring marks. Bearing position must be corrected by giving light taps with plastic hammer. Keep the bearing pressed by hand toward rear cover side for few minutes, till it has acquired sufficient grip on its seat.

Paint the exposed portion of the journal with synthetic enamel to IS:520.

माउन्टिंग के बाद बियरिंग के रेडियल क्लीयरेंस का नाप **Checking Bearing Radial Clearance after Mounting**

Due to interference fit between inner ring bore and journal diameter, the inner ring of the bearing expands after mounting. The clearance between the roller and outer ring track is reduced due to enlargement for inner ring track diameter. Therefore, to ensure satisfactory



Fig: 19.0 Checking bearing radial clearance in mounted condition

performance, it is necessary to check radial clearance of each bearing after mounting on axle. Checking should only be done when the bearing has completely cooled down prior to fitment of axle box housing.

With the bearing in mounted position, only the clearance of front row can be checked as the labyrinth ring's rear cover at the back of the bearing prevents the approach of the fingers to position the back row roller against the inner ring flange. However it will be sufficient to measure the clearance of the front row of the bearing. Here again, the rollers have to be kept pressed by thumb firmly against the centre flange and the procedure as described earlier has to be repeated. Be careful, that feeler gauge is not buckled or rolled between rollers and raceways. Measurement data must be recorded.

Radial clearance of Spherical roller bearings in mounted condition is specified below -

Bearing make	Radial clearance in mounted condition (in mm)	
	New Bearings	In service bearings
FAG/NORMA	0.080-0.160	0.220 max.
NEI/NBC	0.080-0.160	0.245 max.

लुब्रीकेशन /Lubrication

Grease plays very important role in safe and satisfactory performance of bearing. It is recommended that only specified quantity of grease of approved brand should be filled in the axle box. Over greasing or under greasing can lead to poor performance or failure.

Fill grease in specified quantity, to form a truncated cone of grease in front of the bearing. Use volumetric container to measure grease quantity. After the bearing has been mounted and lubricated, wipe thoroughly the bearing grease which has been leaked out through the rear cover. This is necessary in order to enable early detection of grease leakage during service.

▪ **The quantity of grease filled per axle box**

NBC/other make bearings **1.75 kg**

SKF make bearing **2.00 kg**

- Only lithium base grease of approved brands should be used

Brand Name Of Grease	Supplier
Servogem 3	Indian Oil Corporations
Lithon 3	Hindustan Petroleum Corporations Limited

ग्रीस को स्टोर करने के दिशा निर्देश / Guidelines for storage of Grease

1. Grease drums should be stored in vertical position in a covered room.
2. Take all precautions to prevent contamination of grease due to dirt, moisture, dust foreign particals etc.
3. Always store grease in container with cover.
4. Never mix different types of grease.
5. Use only clean tools and container when handling the grease.

रिटेनिंग रिंग, लॉकिंग प्लेट्स और केप स्कू की माउन्टिंग / **Mounting of Retaining Ring, Locking Plate and Cap Screws**

Wipe clean and fit the retaining ring. Apply locking plate and cap screws. Always use new locking plate.

In order to ensure proper retention of the bearing and other parts mounted on the journal, it is of utmost importance that cap screws must be tightened with specified amount of torque using torque wrench. Recommended torque values are as specified in the table below. Apply minimum 2 passes on each cap screw for proper tightening.

Bolt Size	Torque Value
M 16	12 Kg-M
M 20	16 Kg-M

Bend all tabs of locking plate against the sides of the bolt using adjustable rib joint plier. Punch date, month and year and workshop code on the retaining ring.

Notes

- Torque wrench must be accurate within $\pm 4\%$
- Cap screws must be of specified grade (Property class P8.8 or higher)
- Lubricate cap screws before mounting.
- Tapped holes must be clean and free from rust, burr or metal chip etc.
- Use of helicoils or threaded inserts in tapped holes is strictly prohibited.
- Always use new locking plates. Do not re-use.

एक्सल बाक्स हाउसिंग की माउण्टिंग/Mounting of Axle Box Housing

Rotate and align the rear cover. Fill “V” grooves on face of the axle box housing with grease. Align, slide and carefully push the axle box housing over the bearing. Use suitable crane/sling for handling the axle box housing.

फ्रंट कवर की माउण्टिंग / Mounting of front cover

Fix the front cover. Place locking washers on bolts and tight nuts. Be careful for even tightening of all 4 nuts. Finally secure with split pin and seal the axle box.



Fig: 20.0

Check the axle box assembly for free rotation. In case rotation of axle box is not smooth, disassemble the same and inspect for the cause.

Some of the common damages caused due to incorrect mounting are as below -

Damage during mounting	Possible Cause
Score marks on rings	Bearing inner ring not properly aligned with axle during mounting. Forcible entry on axle box during mounting.
Surface cracks	Rapid or excessive heating of bearing (temperature more than 120 °C)
Discolored surface	Excessive heating temperature (more than 120 °C)
Axial cramping of bearing	Faces of bearing and associated part not flush with one other.
Radial cramping of bearing	Oversize or undersize journal diameter.

Damage during mounting	Possible Cause
Excessive fretting of outer race	Oversize housing bore
Grease oozing from rear cover	Used or poor quality of felt seal

7.0 रोलर बियरिंग मेन्टेनेन्स में टूल्स एवं प्लान्ट की सूची List of Tool and Plants for Roller Bearing maintenance

Following are the tools and plants required for a Roller Bearing Maintenance Shop.

Sr.	Nature of Work	Equipment/Facility required
1	Cleaning of Roller Bearing	Automatic roller bearing cleaning equipment with 3 stage cleaning of pre-wash, wash and water rinsing.
2	Cleaning of Axle Boxes	Axle box cleaning plant with Bosch tank and spray jet cleaning in a close chamber
3	Axle Box extraction	Axle Box extractor
4	Dismounting of Spherical Roller Bearings	Hydraulic dismounting Equipment
5	Dismounting of Spherical Roller Bearings - straight bore	Hydraulic Dismounting equipment
6	Mounting of Roller Bearings	Induction heater with de-magnetizing device
7	Securing of end locking bolts	Torque wrench range 7–35 Kg-M and torque wrench tester

Sr.	Nature of Work	Equipment/Facility required
8	Visual inspection of dismounted roller bearings	Magnifying glass with light
9	Measuring/checking of radial clearance	Long feeler gauge range 0.05 mm to 1.0 mm set with number of leaves(25) with different thickness
10	Measurement of journal/shoulder diameter	Outside micrometers range - 125-150 mm.
11	Inspection of axle end tapped holes	Thread plug gauges for different sizes of tapped holes (for M16 x 1.5 mm pitch)
12	Inspection of locking bolts	Thread ring gauges for different sizes of Locking bolts (for M16 x 1.5 mm pitch)
13	Exact quantity of grease to be filled	Digital weighing machine (Range – 0 - 50 Kg.) and volumetric containers of different sizes for different quantity of grease
14	Identification of bearings, inspection details	Engraving/ Etching machine

8.0 हॉट एक्सल को कम करने के उपाय

CAUSE OF BEARING FAILURE & ACTION TO BE TAKEN TO MINIMISE HOT AXLE

In general, if roller bearings are used correctly they will survive to their predicted fatigue life. However, they often fail prematurely due to avoidable mistakes. Failure of the rolling bearing can occur for a variety of reasons. Accurate determination of the cause of a bearing failure is must to make suitable recommendations for eliminating the cause. The major factors that singly or in combination may lead to premature failure during service include incorrect mounting, excessive loading, inadequate & insufficient lubrication, impact loading, vibrations, contamination, entry of harmful liquids.

It is difficult to determine the root cause of some of the premature failures. If all the conditions at the time of failure, and prior to the time of failure are known, including the application, operating conditions and environment, then by studying the nature of failure and its probable causes, the possibility of similar future failures can be reduced. Two or more failure pattern can occur simultaneously and can thus be in competition with one another to reduce the bearing life. Also a pattern of failure that is active for one period in the life of a bearing can lead to or can even be followed by another failure mechanism, which then cause premature failure. Thus in some instances, a single failure pattern will be visible and in other indications of several failure pattern will be evident, making exact determination of root cause difficult. So, when more than one bearing failure pattern

has been occurred, proper analysis depends on careful examination of failed components. In contrast to fatigue life. this premature failure could be caused by :

- (1) **IN CORRECT FIT**
- (2) **IMPROPER MOUNTING**
- (3) **IMPROPER HANDLING**
- (4) **POOR LUBRICATION**
- (5) **CONTAMINATION**
- (6) **EXCESSIVE HEATING**
- (7) **EXCESSIVE LOAD**

Effect of improper practices on performance of Spherical Roller Bearing axle boxes:-

Defect	Effect on Bearing	Remedial Measures
Felt ring perished	1. Grease may ooze out from rear cover 2. Dust and water may enter the axle box	Renew the felt ring every time the bearing is dismantled in workshop. Felt ring should be as per schedule of requirement laid down by RDSO.
Rubber ‘O’ rings of cover perished	Dust and water may enter the axle box	Renew the rubber ‘O’ ring every time the bearing is attended in workshop. The material of the ring should conform to the specifications

Defect	Effect on Bearing	Remedial Measures
		laid down by RDSO.
‘V’ grooves on rear cover, front cover and axle box faces not filled with grease.	Dust and water may enter the axle box.	At the time of maintenance clean out the old grease and apply fresh grease.
Improper and/or excessive / inadequate grease.	Excessive temperature, seizing or complete failure of Roller Bearing.	<ol style="list-style-type: none"> 1. Use only approved brands of grease. 2. Use specified quantity of grease.
Bearing clearance not within prescribed limits.	Excessive wear of rollers and races leading to bearing failure.	Check bearing clearance during attention to roller bearing axle boxes in workshops and scrap bearings with clearances outside prescribed limits.
Fitment of substandard/ improper size end locking bolts/screws.	Bolt may fail in service cause damage to front cover and bearings	Check the end locking bolts /screws and if worn/sub standard, replace
Improper locking of end locking	Screw may get loose in service and cause	Follow correct procedure.

Defect	Effect on Bearing	Remedial Measures
screws.	damage to front cover and bearings	
End locking screws not tightened properly.	End locking arrangement may fail.	Tighten screws with torque wrench at specified torque value.
Journal finish and Diameter not as prescribed in the drawing.	Bearing may become loose/inner ring cracks causing serious damage to the bearing leading to bearing failure.	Journal should be to the size, tolerance and finish shown on the relevant drawings.
Excessive or inadequate lateral clearance between axle box covers and bearings.	<ol style="list-style-type: none"> 1.Excessive clearance may damage roller bearings or covers. 2.Inadequate clearance may result in gap between axle box housing and bearings. 	Maintain correct lateral clearance as indicated in the drawings.

9.0 ओपन लाइन में अनुरक्षण एवं कम करने की सावधानियाँ MAINTENANCE IN OPEN LINE & PRECAUTIONS TO AVOID HOT AXLE CASES

9.1 वीजुअल परीक्षण /Visual Examination

During Rolling-in & Rolling out examination, inspect axle box for any indication of hot box. Any wheel set with axle box running hot in the coach, must immediately be removed from service and sent for replacement. Visually inspect the axle box housing, front cover, rear cover and other parts for any damage. Check for any missing or loose fasteners. Watch for any other reason that could be detrimental to the performance of roller bearing and could lead to unsafe condition in service.

Roller bearings and axle boxes damaged due to fire, over heating, water submersion or welding , must be removed from service and sent for detailed internal examination.

9.2 रनिंग तापमान /Running Temperature

Check operating temperature of axle box by non-contact type thermometers at top of the cast steel axle box (crown) housing. The limit of temperature of the axle box top crown will be 80⁰ C. If the temperature of axle box is found above 80⁰ C, the affected coach should be detached en-route from the train service.

(RDSO LetterNo. MC/AB Dated 21/24.08.2009).

9.3 असामान्य आवाज /Abnormal sound

In Rolling-in and Rolling-out examination, try to listen for any unusual / abnormal noise or grinding. Detach the coach & remove the wheel set / roller bearing axle box in

case it produces abnormal sound and should be sent for internal part examination.

9.4 ग्रीस ऑजिंग /Grease oozing



During service, a small amount of grease leakage could be normal and comes from initial purging of grease and relieving of internal pressures. However, if fresh grease continues to leak, wheel set must be removed from service.



9.5 डिरेलमेन्ट /दुर्घटना/बाढ़ में सामिल एक्सल बॉक्स /Axle boxes involved in derailment / accidents / Flood



All wheel sets of the coaches, involved in accident, fire, flood or submerged in water, must be removed from service.



Bearing and parts must be identified separately by marking “ACCIDENT INVOLVED” and should not be reused. It is recommended that inspection of roller bearing is made together with parts including wheel sets, bogie etc.

10.0 बियरिंग खराबी के वर्गीकरण एवं संशोधित कारण /Classification of Bearing damages and its Corrective measures.



Condition	Causes	Corrective Measures
<p>Rust and corrosion</p>  <p>Surface becomes partially or fully rusted. Sometimes rusted at spacing equal to distances between rolling element</p>	<ul style="list-style-type: none"> • Improper storage • Improper packaging • Insufficient rust preventative oil • Invasion of moisture, acid etc. • Handling with bare hands 	<ul style="list-style-type: none"> • Take measure to prevent rusting while in storage. • Improve sealing performance. • Improve method of assembly and handling. • Soak felt seal in worm oil before installation
<p>Fretting</p>  <p>Fretting Surfaces wear producing red coloured particles that form hollows.</p>	<ul style="list-style-type: none"> • Over size housing bore. • Insufficient interference • Insufficient lubrication • Fluctuating load • Vibration during transport or when not operating <p>Conditions</p>	<ul style="list-style-type: none"> • Use only those housing which have correct bore dia. • Improve fit • Check surface roughness of journal and housing • Check consistency of grease • Do not use worn out or damaged housings
Condition	Causes	Corrective Measures



<p>Flaking/Spalling</p>  <p>Flakes form on the surfaces of the raceway and roller elements. When the flakes fall off, the surface becomes rough and uneven.</p>	<ul style="list-style-type: none"> • Excessive loads, metal fatigue, improper handling. • Improper mounting. • Insufficient precision of journal or housing. • Insufficient clearance • Contamination. • Rusting. • Passing of electric current through bearing. • Softening due to abnormal temperature rise. 	<ul style="list-style-type: none"> • Find the cause of heavy load. • Check internal clearance regularly. • Improve precision of journal and housing. • Improve operating conditions. • Improve method of assembly and handling. • Check grease and greasing method
<p>Seizure</p>  <p>Bearing heats up, becomes discolored and eventually seizes up.</p>	<ul style="list-style-type: none"> • Insufficient clearance (including clearances made smaller by local deformation) • Insufficient Grease. • Bad quality of grease. • Excessive load. • Roller Skewing. • Softening due to abnormal temperature rise. • Slippage of inner ring over journal due to failure of clamping arrangement. 	<ul style="list-style-type: none"> • Check grease type and quantity. • Check internal clearance regularly. • Improve method of assembly and handling. • Use specified grade fasteners. • Apply specified torque.
<p>Condition</p>	<p>Causes</p>	<p>Corrective Measures</p>

<p>Cracking</p>  <p>Splits and cracks in bearing rings and rollers</p>	<ul style="list-style-type: none"> • Rapid heating during mounting. • Excessive shock load. • Improper handling, use of steel hammer and ingress of large foreign particles. • Surface deformation due to improper lubrication. • Excessive interference. • Over size housing bore and excessive ovality. • Large flaking. • Overheating due to creeping. 	<ul style="list-style-type: none"> • Avoid rapid heating of bearing during mounting. • Reconsider operating condition. • Improve method of assembly and handling. • Prevention of creep • Do not use excessively worn out or deformed housing
<p>Cage damage</p>  <p>Breaking or wear of cage.</p>	<ul style="list-style-type: none"> • Excessive moment load. • Excessive fluctuation of speed. • Trapping of foreign objects. • Excessive vibration. • Improper mounting (misalignment) 	<ul style="list-style-type: none"> • Investigate rigidity of system. • Reconsider operating conditions. • Improve method of assembly and handling. • Improve sealing efficiency. • Check for any grease contamination.
<p>Condition</p>	<p>Causes</p>	<p>Corrective Measures</p>

<p>Rolling Path Skewing</p>  <p>Roller contact path in raceway surface strays or skews.</p>	<ul style="list-style-type: none"> • Deformation or tilt of bearing due to insufficient precision of journal or housing. • Improper mounting. • Insufficient rigidity of journal and housing. 	<ul style="list-style-type: none"> • Re-check internal clearance • Re-check precision of journal and housing. • Investigate rigidity of system.
<p>Smearing and scuffing</p>  <p>Surface becomes rough with small deposits. “Scuffing” generally refers to roughness of the bearing ring ribs and roller end faces.</p>	<ul style="list-style-type: none"> • Improper lubrication. • Ingress of foreign matter. • Rollers skew due to excessive misalignment. • Excessive surface roughness. • Excessive sliding of rolling elements. 	<ul style="list-style-type: none"> • Check the quality/ quantity of grease. • Improve sealing performance. • Check operating conditions. • Improve method of assembly and handling. • Check for any grease contamination.

Condition	Causes	Corrective Measures
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<p>Indentations</p>  <p>Hollows in raceway surface produced by solid foreign objects trapped or impacts (False brinelling)</p>	<ul style="list-style-type: none"> • Ingress of small solid foreign objects such as dirt, dust. • Trapping of flaked particles. • Impacts due to careless handling. 	<ul style="list-style-type: none"> • Improve sealing performance. • Improvement in handling and mounting practices. • Check involved bearing for flaking if dents produced by metal practices. • Always use clean grease.
<p>Electric Current Damages</p>  <p>Pits form on raceway and develop into ripples. Further development leads to corrugated surface. Some times spot or localized burns are also noticed.</p>	<ul style="list-style-type: none"> • Electric current flowing through raceway . 	<ul style="list-style-type: none"> • Create a bypass for current. • Insulate the bearing. • Follow proper instruction/ procedure for welding. Current must never be allowed to pass through bearing.

Condition	Causes	Corrective Measures
<p>Discoloration</p>  <p>Change of raceways / roller colour</p>	<ul style="list-style-type: none"> • Temper color by overheating. • Deposition of deteriorated grease on surface. • Improper lubrication. 	<ul style="list-style-type: none"> • Use good quality of grease. • Replacement of grease after recommended Intervals. • Do not allow heating of bearing beyond 120⁰C during mounting.
<p>Peeling</p>  <p>Peeling is a cluster of very small spalls. Peeling can also include very small cracks which develop in to spalls.</p>	<ul style="list-style-type: none"> • Ingress of foreign matter. • Improper lubrication. 	<ul style="list-style-type: none"> • Control of surface roughness and dust. • Improve sealing performance. • Use only clean grease.

11.0 करे या ना करें /Do's & Don'ts

Do's

- Work with clean tools in clean surroundings.
- Keep bearings wrapped in polythene sheet when not in use.
- Install new bearings as removed from packing without washing.
- Apply clean grease and keep grease container closed when not in use.
- Use volumetric container for filling correct amount of grease.
- Use clean, lint free cloth for wiping the bearings.
- Tools should be clean, in good condition and dust free.
- Store bearing horizontally and room should be dry and clean.
- Journal and axle box housing dimensions should be maintained within the specified limits.
- Calibration of measuring instruments and gauges should be done timely.
- Bearing should be unwrapped only at the time of mounting.
- Felt seal & locking plate should invariably be replaced by new, at the time of POH or reassembly.
- It should be ensured that heating temperature is within 120 degree C and the heating time allowed should be between 5-7 minutes.

- RDSO approved brands of grease should be used. Complete grease must be changed at the time of POH.
- Use clean solvents and flushing oil.

Don'ts

- Don't work in dirty surroundings.
- Don't expose bearings to moisture or dirt at any time.
- Don't remove oil from new bearings.
- Don't use incorrect brand or amount of grease and also don't keep grease in open condition.
- Don't use cotton waste and dirty clothes to wipe bearings.
- Don't use dirty and rusty tools.
- Don't store bearings vertically, in uncleaned and in humid environment.
- Don't compromise with the journal and axle box housing dimensions.
- Don't use faulty measuring instrument and gauges.
- Don't unnecessarily unwrap the bearing from its original packing.
- Don't re-use components like felt seal, locking plate, sealing ring etc.
- Don't heat the bearing beyond 120⁰ C temperatures. Rapid heating should also be avoided.
- Don't recycle the used grease. Never Mix up the greases of different grades or even different makes of same grade.
- Don't use compressed air for cleaning the bearings.

12.0 आई.सी.एफ. कोचिंग स्टॉक के हॉट एक्सल का प्रोफार्मा /Proforma for Reporting Hot Axle in ICF coaching stock

SN	Description	Remarks
1	Train No & Name	
2	Loco No. & Base	
3	Load	
4	Last Exam station /Date/% / BPC No.	
5	Coach No./Class/ Rly.	
6	Last POH Workshop / Date:	
7	Return date:	
8	Last IOH station/Date :	
9	Name of Station where coach detached	
10	Position of coach from engine	
11	Position of affected wheel	
12	Type of bearing	
13	Make of Bearing & year of Manufacture	
14	Latest UST particulars stamped/ punched	
15	Axle Particulars	
16	Return date stamped on Bearing	
17	Rotation of Axle box (Free / Jam)	

SN	Description	Remarks
18	Condition of Rollers (Damaged / seized)	
19	Condition of Outer race (Broken / Damaged)	
20	Condition of Inner race (Broken / Damaged)	
21	Condition of Cage (Broken / Damaged)	
22	Condition of Rear Cover (Broken / Damaged)	
23	Condition of Front Cover (Broken / Damaged)	
24	Condition of grease	
25	Condition of grease seal	
26	Condition of Locking studs (loose /deficient)	
27	Condition of Locking plate	
28	Any symptoms of brake binding	
29	Flat places /Skidding of wheels (size of flat if any)	
30	Any other unusual occurrences on bogies which could have prevented free rotation of bearing.	
31	Any other unusual noticed	
32	Probable cause of failure	
33	Responsibility	

Note: Failed bearing must be sent for CMT analysis after joint inspection with OEM's representative.

SSE(C&W)