



(Govt. of India)
(Ministry of Railways)

Hand Book
On
Maintenance of
Spherical Roller Bearing for ICF Coaches,
CTBUs/TBUs for LHB Coaches
&
CTRB for Freight Stock
In Workshops



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

अअमा सं RDS
रेल अग्रदूत Transforming Railways



Indian Railways
Centre for Advanced Maintenance Technology

MAHARAJPUR, GWALIOR -474005
महाराजपुर, ग्वालियर

Foreword

Vide Railway Board's Letter No. 2009/M(W)/814/Safety/Pt. dated 30.05.2012, CAMTECH was assigned to prepare Hand Book on Maintenance of Bearings like Roller Bearing for Coaches, CTRB for Freight stock and CTBU/TBU for LHB coaches in the Workshops as well as in the open line.

The failure of bearings has a great impact on the reliability of the freight & coaching stock. This Maintenance handbook has been prepared for workshop and open line staff who are involved in the maintenance of bearings.

This Maintenance Hand book not only describes maintenance but care has been taken to explain basic things about bearings including its storage and handling. Spherical Roller Bearings of ICF coaches, CTRB of Freight stock & CTBU/TBU of LHB coaches have been covered in this Handbook. With these important features, I am sure that the handbook will give necessary help to the concerned staff to ensure problem free service of the bearings.

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: 31.12.2012

(A .R. Tupe)
Executive Director

Preface

As per the AM(PU) DO Letter No. 2009/M(W)/814/Safety/Pt Dt. 30.05.2012, CAMTECH was assigned to prepare Maintenance manual for bearings like Roller Bearing for Coaches, CTRB for Freight stock and CTBU/TBU for LHB coaches.

Bearing is a vital part of coaching and freight stock. Proper upkeeping and maintenance of bearings is necessary to ensure reliability and availability of freight & coaching stock. This Hand Book on Maintenance of bearing of freight and coaching stock has been prepared by CAMTECH with the objective that those involved in maintenance of coaching & freight stock in workshops and in open line must be aware of correct maintenance procedure of bearings and must know how to investigate cause of failure and what remedial action is required.

The purpose of this maintenance hand book is to enhance knowledge and competence of C&W staff in dealing with coaching and freight stock bearing maintenance.

Specifications for M&Ps & T&Ps have been included in the Handbook on the recommendations of Railway board communicated to CAMTECH vide Board's letter No. 2009/M(W)/814/Safety Pt. dated 21.09.2012. M&Ps specifications are indicative and only for guidance of workshops. Railway may like to update/review the same before initiating procurement action.

It is also clarified that this handbook does not supersede any existing procedures and practices laid down in the maintenance instructions issued by manufacturers or by RDSO/LKO.

Technological upgradation and learning is a continuous process. Hence feel free to write us any addition / modification in this handbook or in case you have any suggestion to improve the handbook. Your contribution in this direction shall be highly appreciated.

Date: 31.12.2012

(K.P. Yadav)
Director/Mech
CAMTECH /GWL

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Roller Bearing for ICF Coaches
in Workshop**

**PART-B Maintenance of CTBUs/TBUs
for LHB Coaches in Workshop**

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Hand Book

On

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PART - A

Maintenance of Spherical Roller Bearing for ICF Coaches



1.0 INTRODUCTION

Bearing plays a vital role 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.

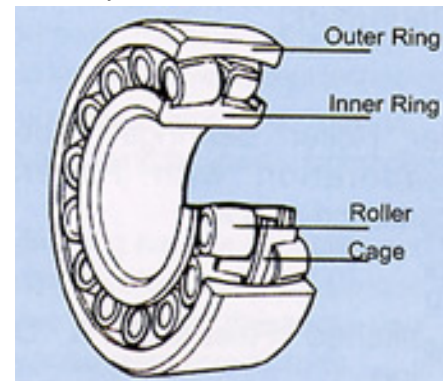


Fig.: 1.0

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 a cylindrical bore (Direct Mounted type).

2.0 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 BEARING COMPONENTS

3.1 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 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 Roller

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

3.4 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.

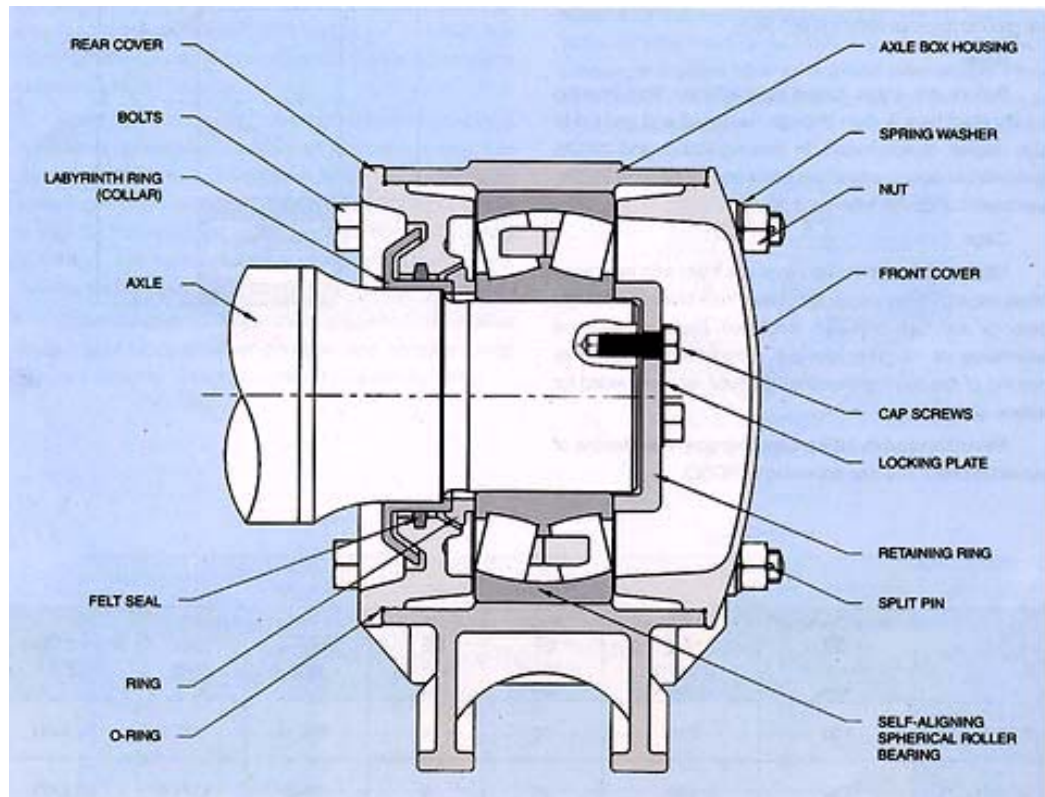


Fig.: 2.0 Spherical Roller Bearing and Axle Box Assembly

4.0 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.
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 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 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.

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.

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.

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.

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.
- Nylon hammer
- Volumetric containers.

6.0 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:

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 dismounted 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 dismounted 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 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 pressurized kerosene spray 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 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.



Fig: 3.0 Checking Bearing radial clearance in mounted condition

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 (1.75 Kg) 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 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.

- Identification tags are provided behind Rear Cover i.e. between long bolt head and Rear cover marked "S" (Strip & Fit) in case of assembled bearings. The identification Tags are provided over the front cover assembly marked "I" (In-Situ Cleaned) in case of in-situ cleaned bearings. Annular nut type arrangement is not in use. (see 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.

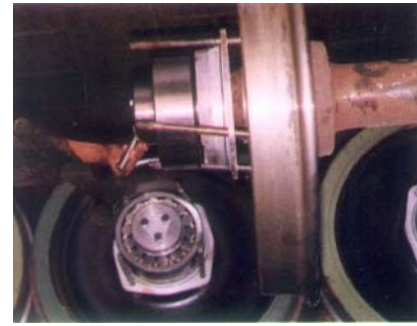


Fig: 4.0

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.

The following Marking Scheme for Spherical Roller Bearing of ICF Design Coaches is Standardized.

1. Provide two aluminum tags on the axle box housing through axle box bolts, one on the front side of axle box and the other on the rear side. Mention workshop code, bearing overhauling date and bearing serial number by punching on the each tag.
2. Both the tags will be changed with new ones at the time of attending spherical roller bearing after dismounting. The two tags shall be provided with identical markings, so that bearing overhauling after dismounting will have identical date of attention on the front tag and rear tag.
3. The front tag will be replaced with new tag having new date of attention of spherical roller bearings by cleaning, examination and re-lubrication with fresh grease in-situ (without dismounting of bearing). The bearing attended in-situ condition will have different date on the rear and front tags. The front tag will indicate date of attention given in-situ whereas date on the rear tag will give the date of last attention after dismounting of roller bearing.

(RDSO letter No. MC/RB/General Dated 25.03.2009)

Life of Spherical Roller Bearing:

The codal life of spherical roller bearings type 22326 (16.25 t) used on BG main line coaches is fixed as 20 years. Railways should condemn the spherical roller bearings of type 22326 used on BG main line coaches which have completed the age of 20 years. For bearing less than 20 years of age, Railways shall continue the practice of rejection of spherical roller bearings on condition basis.

(RDSO letter No. MC/RB/General Dated 20.07.2010)

6.2 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.
- Zyglo testing should be ensure as per instructions
- ***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 Dismounting of bearing

- For dismantling roller bearings, a special hydraulic dismantling extractor is used (see fig. 5.0). Following is the procedure for dismantling 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.

- 100% Zyglo testing of bearing to be carried out to detect Minute/Micro cracks.

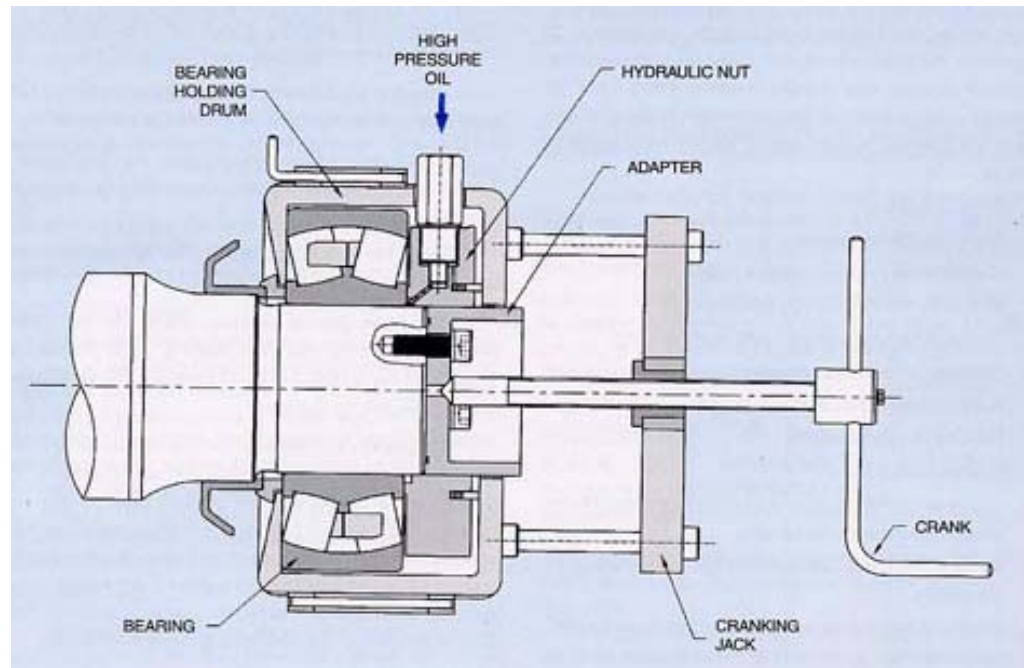


Fig: 5.0 Dismounting of Bearing

Recommended limits of radial clearance for bearings in dismounted 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 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) Axle end hole

The axle end holes should be checked with GO–NO-GO thread plug gauge for correct size and thread condition. The practice of blocking of worn out holes and drilling a new hole **60°** away from old ones reduces the probing area on axle face for ultrasonic testing & therefore not recommended.

Note: Use of heli-coils or thread inserts in tapped holes is strictly prohibited.

ii) End locking plate

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

iii) 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) 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) 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) 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**.

vii) 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 $61 \pm 0.1 \text{ mm}$ 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 $60 \pm 0.1 \text{ mm}$.

viii) 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 specified 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.

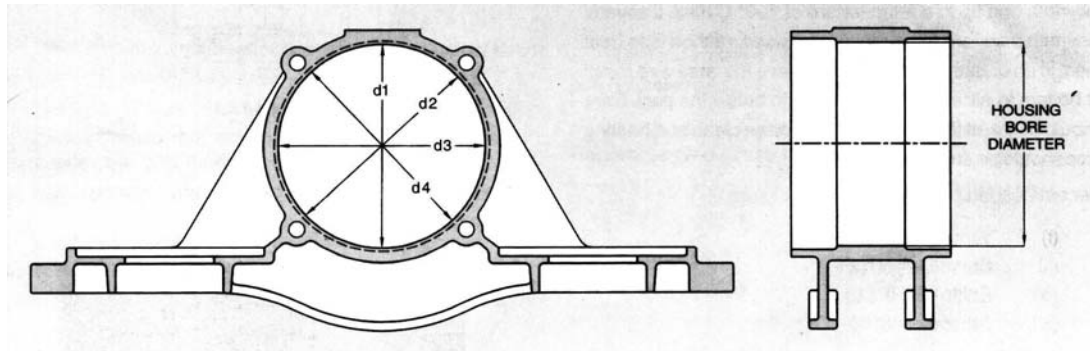


Fig: 6.0

Axle box faces should be even. The bore of the box should be $280^{+0.052}_{+0.080}$ between faces. As per Axle Box Housing Drawing No. T.O.2.602 alt-4.



Fig: 7.0

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 for checking condition. 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 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 plate 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.

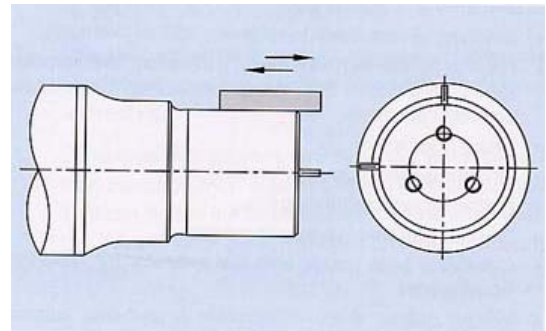


Fig. 8.0 Use of straight edge for checking journal

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 (See Fig 10)

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.

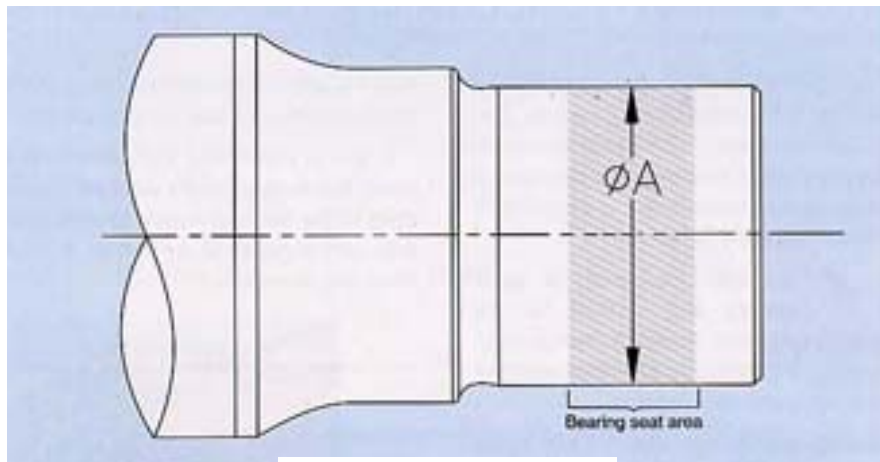


Fig. 10.0 Axle Journal

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

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.

Railways and production units are advised to follow the following:

1. RDSO drawing No. CG-K6015 alt. 1 for 16.25t BG coaching axles should be followed in respect of all dimensions.
2. On ICF type 16.25t BG coaching axle M16 x1.5 x 50 mm long hexagonal head axle end screw, item-1 of ICF drawing No. T-0-2-619 shall be used.
3. On existing ICF type 13.0 te BG coaching axles, which are still in service, M16 x1.5 x 40 mm long hexagonal head axle end screws item-2 of ICF drawing No. T-0-2-619 shall be used.

(RDSO letter No. MC/RB/General Dated 10.08.2010)

6.6 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 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.
- 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 13.0).



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



Fig: 12.0



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 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 –

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 100°C 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 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.

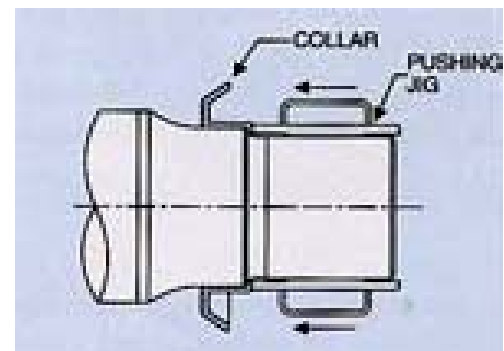


Fig: 15.0

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. Always use new felt seal of specified quality. Used felt seals must be discarded.

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.



Fig.16.0

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.

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.

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.

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.

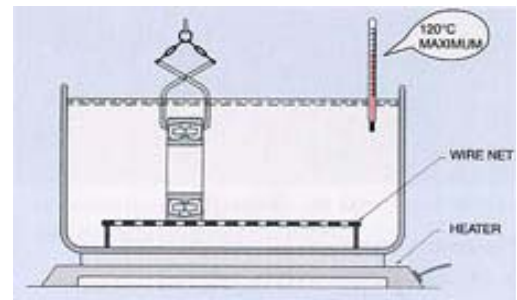


Fig: 17.0 Heating of Bearing in oil Bath

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.

Induction Heating System

Induction heating is quick, safe, energy saving and environment friendly process. In this system, bearing performs as a secondary winding whereas core winding is at primary side. Bearing is placed around a yoke. Due to principal of induction current, bearing is heated due to its electrical resistance and attains desired temperature.



Fig: 18.0

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

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 takes 5 to 7 minutes to attain the temperature of 120°C maximum. Overheating (beyond 120°C) 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.

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 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.



Fig: 19.0 Checking bearing radial clearance in mounted condition

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.

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
M16	12 Kg-M
M20	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 tag

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.

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

FAG/NBC/other make bearings **1.75 kg**

▪ Only lithium base grease of approved brands should be used

Brand Name Of Grease	Supplier
Servogem RR3	Indian Oil Corporations
LL3 (Balmerol multigrease)	M/s Bamer Lawre & Co. Ltd. Corporation Limited
Bharat RR Grease-3	M/s Bharat Petroleum Corp. Ltd.

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.

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.

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.

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.



Fig: 20.0

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.
Excessive fretting of outer race	Oversize housing bore
Grease oozing from rear cover	Used or poor quality of felt seal

7.0 List of Tools 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
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	Dial Snap Gauge with 0.001 mm least count and 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 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

Defect	Effect on Bearing	Remedial Measures
		material of the ring should conform to the specifications 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.	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 screws.	Screw may get loose in service and cause damage to front cover and bearings	Follow correct procedure.
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.	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 MAINTENANCE IN OPEN LINE & PRECAUTIONS TO AVOID HOT AXLE CASES

9.1 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 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 Letter No. MC/AB Dated 21/24.08.2009).

9.3 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 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 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 Classification of Bearing damages and its Corrective measures.

Condition	Causes	Corrective Measures
Rust and corrosion  Surface becomes partially or fully rusted. Sometimes rusted at spacing equal to distances between rolling element	<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
Fretting  Fretting Surfaces wear producing red coloured particles that form hollows.	<ul style="list-style-type: none"> • Over size housing bore. • Insufficient interference • Insufficient lubrication • Fluctuating load • Vibration during transport or when not operating Conditions 	<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 •
Flaking/ Spalling  Flakes form on the surfaces of the raceway and roller elements. When the flakes fall off, the surface becomes rough and uneven.	<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
Seizure  Bearing heats up, becomes discolored and eventually seizes up.	<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.

Condition	Causes	Corrective Measures
Cracking  Splits and cracks in bearing rings and rollers	<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
Cage damage  Breaking or wear of cage.	<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.
Rolling Path Skewing  Roller contact path in raceway surface strays or skews.	<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.
Smearing and scuffing  Surface becomes rough with small deposits. "Scuffing" generally refers to roughness of the bearing ring ribs and roller end faces.	<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
Indentations  Hollows in raceway surface produced by solid foreign objects trapped or impacts (False brinelling)	<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.
Electric Current Damages  Pits form on raceway and develop into ripples. Further development leads to corrugated surface. Some times spot or localized burns are also noticed.	<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.
Discoloration  Change of raceways / roller colour	<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.
Peeling  Peeling is a cluster of very small spalls. Peeling can also include very small cracks which develop in to spalls.	<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 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 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)	
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)	

SN	Description	Remarks
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)

13.0 **STANDARDIZATION OF FACILITIES FOR ROLLER BEARING SHOP FOR ICF COACHES**

Roller Bearing is being used for the wheels of ICF coaches on IR. The facilities proposed for a typical Roller Bearing shop attending 2000 Roller Bearings per month is given as under -

1.0 Roller Bearing Shop

The shop layout is shown as annexure 1. It will consist of the following distinct areas-

- A. Axle box assembly /Dis-assembling area
- B. Housing cleaning Plant.
- C. Bearing Dismounting Area
- D. Bearing Cleaning Area
- E. Bearing Inspection and Zyglo Testing area
- F. Bearing Mounting Section
- G. Wheel Assembly Section
- H. Wheel Dispatching Area

The Roller Bearing shop should be air-conditioned and maintained dust free. The floor should be epoxy painted for easy maintainability.

A. Axle box assembly /Disassembling area

- i) Inspection of wheel set.
- ii) Inspection of Axle Box.
- iii) Axle Box Extractor

B. Housing Cleaning Plant.

This area shall have following activities-

- i) Axle Box Housing Cleaning Plant.
- ii) Bosch Tank
- iii) Close chamber with spray jet cleaning

C. Bearing Dismounting area.

This area shall have following activities-

- iv) Dismounting by Hyd. Extractor.
- v) Cleaning of Bearing by automatic bearing cleaning plant

As far as possible, the removed bearings should be cleaned immediately

D. Bearing Inspection & Zyglo Testing.

This area shall have following activities-

- i) Magnifying Glass with light.
- ii) Long feeler gauge set

- iii) Zygo Testing Machine
- iv) Dye penetration test equipments

E. Bearing Mounting Area

This area shall have facilities for mounting of Bearings on wheel sets.

- i) Bearing Mounting Equipment (Hyd. Press)
- ii) Torque Wrench
- iii) Box Spanners

F. Wheel Assembly Section.

This area shall have following activities-

- i) Out side Micrometer.
- ii) Thread Plug Gauges for different sizes of tapped holes.
- iii) Thread Ring Gauges for different sizes of locking bolts
- iv) Volumetric Containers for grease.
- v) Etching Machine/ Engraving

2.0 Shop Layout

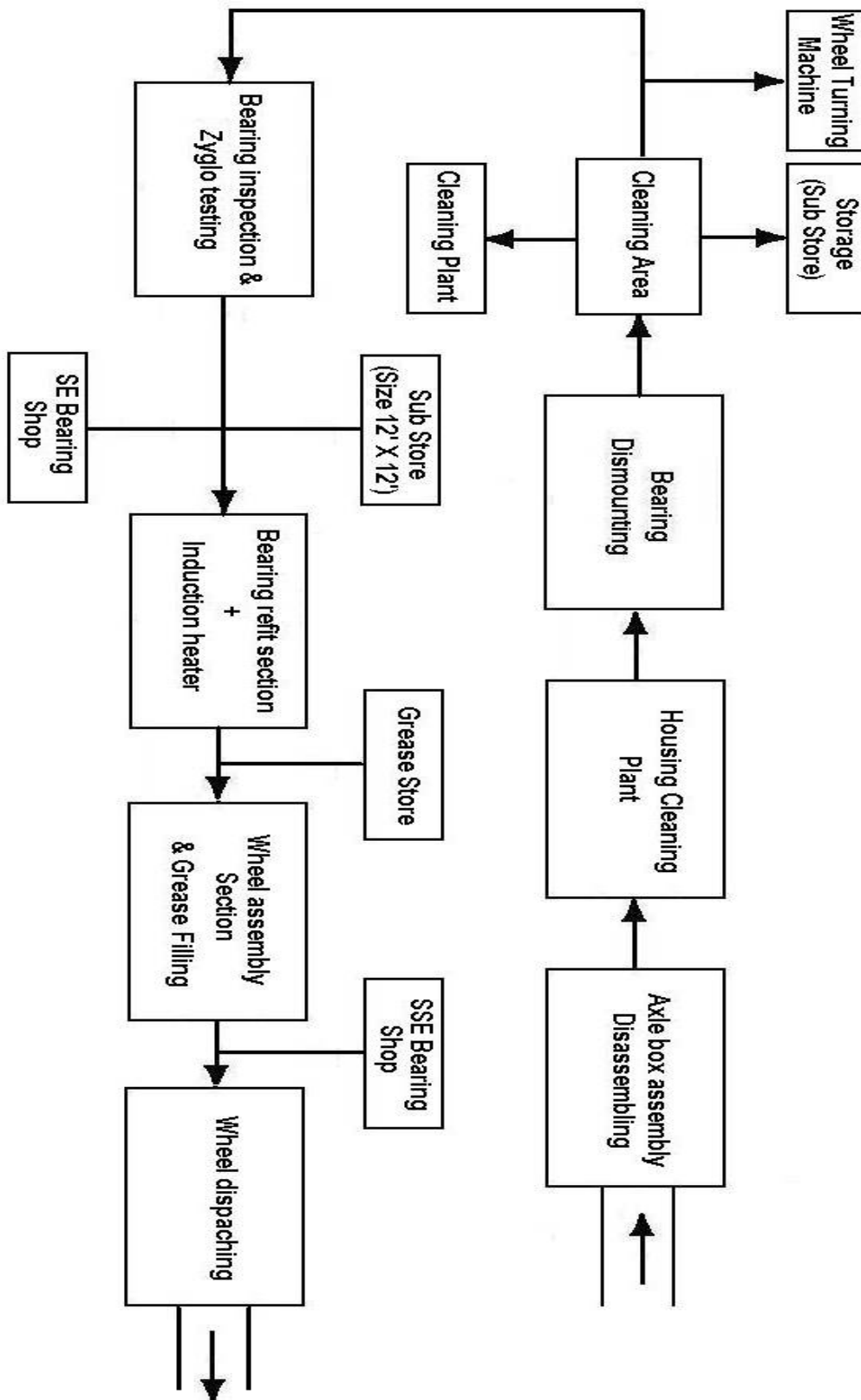
Schematic Layout of Roller Bearing shop is enclosed as Annexure 1

3.0 List of Tools and Equipment for Roller Bearing Shop

The facilities required for the Roller Bearing shop are enclosed as Annexure 2.

ANNEXURE – I

Layout of Spherical Roller Bearing Maintenance Shop



ANNEXURE – II**List of Tools and Equipment for Roller Bearing Shop****A. Bearing dismounting and General cleaning area-**

1. Hydraulic extractor for bearing Dismounting - 02 Nos.
2. Hydraulic extractor for Axle Box. - 02 Nos.

B. Inspection and assembly Area

1. Box spanner set - 02 Nos.
2. Wheel dia gauge - 02 Nos.
3. Wheel gauge - 02 Nos.
4. Chiesel - 02 Nos.
5. Hand Hammer - 02 Nos.
6. Bore Dial Gauge (125 to 150 mm)
(least count 0.001 mm) -02 Nos.
7. Magnifying glass with light fitted for
visual inspection - 02Nos
8. Master piece - 02 Nos.
9. Feeler gauge - 04 Nos.
10. Nylon hammer - 02 Nos.
11. Gauge for front cover (Fig -05 & 06 – As per RDSO Pamphlet C 7817) - 02 Nos.
12. Gauge for Rear cover (Fig -05 & 06 – As per RDSO Pamphlet C 7817) - 02Nos.
13. Tool for mounting the collar (Fig -07– As per RDSO Pamphlet C 7817) - 02 Nos.
14. Groove gauge for rear cover to measure depth/width of felt ring groove - 02 Nos.
15. Go & Not Go gauge for rear cover bore - 02 Nos.
16. Gauge for measuring shoulder height for rear cover - 02 Nos.
17. Induction heater with demagnetized device. - 04 Nos.

C. Bearing mounting Area

18. Torque wrench 5-23 Kg-M - 02 Nos.
19. Bearing weighing machine - 02 Nos.
20. Induction heater with demagnetizing device - 02 Nos

D. Others

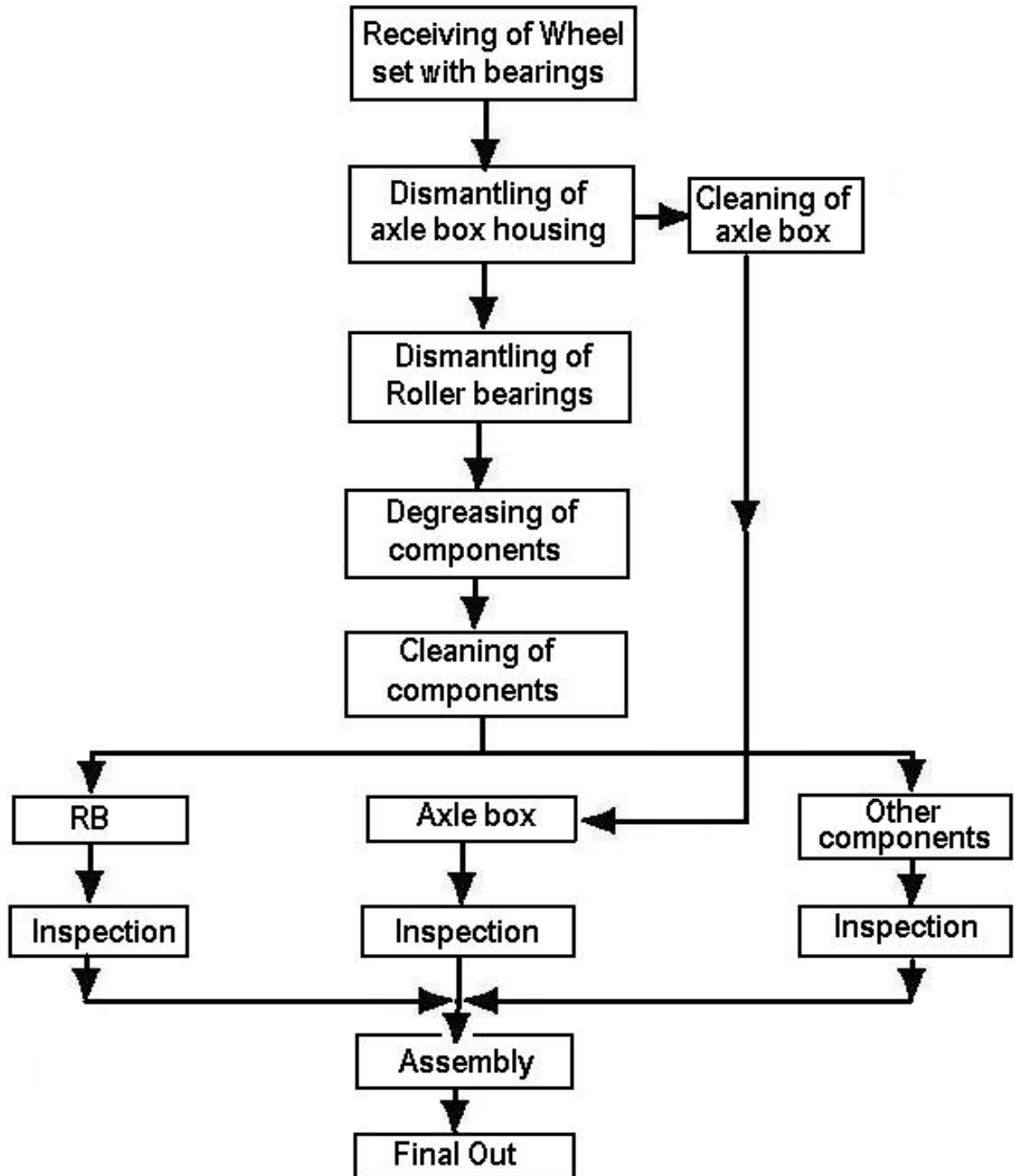
- Roller Bearing shop - As per lay out
- Air Conditioning requirement - As per
- Elect. Fittings & illuminations requirement - As per
- Working Benches requirement - As per
- Computer with Printer - 01 No.

Additional Facilities for Better Maintenance in Workshops

1. Two numbers of Electrical ovens for heating the cast steel axle box housing before mounting. Axle box housing is heated in electrical ovens to temperature range of 80-90⁰C before mounting on bearing for easy mounting without hammering. Electrical ovens are equipped with temperature controller to control the temperature.
2. Sleeve should be used for mounting the rear cover to avoid the twisting of felt sealing ring during mounting.
3. Bearing shop should inspect the bearings with the help of equipment having 100 lux illumination level and magnifying glass of 10x for better visual inspection of bearings.
4. Good quality motorized hydraulic dismounting equipment for easy and quick dismounting of roller bearings.
5. Axle box rear cover cleaning plant. The plant should have facility of rotating fixture for rotating rear cover, stationary cleaning brushes & spray jet for spraying the kerosene oil.
6. Bearing shop should have a trolley mounted bearing cleaning arrangement for cleaning of spherical roller bearing in mounted condition by spraying kerosene with movable jet.
7. Locally made revolving stand may also be used for inspection of the spherical roller bearings.

(RDSO Letter No. MC/RB/General Dated 02.12.2009)

FLOW CHART FOR ROLLER BEARING MAINTENANCE IN WORKSHOPS



TECHNICAL AUDIT OF SPHERICAL ROLLER BEARINGS

S.N.	Activity	Observation.
1	Check that Roller Bearings are handled Carefully	
2	Roller Bearing shop must have clean surrounding Dismantling as well as assembly being done at separate nominated areas free from dust & muck	
3	Section should have adequate equipment and facility i.e. a. Hydraulic dismounting equipment for direct mounted spherical roller bearing.	
	b. Automatic roller bearing cleaning plant (PRECECO) with 3 stage cleaning viz. Pre-wash, hot water rinsing, lubricating.	
	c. Wheel washing plant.	
	d. Dyan scan with light.	
	e. Three legged inside Micrometer with 0.05mm least counter for inner race bore measurement.	
	f. Engraving/etching Machine.	
	g. Induction Heater with demagnetizing device.	
	h. Volumetric containers for grease.	
	i. Thread plug gauge for end locking holes	
	j. Thread ring gauge for end locking screws inspection	
	k. Torque wrench and Torque Wrench Tester.	
	l. Feeler Gauges set.	
4	Check the availability of RDSO Technical pamphlet C-7817 for inspection & maintenance of Direct Mounted Roller bearings on BG Coaches & specified procedure for examination of bearings being followed.	
5	Check that axle box housing is thoroughly cleaned and being inspected for dimensions of bore and width of the box. Width of Box is 216+0.1 mm, Axle Box Bore. $280^{+0.052}_{+0.080}$	

S.N.	Activity	Observation.
6	Check that: Only specified tools viz Spanners, Hammers, Torque wrench's Hyd Injector are being used for attention to the bearing.	
7	Check that: New bearings are being stored in dry place and opened at the time of mounting only.	
8	Check that; Only Khadi cloth, to be used for bearing cleaning, Cotton Waste should not be used.	
9	Check that only specified quantity of grease is being used to pack the bearings.	
10	Check that record of defects of incoming bearings is being maintained & analysis of rejections & other parameters being carried out.	
11	Check that bearings are being thoroughly cleaned in kerosene oil or petrol and bearings are being inspected under Dyna scan.	
12	Check that rear and front covers are being checked for crack dimensions and height of shoulders from the face.	
13	Check that felt ring of dismantled box is not being reused and new felt ring is being fitted after proper treatment.	
14	Check that inner ring dia. is being measured 100%	
15	Check the retaining ring are being inspected for flatness and dimensions.	
16	Check that dismantled collars are not being reused.	
17	Check that all bearings are being dismantled every alternate POH & self audit of Roller Bearing shop is being carried out.	
18	Axle journal dia is checked 100% even journal is being inspected for concentricity, ovality & dimensions. Surface finish & cracks.	
19	Check that Etching pencils are available for easy traceability of bearings.	
20	Check that bearings are being Zyglo tested for checking of minute cracks.	
21	Check that serviceable bearings are being kept in a dry, clean and dust free place.	

S.N.	Activity	Observation.
22	Check that load zone of outer ring top position should be marked.	
23	Check that bearings are being heated in induction heater before fitment at 110°C to 120°C for 5 to 7 minutes.	
24	Check that Tools are being kept clean and placed on dry surface.	
25	a. Grease with respect to its consistency, colour, contamination with water, foreign particle etc. Is being examined.	
	b. Rear cover are being examined for damages. If found damaged bearings are being dismounted.	
26	Check that: a. Bearings are being thoroughly inspected after removing the grease for roller cage outer and inner races, rolling tracks.	
	b. Radial clearance of the bearing is being measured in un-mounted condition and in Mounted condition as per Para 6.1 of bearing manual	

PART - B

Maintenance of CTBU/TBU Bearing for LHB Coaches

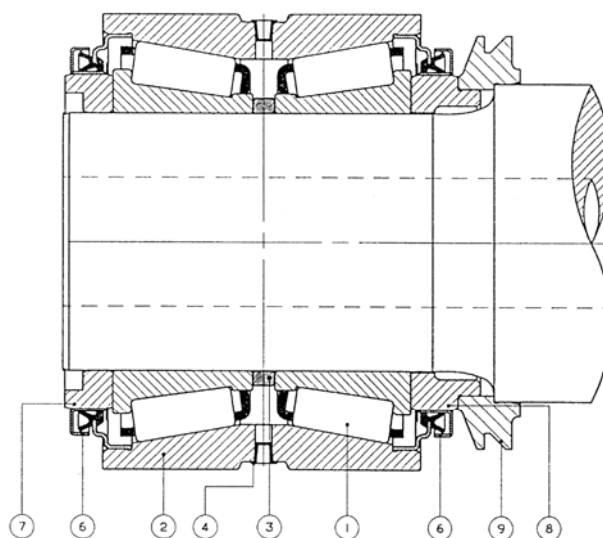


1.0 CARTRIDGE TAPERED BEARING UNIT (CTBU/TBU):

CTBU / TBU: - As the name implies it is Cartridge Taper Roller Bearing unit being used for the wheels of LHB coaches. On the basis of their manufacturers there are two types of CTBUs/TBUs. One is manufactured by M/s Timken & another by M/s SKF. They are the only suppliers of CTBUs/TBUs for Indian Railways.

1.1 Introduction of TIMKEN make CTBU:

Cartridge bearing is a self-contained, pre-assembled, pre-adjusted, pre-lubricated tapered roller bearing unit, and is applied to and removed from the axle without exposing the bearing elements, or lubricant to contamination or damage. This pre-assembled cartridge bearing reduces the no. of separate parts to be applied to the axle assembly to a minimum. The CTBU is designed and manufactured according to high technical and safety standards.



Timken bearing unit sectional view

1.2 Parts of Timken CTBU:

S NO	DESCRIPTION	QTY	PART NO	WEIGHT (KG)
1	CONE ASSEMBLY	2	H127746	5.812
2	DOUBLE CAP	1	NP499858	14.306
3	CONE SPACER	1	H127748XA	0.274
5	GREASE	1	GR 241	0.280
6	HDL TM SEAL	2	K152139	0.500
7	BACKING SPACER	1	K153064	1.393
8	SEALING RING	1	K153063	0.910
9	BACKING RING	1	K160115	3.012
TOTAL WEIGHT				32.799

1.3 Lubricant Details: GR represents 280 Grams of MOBLITH SHC220.

2.0. SERVICE INSPECTION:

A Visual Inspection in open line

2.1 Abnormal Noise

During rolling in and rolling out examination, try to listen for any unusual/ abnormal noise or grinding etc.

Bearings should be given a visual inspection at terminals for proper positioning of control arm.

2.2 Bearing Running Temperature

2.2.1 For LHB coaches fitted with UIC -130 bearings, it is not possible to measure temperature at top of the axle box due to obstruction by primary springs which are mounted over axle box housing. Railways are advised to measure the control arm axle box temperature fitted with UIC-130 bearings on the control arm axle box front cover. The temperature should be checked with the help of non-contact type thermometer. The limit of temperature of axle box will be 80⁰C. If the temperature of the axle box is found above 80⁰C, the affected coach should be detached enroute from the train service.

(RDSO Letter No. MC/RB/General Dated 06.01.2010).

2.2.2 If the difference between two bearings is more than 20⁰C, the warmer bearing should be removed.

2.2.3 Slight grease oozing is acceptable and oozed out grease should not be removed if the bearing temperature is within acceptable limit i.e. within 80⁰C, such bearing should be allowed to continue in service.

(Minutes of meeting held on 13.04.2011 at RDSO, Lucknow.)

B. Inspection in workshops

2.3 Visual Inspection in workshops

When equipment is on repair track or in the shop for tyre turning or for other reasons. Inspect for overheating, roughness when bearing is revolved, excessive lubricant leakage, broken, loose, or missing parts such as axle end caps, loose bolts, loose or defective seals, cracked or broken cups, end caps and housings. Examine the outside of the bearing for damage or distortion.

2.4 Loose or Missing Axle End Bolts

If one axle end bolt is found loose or missing, remove all of the bolts, fit new locking plates, refit all of the bolts and tighten to the correct torque. Bend all tabs against the flats of the bolt heads.

If two or more axle end bolts of different pairs are found loose or missing, the wheel set must be removed from the truck. Remove the end cap, if there is any evidence that the bearing is not properly seated, or if the end play is 0.75 mm more, remove the bearing from the axle for a complete inspection to determine the cause and possible resulting damage.

2.5 Accidental Damage

Bearing assemblies involved in re-discing derailment or collision, or subject to damage by fire, floods, or other causes, bearing must be removed from the axle, disassembled, cleaned and inspected in accordance with instructions given in the manual.

(Authority: ALSTOM Manual)

3.0 INSPECTION OF CTBUs IN MOUNTED POSITION IN WORKSHOP

3.1 Inspection of Bearing in mounted position

- 3.1.1 Visually check the outside of the bearing assembly for broken, loose end cap screw, grease oozing, any unusual sound, any missing parts or any external damage.
- 3.1.2 Check the bearing mounted end play. It should be in the range **0.025 mm to 0.500 mm (for old bearings). For new bearings MEP should be within 0.025 mm to 0.330 mm.**
- 3.1.3 If there is any abnormality the bearing assembly should be removed from the axle.
- 3.1.4 Bearing assembly once removed should be sent for refurbishing or condemnation, as the case may be.

3.2 Dismounting of Bearing with Hydraulic Press

- 3.2.1 The bearing assembly should be removed with a hydraulic extractor.
- 3.2.2 Normally 12 -15 tonne pressure is required but in some cases 30 to 40 tonnes pressure may also be required to break the bearing fit.
- 3.2.3 When bearings are removed from the axle, a pilot sleeve should be fastened to the end of the axle or to the press ram to keep the bearing parts together and protect them from damage.



3.3 Sequence of proper Dismounting and Mounting of CTBU/TBU of LHB coaches

S.N	Activities
1.0	Removal of Bearing from Axle:
1.1	Bend the tabs of the bolt locking plate away from the heads of the bolts.
1.2	Remove the bolts, locking plate and axle end cap.
1.3	Fit the Pilot Sleeve to the axle end.
1.4	Ensure that the removal of bearing is done as specified in maintenance manual of M/s TIMKEN & SKF. The falling of the bearing freely on the ground after removal should be avoided by putting suitable rubber cushioning.
1.5	After the bearing assembly is removed from the pilot sleeve, a card board to be inserted in the bore of the bearing assembly to hold the internal bearing parts in place.
1.6	Ensure bearings are kept in a clean and dry place in a covered room.
1.7	Ensure bearings are stacked properly and not thrown one over the other.
2.0	Mounting of Taper Bearing on Axle:
2.1	Check journal dia at three points as described in case of new axle.
2.2	Clean the journal with kerosene oil and inspect carefully
2.3	Check threads with the help of thread gauge
2.4	Apply lubricant on the journal
2.5	Tighten the pilot sleeve on axle with the help of bolts
2.6	Put the bearing assembly on pilot sleeve and refit the bearing on journal with 20-25 tonne seating load (for Timken Makes bearings).
2.7	Rotate the bearing for ensuring free movement
2.8	Tighten the security plate & security disc with M-20 cap screw at 18-22 Kg-m torque with the help of torque wrench
2.9	Check mounting lateral play with the help of magnetic base dial indicator. It should be 0.025 mm to 0.33 mm for new bearing and 0.025 mm to 0.500 mm for in-service bearings
3.0	Seal the cap screw by bending tabs of the locking plate.
4.0	End Cap:
4.1	Inspect end cap for cracks, breakage, wear and distortion of machined surface.
5.0	Cap Screw and Locking plate:
5.1	Check cap screws for wear on threads and for stretching or elongation.
5.2	Check that cap screw threads are properly cleaned and lubricated before fitment.
5.3	Lock the bolts by bending all tabs of the locking plate flat against the sides of the bolt heads using adjustable rib-joint pliers.
5.4	Ensure that cap screws are tightened with torque wrench. (Set at 18-22 Kg-m)
5.5	Ensure that locking plates are not re-used.

4.0 INSPECTION OF THE JOURNAL

- 4.1 Axles should be checked for -
- Journal dia should be **130.043 mm to 130.068 mm**. Taper of dia must not exceed **0.02 mm** over length of journal
 - Shoulder dia should be **160.174 mm to 160.134 mm**.
- 4.2 Axle bearing seat diameters, shoulder and radii should be smooth machined and rolled, or ground finish, and must be free from sharp corners, burrs, nicks, tool marks, scratches, or Corrosion.
- 4.3 The journal must not have waves on its surface.
- 4.4 Any axle found with high spots should be carefully reground for the full circumference and length of the bearing seats. The refinished axle must be within the prescribed tolerance limits.
- 4.5 All steel chips, dirt, and grease must be cleaned out of the lathe centers and end locking bolt holes should be cleaned with compressed air before applying the bearings.
- 4.6 The bolt holes in the ends of the axle should be checked with a "Thread plug checking gauge" and the bolt threads should be checked with the help of "Ring gauge".

Note: only RDSO approved make cap screws should be used.

5.0 INSPECTION OF BEARING IN SHOP

5.1 Checking Bearing Mounted End Play (MEP)

Check the bearing mounted end play with a dial indicator mounted on a magnetic base. Place the magnetic base on the axle end and position the indicator stem against the face of the cup, marking the position on the cup.

With the dial indicator in position, pull hard but steadily on the bearing cup and oscillate at the same time. Without releasing the pressure, steady the cup so that the indicator stem contacts the marked spot, and note the reading on the indicator dial. Then push the bearing cup hard and oscillate as before, turn the cup until the stem of the indicator contacts the marked spot, and without releasing the pressure take a second reading. The difference between the two readings is the amount of mounted end play in the bearing.

If bearing end play as indicated by the dial indicator is less than Minimum "MEP at installation" or more than Maximum "MEP at installation", remove the bearing assembly from the axle. Minimum and Maximum end play values are shown in the following table:

Bench End Play (mm)	Mounted End Play at installation (mm)
0.58 - 0.64	0.025 - 0.500

The bearing mounted end play may be corrected so as to fall within the specified Limits by one of the following methods:

- Check the bearing seat on the axle for size and condition. If the size or condition of the axle is not according to specification, correct any undesirable condition found and reapply the bearing.

If a bearing was applied to an over-sized axle, check the size of the cone bores before reapplying the bearing.

2. If the size and condition of the axle are satisfactory, but the end play indicated was less than Minimum apply the bearing to an axle having a bearing seat diameter nearer the minimum dimensions, but within the specified tolerance.
3. If the size and condition of the axle are satisfactory, but the end play indicated was more than Maximum apply the bearing to an axle having a bearing seat diameter nearer the maximum dimension, but within the specified tolerance.

If the bearing mounted end play is still not within the specified limits, remove the bearing from the axle.

Prior service bearings removed from axles because of improper mounted end play should be disassembled. The bench end play and the bore of both cone assemblies should be re-checked. The bearing seat diameter of the axle from which the bearing was removed should also be checked for size.

5.2 Lubricant Contamination

Lubricant containing water is destructive to roller bearings, causing rapid wear. All possible precautions should be taken to prevent water from entering the bearing assembly. If the equipment has been submerged or operated through water of such a depth that the water could have entered the bearings, the bearing assemblies must be removed from the axle, disassembled, cleaned, inspected, and replacements or repairs made as necessary.

When cleaning the exterior of equipment, the stream of water should not be directed at the bearing seals. When sandblast or shot blast cleaning of the vehicle, a shield should be provided to protect both the front and rear of the bearing assemblies from sand or shot. Tunnel cleaning machines, high pressure sprays, sandblast or shot blast cleaning of roller bearing equipped axle assemblies is not recommended.

5.3 Lubrication

The cartridge bearing is pre lubricated at the factory. No additional lubricant is to be added after the bearing is applied to the axle.

6.0 BEARING INSTALLATION

6.1 General :

1. Cartridge bearings must be pressed on the axle. Heat must not be applied to the bearing cone assemblies to facilitate installation.
2. The bore of bearing cones that have had previous service should be checked for acceptability before being pressed on the axle to ensure a suitable interference fit.
3. Oversize bearing cones should be scrapped.
4. Coat the bearing seats of the axle with castor oil, heavy mineral oil, or a molybdenum-disulphide and oil mixture.
5. DO NOT USE WHITE LEAD. Lead compounds may be detrimental to lubricating greases by acting as an oxidation catalyst.
6. To minimize the risk of ingress of water through the backing ring contact area with the axle, apply a sealant (Anabond-685 or equivalent) to the backing ring/axle interface as shown in Fig. 1.
7. A thin coating of a quick-drying rust preventative must also be applied to the portion of the axle between the wheel hub and the bearing. The rust preventative used must not contain lead or other compounds which may be detrimental to lubricating greases.

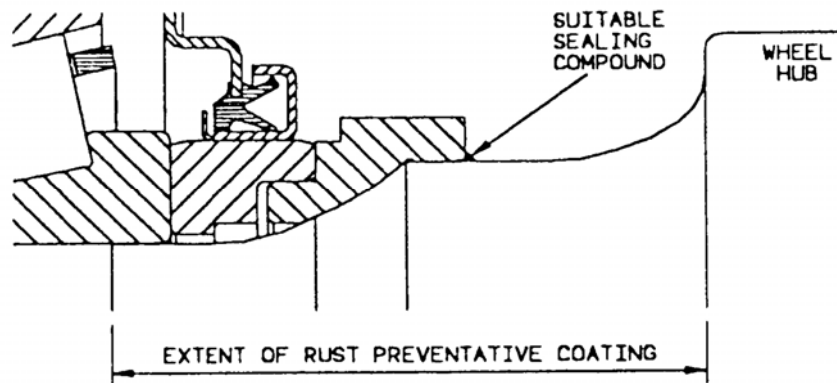


Fig: 1. Installation requirement

6.2 Pressing of Bearing Assembly on Axle

- 6.2.1 Place the wheel and axle assembly in a bearing press, in position to press the bearing assembly on to the axle.
- 6.2.2 Measure and record the outer Dia of axle at three locations. Each location should have three readings at 120⁰C. Refer drawing for axle dimensions.



- 6.2.3 Fit the pilot sleeve onto the end of the axle, using the screws to hold it in position. Slide the bearing assembly over the pilot as far as it will go and place the bearing assembly.
- 6.2.4 Coat the bearing seats of the axle with Oil (SAE 30)
- 6.2.5 Apply pressure to the end of the assembly sleeve until the bearing assembly is correctly seated. Keep rotating the CTBU by using both hands while mounting it on the axle. If it stops rotating then mounting should be stopped. After removing the CTBU from the axle it should be sent for refurbishment.
- 6.2.6 To ensure that the bearing is firmly seated against the axle fillet, the pressure indicated on, the gauge during pressing on should be increased by 50%. This seating load pressure should be within the limits 20-30 tonnes.

6.3 Mounting of End cap

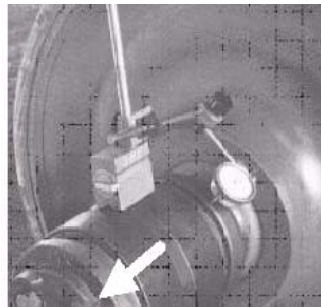
- 6.3.1 Apply the axle security disc (end cap).
- 6.3.2 Apply the security plate and axle end cap screw
- 6.3.3 A torque wrench or on impact wrench shall be used to tighten (“run –up”) the bolts.
- 6.3.4 Tighten the bolts with a torque wrench with the torque value of 18 -22 Kg-m. Recheck each bolt does not turn when the **21.5 kg-m** torque is applied.
- 6.3.5 Lock faces of the bolts by bending all tabs of the locking plate flat against the sides of the end locking bolt heads using adjustable rib-joint pliers/chisel.
- 6.3.6 Do not tighten or loosen a bolt after the specified torque has been obtained to position the bolt head flats relative to the locking plate tabs.

7.0. CHECK OF AXIAL INTERNAL CLEARANCE (LATERAL)(MEP)

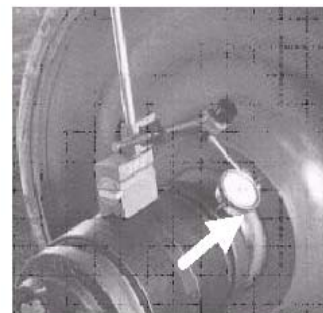
7.1 Check the bearing mounting end play with the dial indicator mounted on a magnetic base. Place the magnetic base on the axle end and position the indicator stem against the face of the cap.



7.2 If bearing end play as indicated by the dial indicator is less than minimum "MEP at installation", remove the bearing assembly from the axle. Minimum and maximum end play values at mounted end are:- 0.025 mm - 0.330 mm for new bearing and in service bearing 0.025 mm to 0.500 mm. If the bearings do not fall under the above MEP range and the bearing can still be rotated by hand, it can be taken into service/operation.



Pulling the TBU



Pushing the TBU

8.0 WHEEL TURNING

It is not necessary to remove the bearing assembly during wheel turning, but the bearing assembly must be suitably protected to prevent any steel chips from damaging or entering the bearing. Heavy grease must be used to lubricate the lathe centers.

9.0 ELECTRIC WELDING

Whenever it is necessary to do any electric welding on coaches, or wheel and axle assemblies equipped with bearings, the ground cable must be clamped to or near the part being welded so that **NO CURRENT WILL PASS THROUGH THE BEARINGS.**

10 INTRODUCTION OF SKF TBU

Taper Bearing Unit (TBU) defined as an assembled unit formed by the bearing, the grease and a sealing system.

10.1 Parts of SKF TBU:

As per SKF Drg. No 1639433 BC parts of SKF TBU are as below

S No	DESCRIPTION	QTY	PART NO	WEIGHT (KG)
1	DISTANCE RING	1	RD-1639433 B-15	4.45
2	Z LABYRINTH (INTERNAL PARTS)	2	SD-BT2-8516-25	0.10
3	Z LABYRINTH (EXTERNAL PARTS)	2	SE-BT2-8544-23	0.50
4	DISTANCE RING	1	RD-1639424 D-13	0.030
5	DISTANCE RING	1	RD-1639433 BA-13	1.20
6	BEARING	1	BT2B 641157 CB	25.000
7	GREASE	1	VL 1632279-36	0.350
TOTAL WEIGHT				31.630

10.2 SERVICE INSPECTION:

Visual Inspection in open line

A Abnormal Noise

During rolling in and rolling out examination, try to listen for any unusual/ abnormal noise or grinding etc.

Bearings should be given a visual inspection at terminals for proper positioning of control arm.

B Bearing Running Temperature

B-1 For LHB coaches fitted with UIC -130 bearings, it is not possible to measure temperature at top of the axle box due to obstruction by primary springs which are mounted over axle box housing. Railways are advised to measure the control arm axle box temperature fitted with UIC-130 bearings on the control arm axle box front cover. The temperature should be checked with the help of non-contact type thermometer. The limit of temperature of axle box will be 80°C. If the temperature of the axle box is found above 80°C, the affected coach should be detached enroute from the train service.

(RDSO Letter No. MC/RB/General Dated 06.01.2010).

B-2 If the difference between two bearings is more than 20°C, the warmer bearing should be removed.

B-3 Slight grease oozing is acceptable and oozed out grease should not be removed if the bearing temperature is within acceptable limit i.e. within 80°C, such bearing should be allowed to continue in service.

(Minutes of meeting held on 13.04.2011 at RDSO, Lucknow.)

11.0 MAINTENANCE PROCEDURE IN WORKSHOP

11.1. Inspection of Bearing in Mounted position

- 10.1.1 Visually check the outside of the bearing assembly for broken, loose, grease oozing or any missing parts or any external damage.
- 10.1.2 Check the bearing axial clearance 0.100 mm -0.400 mm

11.2. Dismounting of Bearing with the hydraulic press

- 10.2.1 Unlock the locking plate. Dismount the screws and end-cap.
- 10.2.2 Put the Pulling Shoe over the back side of the backing ring of the TBU; put the press at the good level in order to lock the pulling flange just behind the backing ring. The pulling shoe must engage the backing ring only.
- 10.2.3 Build the pressure. The pressure on the piston applies to the end of the journal permits to withdraw the TBU.
- 10.2.4 When bearings are removed from the axle, a pilot sleeve should be fastened to the end of the axle or to the press ram to keep the bearing parts together and protect them from damage.

12.0. INSPECTION OF THE JOURNAL

- 12.1 Clean the TBU bearing seating, the journal collar for the backing ring seat and blow the threaded holes of end cap bolts with compressed air. Journal shoulder must be free from pre-existing painting and, or antirust coating.
- 12.2 If some edges protruding outside from the journal cylindrical shape are detected on the bearing sealing, they must be carefully removed.
- 12.3 The journal must not have waves on its surface.
- 12.4 Check the bearing seating. The journal diameters should be **130.043 mm to 130.068 mm** and taper of dia must not exceed 0.02 mm over length of journal.
- 12.5 Shoulder dia should be **160.174 to 160.134 mm** must be measured in 2 planes at 90° (maximum different value between 2 points = 0.012 mm) in 3 points.

13.0. PRESSING OF BEARING ASSEMBLY ON AXLE

- 13.1 Measure and record the inner dia of TBU. It should be **130.0 mm - 0.000 to - 0.025 mm (for SKF)**. Mount the pilot sleeve onto the journal with the bolts, in order to sustain and guide the TBU during the mounting, and tightening the screws with the tightening torque **21.5 kg-m**.
- 13.2 Mount the installer bolt onto pilot sleeve. Apply a thin and uniform coat of the most suitable agent Thick mineral oil (SAE 30) or Oil and molybdenum disulphide mixture (70% - 30%) or Anti Stick-Slip oil to the bearing and backing ring seating on the journal, (SAE 30)
- 13.3 Pick up the TBU from the pallet box, without removing the triangular retainer placed in the TBU bore, in order to avoid any movements of the central spacer. Place the TBU on the pilot sleeve, the retainer will be automatically pushed out. Screw the threaded bar on the pilot sleeve.

- 13.4 Lock the hydraulic press against the pushing tube using the nut. The TBU is now ready for mounting.
- 13.5 Put hydraulic press “on” for seating force
- 13.6 In this condition, TBU starts moving on to the journal.
- 13.7 During the mounting the pressure (**28 to 32 tons**) will gently increase. During the final seating phase, when the backing ring enters on contact with journal with pressure, it should be noted. This phase is called “final seating force” phase.

14.0 MOUNTING OF END CAP

Please refer to para 6.3

15.0 CHECK OF AXIAL INTERNAL CLEARANCE (LATERAL)

- 15.1 The axle internal clearance must be measured only when the bearing is completely mounted, with the end cap fitted with the good tightening torque.
- 15.2 Check the axial internal clearance of the TBU with a magnetic base dial indicator. The value of the theoretical residual axial clearance of the TBU is indicated on the drawing as **0.10 mm - 0.40 mm**.

16.0 REJECTION OF CTBU/TBU DURING POH / IOH

Bearing should be rejected during refurbishing in the firm for following Defects/Damages in the presence of Railway representative

- **Stains, Dislocation and Water etching:**

These are the three forms of surface damages.



- **Brinelling**

Impressions in the roller paths of bearing cups or cones caused by the imbedding of rollers resulting from impact.



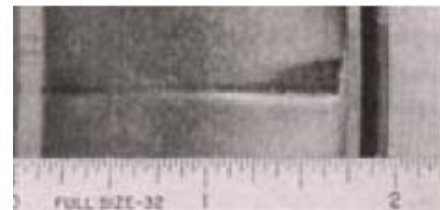
Acceptable Brinelling



Acceptable Brinelling



Acceptable Brinelling



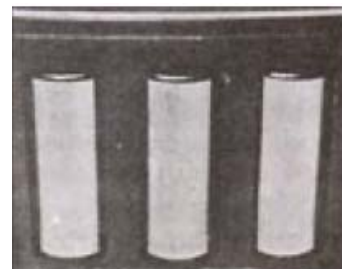
Brinelling not acceptable

- **Spalling**

Spalls if found on cup and cone track the bearing component should be rejected.

- **Peeling**

Peeling is just a metal pickups. Peeling up to 0.025 mm deep is allowable.



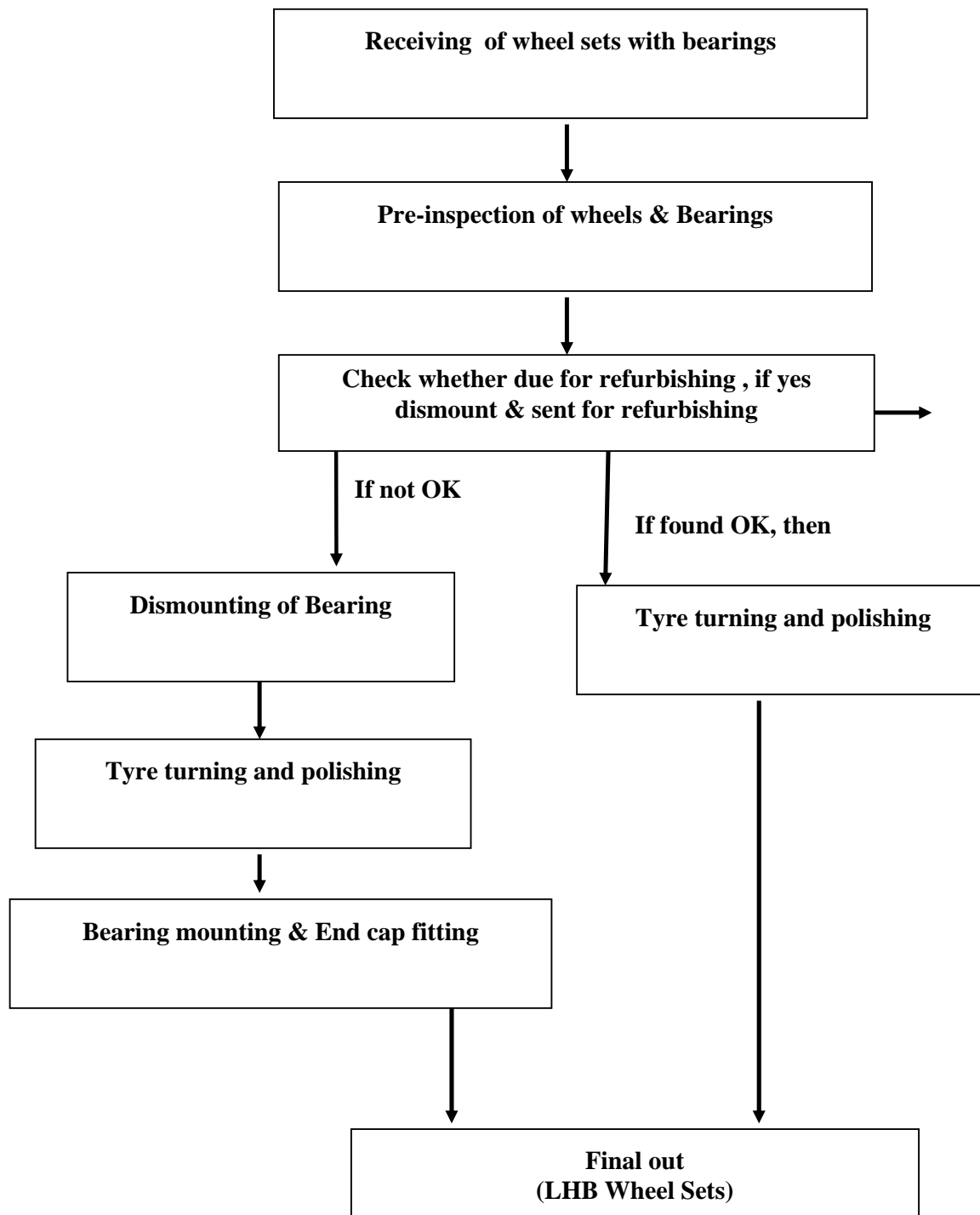
Peeling-Acceptable

17.0 REFURBISHING OF LHB BEARING:

As per Railway Board's instruction bearings should be refurbished by OEMs or manufacture after every 3 years or 12 Lakhs Kms of running, whichever is earlier. If the bearings are removed from axle prior to the above mentioned period, it should also be refurbished.

(Railway Board's letter No. 2004/M(C)/137/08 Dated 27.12.2006)

18.0 FLOW CHART FOR LHB BEARING MAINTENANCE IN WORKSHOP



19.0 STANDARDIZATION OF FACILITIES FOR CTBU/TBU SHOP FOR LHB COACHES

CTBU/TBU:- Taper Roller Bearing unit are being used for the wheels of LHB coaches. On the basis of their manufactures, there are two types of CTBUs

The facilities proposed are for a typical CTBU/TBU shop attending up to 800 CTBUs/TBUs per month.

1.0 CTBU/TBU Shop

The shop layout is shown as annexure 1. It will consist of three distinct areas, as follows-

- A. Bearing Pre-inspection Area
- B. Bearing Dismounting and Cleaning area.
- C. Bearing Mounting Area

The CTBU/TBU shop should be air-conditioned and maintained dust free. The floor should be epoxy painted for easy maintainability.

A. Bearing Pre-inspection Area

- i) Inspection of wheel set.
- ii) Inspection of bearing unit.

B. Bearing Dismounting area.

This area shall have following activities-

- vi) Dismounting by Hyd. Extractor.
- vii) Cleaning of Bearing

As far as possible, the removed bearings should be sent to the firm immediately for refurbishing.

C. Bearing Mounting Area

This area shall have facilities for mounting of Bearings on wheel sets.

- i) Bearing Mounting Equipment (Hyd. Press)
- ii) Torque Wrench
- iii) Box Spanners

2.0 Shop Layout

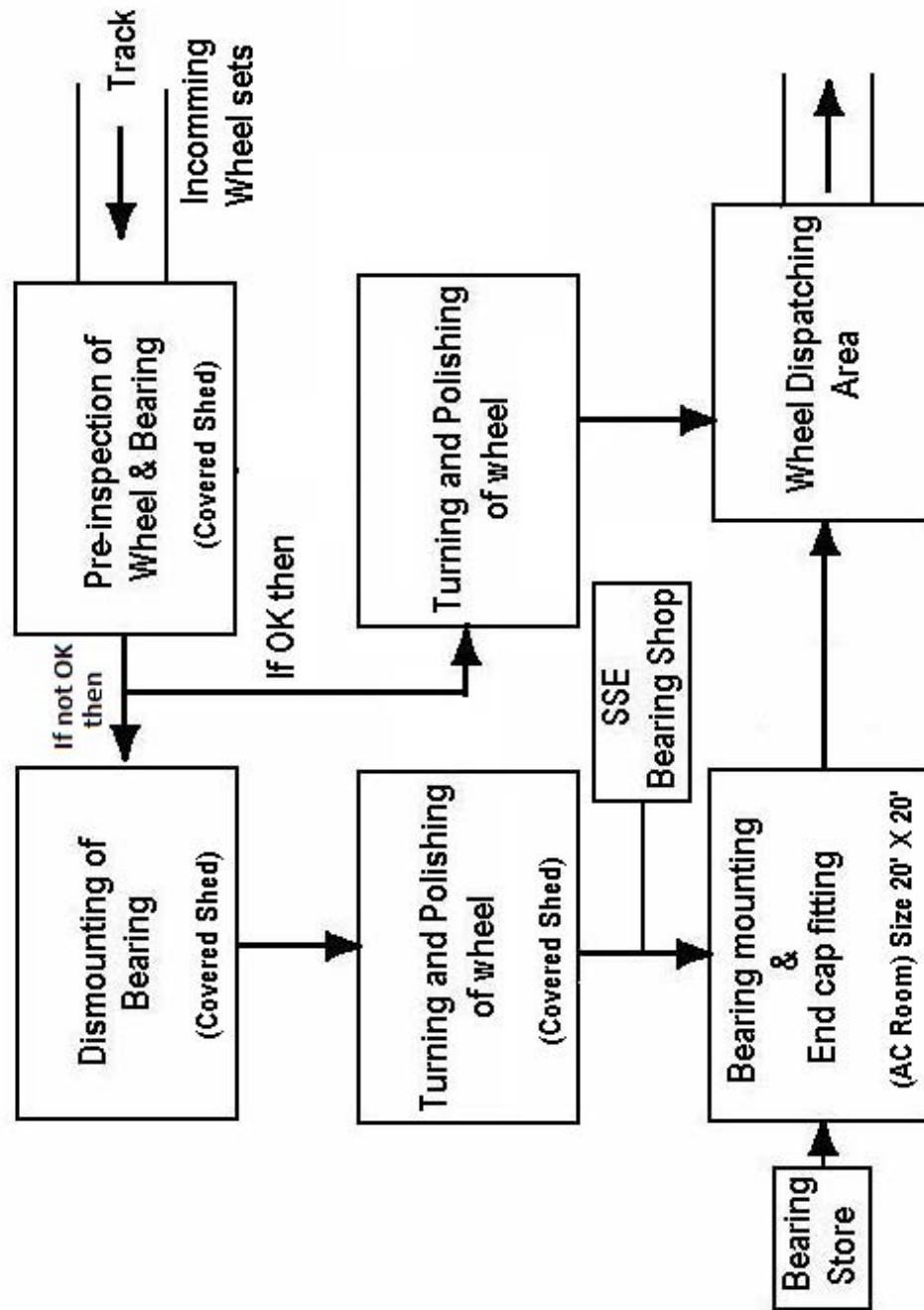
Schematic Layout of CTBU/TBU shop is enclosed as Annexure 1

3.0 facilities

The facilities required for the CTBU/TBU shop are enclosed as Annexure 2.

ANNEXURE – I

Lay out of LHB Bearing Maintenance Shop



ANNEXURE - II**List of Tools and Equipment for LHB Bearing Shop****A. Bearing dismounting and General cleaning area-**

- | | | |
|----|---|-----------|
| 1. | Hydraulic extractor for bearing Dismounting | - 02 Nos. |
|----|---|-----------|

B. Inspection and assembly Area

- | | | |
|----|--------------------------|-----------|
| 1. | Box spanner set 30"-32" | - 02 Nos. |
| 2. | Magnetic dial bore gauge | - 02 Nos. |
| 3. | Wheel dia gauge | - 02 Nos. |
| 4. | Wheel gauge | - 02 Nos. |
| 5. | Chisel | - 02 Nos. |
| 6. | Hand Hammer | - 02 Nos. |

C. Bearing mounting Area

- | | | |
|----|--|-----------|
| 1. | Hydraulic press machine for bearing mounting - | - 02 Nos. |
| 2. | Torque wrench 5-23 Kg-M | - 02 Nos. |

D. Others

- | | | |
|---|---------------------------------|----------------------|
| • | CTBU/TBU shop | - As per lay out |
| • | Air Conditioning | - As per requirement |
| • | Elect. Fittings & illuminations | - As per requirement |
| • | Working Benches | - As per requirement |
| • | Computer with Printer | - 01 No. |

Annexure B**Maintenance Instructions for CTBU/TBU circulated by RDSO/LKO.**
(RDSO Letter No. MC/RB/General Dated 04.05.2011)**Sub: Bearing installation instructions**

1. Check Axle journals, fillets and dust guard diameter for any damages before applying bearings
2. Ensure that the journal diameter & dust guard diameters are within the specified limits. DO NOT assemble bearings if these diameter are outside the specified limits.
3. Coat the axle journal with an approved press –fit lubricant prior to applying bearings **DO NOT USE WHITE LEAD MIXTURES.** Apply a moderate to heavy coating of approved anti-rust compound to the axle and dust guard fillets up to the wheel hub before the bearings are applied.
4. Check the bearing to be mounted for damaged seals or any other visual defects. DO NOT mount bearings with any defect. Contact OEMs representative immediately.
5. Ensure that the bearings are mounted with appropriate tooling meant for the purpose.
6. The mounting press should be calibrated and should have the capacity for the seating tonnage of the bearing.
7. Press the bearings on the axle journal and allow the pressure to build up to the tonnage specified. (see maintenance manual) in the table after the bearings have seated against the axle fillet.

NOTE: Be careful during mounting as the backing ring may separate from the bearing.

8. Inspect cap screw threads, cap screws that are damaged, worn or that cannot be tightened to the required torque must be replaced.
9. Apply the axle end caps and tighten the cap screws with a torque wrench to the torque specified (see OE specification). **RECHECK EACH CAP SCREW SEVERAL TIMES UNTIL THE CAP SCREWS DO NOT MOVE WHEN THE SPECIFIED TORQUE IS APPLIED.**

NOTE: Ensure that the torque wrench is calibrated. End caps that are distorted, damaged or cracked should be used and must be replaced with new.

10. Lock the cap screws by bending all of the locking plate taps flat against the sides of the cap screw heads.

NOTE: Do not re-use locking plates.

Bearing Storage:

- Un-mounted / New roller bearings and component parts must be stored in an area that is clean well protected from moisture/ rain.
- A Periodic inspection of stored roller bearings should be made. Any undesirable condition (bearing assemblies subjected to moisture) found should be intimated to the Company immediately.
- Roller Bearings, either new or used, that are placed in storage as individual parts or as bearings assemblies, should be used in the order in which they were stored, Principle of “first in first out” must be followed.
- New roller bearings and component parts should not be removed from the shipping package until they are to be installed on to an axle.
- When new roller bearing parts are removed from storage it is not necessary to clean the protective coating of the parts that have been retained in their original shipping package.
- When bearings that have had previous service are disassembled, cleaned, and inspected in accordance with the instructions and are to be placed in stock, may be stored as complete assemblies or as individual parts.
- When loading or unloading wheel and axle assemblies with bearings applied, wooden boards should be placed between the bearing cups and the wheel flanges of adjacent wheel and axle assemblies to protect the bearings from damage.

The first incident report of bearing failure

Railways should send First Incident Report of bearing failure, including mate bearing to RDSO containing following details (See Performa for CTBU/TBU Failure)

- a. Wheel condition
- b. Torque value of bolts when removed (use method to mark position loosen one by one and torque back to mark and record)
- c. Journal size at 9 points.
- d. Bearing pictures of the seal for analysis
- e. Weigh the bearing to confirm grease fill.
- f. A grease sample kept. For possible future use.
- g. Detailed inspection of cage for cracks, and cage date to try and narrow down and link to failed bearing.
- h. Comment of raceway condition and roller end condition, this is important to establish root cause.
- i. A photo and comment of adaptor to cup contact pattern to understand load path.

Wherever bearing is sent for refurbishment, it may be ensured that a representative from the Workshop is available when the bearings are opened.

In order to prevent bearing damage the following may be checked on line and workshop.

Online checks- Bearing damage

- a. Monitor bearing temperature and compare with mate bearing on same axle and bearings on same coach. Any bearing with unusual high temperature should be suspect.
- b. Check for looseness of front covers and also bottom strap of control arm.
- c. Check for missing front cover screws and also screws holding top and bottom strap of control arms.
- d. Check for displaced or cracked control arms.
- e. Check for heat/burn marks on the control arm/covers.
- f. Check for dislodged /open speed sensor cables.

Workshop checks- Bearing damage

- a. Wheel size specification: Ensure that the wheel sizes are to the required specification on the same axle, on the same bogie and coach.

Wheel dia difference (Permitted)

On the same axle - 0.5 mm

On same bogie - 5 mm

On bogie to bogie - 13 mm

Note: these are the shop tolerances & not service tolerance limits

- b. Check for wheel flats and shelled wheels.
- c. Check for looseness of front covers and also bottom strap of control arm.
- d. Check for excessive grease oozing on the bearings.
- e. Check for missing phonic wheel screws and/ or end cap screws.
- f. Check for looseness of phonic wheel screws and/ end cap screws.
- g. Check for damaged seals.

It is also imperative that the failed wheel set should be sent to the workshop for a thorough investigation.

Annexure C**Proforma to be filled in case of CTBU/TBU failure of LHB coaches**

S. N	Details	Observation
1	Occurrence Particulars	
a	Date of Failure	
b	Station	
c	Section	
d	Division	
e	Railway	
2	Train Particulars	
a	Train no.	
b	Last examination station	
c	Last examination date	
d	Distance traveled since last examination	
3	Failure particulars	
a	Description of failure	
b	How failure detected	
c	Position of affected coach from loco	
4	Coach Particulars	
a	Coach Nos.	
b	Coach Type	
c	Coach Built by	
d	Coach Built year	
e	D1 Schedule date	
f	D2 Schedule date	
g	D3 Schedule date	
h	IOH date	
i	POH date	
j	Return date	
k	POH shop	
5	Bearing particulars	
a	Bearing side (phonic, earthing or plain side)	
b	Bearing marks	
c	Bearing No.	
d	Mfg. Date of bearing	
e	Within warranty or beyond warranty	
f	Refurbished/New	
g	If refurbished date of refurbishing	
h	Check for any damage to grease seal	
6	Affected end	
i	Phonic wheel side	
a	WSP functional or not	
b	Phonic wheel present or not	
c	Sensor cable present or not	

S. N	Details	Observation
d	Physical condition of sensor damage/rubbing mark	
e	Gap between phonic wheel & sensor	
f	Phonic wheel mounting M8 screws/bolts present or not	
g	Make of (WSP, Sensor & phonic wheel)	
h	Make of M8 bolts	
i	Property class of M8 bolts	
j	Phonic wheel M8 screws/Bolts condition	
k	Spring washer of M8 bolts present or not	
l	M8 Screws/bolts Full or half threaded	
m	Sensor fixing bolts are present/damage or not available	
n	Phonic wheel OD-wear/damage	
o	Max temperature	
ii	Earthing Side (if failed earthing side	
a	Make of earthing device	
b	Earthing device functional or not	
c	Earthing cable present or not	
d	Physical condition of carbon bushes	
e	Spring of carbon bushes functional or not	
7	Control arm	
a	Visual check on all fixings for loosening and/or missing components.	
b	Check the control arm to see is misaligned or not	
c	If there is gap between the upper and lower control arm, then measure it.	
d	Visually check control arm parts for damages, cracks or corrosion marks.	
e	Drain holes choked or open	
8	Axle end over	
a	Axle end cover mounting bolt missing/loose	
b	Inspection bolt present or not at axle end cover	
c	Axle end cover physical condition at the phonic wheel area any sign of rubbing	
d	Axle end cover rusted or not	
e	Condition or end locking screws	
f	Condition of end locking plate	
g	End locking plate tab is bent against End cap screw (all 3 screws)	
h	Heat/burn marks on the Axle end cover/control arm	
9	Vertical Damper	
a	Check the vertical damper functional or not	
b	Leakage of lubricant	
c	Check the bolts & nuts present or not	
10	Wheel	
a	Wheel shelling is present or not (depth-1 5 mm Max.,& depth or hollow tyre-3mm Max.)	
b	Wheel flat present or not (Max. 50mm)	

S. N	Details	Observation
	Wheel diameter affected side	
d	Wheel diameter Other End (Mate Bearing)	
e	Position/location of affected wheel in coach	
f	Stamping particulars of wheel	
g	UST particular of wheel	

History Card for LHB Coach Bearing**Annexure D**

				Visual Check								
History Card No.		Bearing No.		D.Cup	Cone 1	Cone 2	Roller 1	Roller 2	Spacer	B. Spacer	S.Sleeve	B.Ring
Etching (Gray or Greyish colour & slight pitting is allowed)												
Corrosion pitting and rust (Slight corrosion & rust is allowed)												
Heat discolouration (Dark blue indicating the evidence of over heating is not allowed)												
Fatigue/ Cracks / Spalling or Flaking												
Repaired spalls of more then 9.5 mm x 3.2 mm not allowed												
More than 2 spalls within 50 mm circumference section not allowed												
Total no. of spalls more than 6 not allowed												
A bridge or separation of less than 4.75 mm long between 2 repaired spalls not allowed												
Fracture (No fracture allowed)												
Peeling (Peeling of depth more than 25 micron not allowed)												
Smearing (Smearing more than 25 micron not allowed)												
Brinelling (Brinelling of as follows not allowed)												
Length upto ½ of the raceway width X width more than 3.95 mm not allowed												
Length more than ½ of the raceway width X width more than 2.4 mm not allowed												
Crack associated with brinelling not allowed												
Electric burn marks like craters, pits, fluting or corrugation												

not allowed									
atch									
Distortions/ Cracks/Broken									
Dent									
Remarks (Minor Repair =M, Major Repair =J, Rejection (No Repair) =R, Replace with New = N)	M	M	R/N				R/N	M	R/N
Dimensional Check					Remarks				
Description	Observation		Remarks						
Cup OD Size 229.870 mm (Min.)									
OD out of Round 0.030 mm									
Grease Weight 280 gm					Primary Stage Date Secondary Stage Date Final Stage Date Approved By Date				
Cup Counter Bore Size 209.500 mm to 209.550 mm									
Cup Counter Bore out of Round 0.030 mm									
Cone ID 129.992 mm (Max.)									
Cone ID out of Round 0.030 mm (Cone 1 & 2)									
Backing Ring Counter bore 160.125 mm Max.									
Bench End Lateral Play 0.023” to 0.025”									
Cage Shake 0.21 mm to 0.61 mm									

PART - C

Maintenance of CTRB for Freight Stock



1.0 GENERAL INFORMATION

1.1 BASIC BEARING ASSEMBLY (CTRB)

The Cartridge Tapered Roller Bearing is a self-contained, pre-assembled, pre-adjusted, pre-lubricated, completely sealed unit, and is applied to or removed from the axle without exposing the bearing elements, seals or lubricants to contamination or damage. The Cartridge Tapered Roller Bearings are manufactured in different sizes to fit on axles for all types of new and existing wagons.

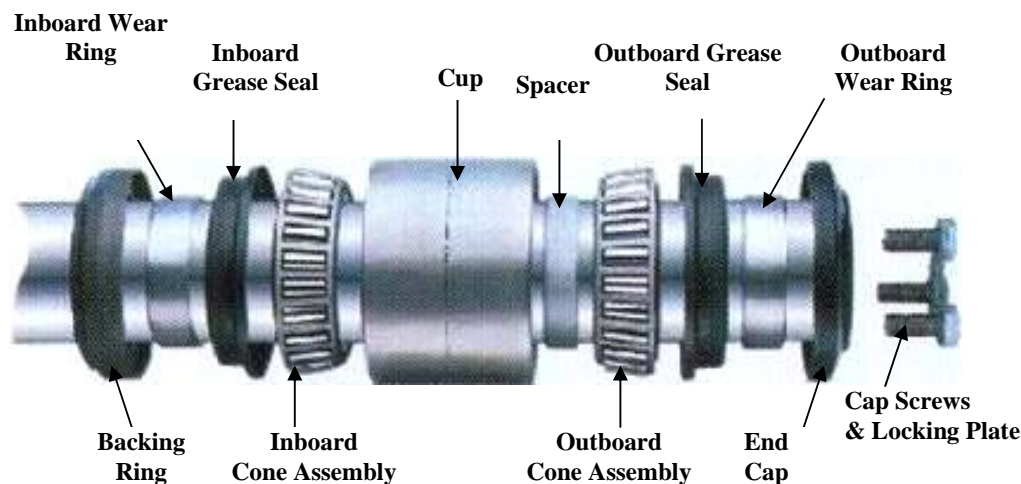


Fig: 1

1.2 NOMENCLATURE AND DESCRIPTION OF BEARING PARTS

1. Cone Assembly

The cone, rollers and cage assembly is perfectly matched to ensure long service life. Assembly configuration is similar to standard single row tapered roller bearings. Both cone and rollers are manufactured from bearing quality case hardened steel.

2. Cup

The double cup is forged, rolled and machined from bearing quality case hardened steel. The cup has two tapered raceways. It also has seal grooves located at each end, precision machined to effect a leak-proof fit to provide positive locking for the grease seals.

3. Spacer

The spacer width is precision ground and selected at the factory to achieve proper axial clearance in an assembled bearing. Subsequent adjustment or interchange at the time of installation should not be done.

4. Wear Ring

The wear ring is a steel ring, heat treated & precision ground on the OD to provide a smooth, concentric mating surface for the grease seal. The bore diameter of the wear ring has an interference fit with the axle.

5. Grease Seal

The seal is made of special synthetic rubber of superior oil resistance quality, bonded with metal casing by a special process. The primary function of the roller bearing seal is to keep vital lubricating grease inside the bearing and avoid ingress of water and foreign particles.

Primarily the seal is required to perform three functions. Firstly, it should be held firmly by itself to the counter bore of the double cup (a press-fit). Secondly, the rubber lip of the seal must retain its interference fit with the rotating wear ring over a life of several hundred thousand kilometers of operation, despite heat, friction and dirt, and, thirdly, the seal has to do all this with the minimum friction & minimum temperature rise, which directly affects the fuel consumption. As the seal rubs on the wear ring, friction or drag is developed, which the locomotive must overcome. In an era of rising fuel costs it is essential to reduce this loss. It is also necessary to ensure that some quantity of grease also exist in this sealing element of grease seal.

The Cartridge Tapered Roller Bearing are presently fitted with the contact type grease seals which are proven for excellent performance & also helps in reducing fuel consumption and cooler running of bearing..

6. End Cap

The end cap is affixed to the axle by three cap screws and is designed for sufficient rigidity to maintain proper cap screw tension, even after years of service. The wear ring should seat properly inside the recess of end cap to prevent ingress of water.

7. Axle Cap Screws

The Axle Cap Screws affix the axle end cap with axle to provide sufficient clamping of the bearing on the journal. Both used & new cap screws should be lubricated with oil before installation.

8. Locking Plate

The locking plate provides tabs which are bent against the flats of the cap screws after tightening, thus preventing their undesired turning and subsequent loss of bearing lateral clamp. Two tabs provided for each cap screw must be bent against the flats of the screw heads for proper locking of the cap screws.

9. Backing Ring

The Backing Ring positions the bearing, provides a firm base and helps prevent intrusion of dirt, water and other foreign substances. The backing ring collar must have an interference fit on the axle shoulder and should not rotate by hand-pressure after bearing installation.

NOMENCLATURE

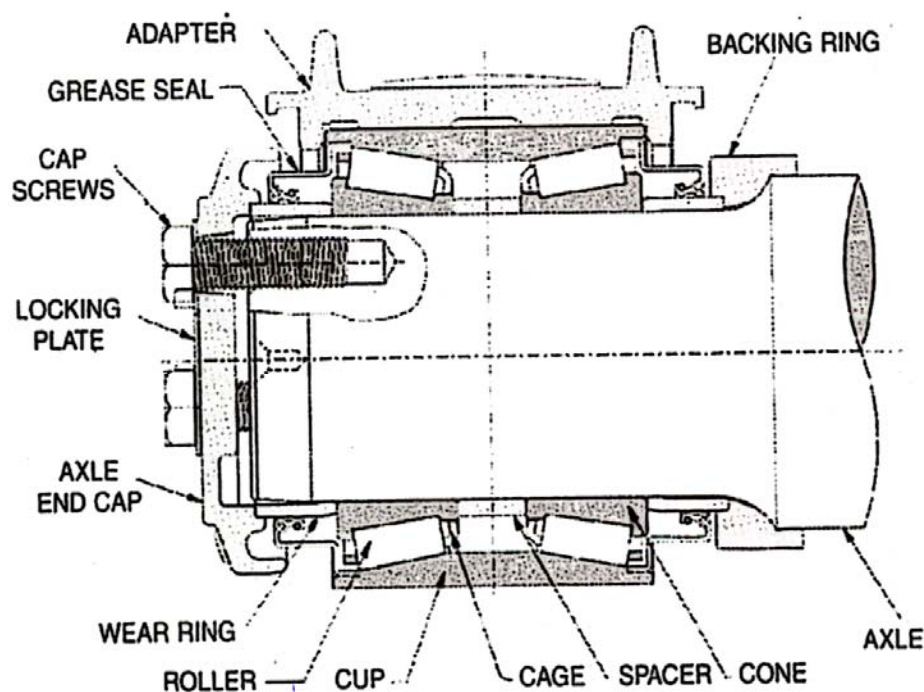


Fig.: 2 Cartridge Bearing Shown in Section

1.2.1 PERIODICITY OF MAINTENANCE

The Cartridge Taper Roller Bearings used on Indian Railways are of 'No Field Lubrication' (NFL) Type. These bearings require no maintenance between POH to POH. The bearings, therefore, should not be opened in the Sicklines / ROH Depots. The periodicity of first POH has been laid down as six years by Railway Board vide letter No. 85/M(W)/814/53 dated 19-3-86. The periodicity of subsequent POH has been fixed as 4 1/2 years by Railway Board's vide their letter No.85/M (W)/814/53 dated 3-7-90.

1.3 APPLICATION PARTS

All the parts to be applied to the axle assembly are shown in Fig. 2. The Bearing Assembly is pressed on the axle as a completely sealed unit. The axle end cap, cap screws and locking plate are applied as an assembled unit on the axle journal already fitted with complete bearing assembly.

1.4 PACKING OF BEARINGS

The Cartridge Bearings shall be suitably packed to protect them against ingress of dust, dirt and moisture. The supplier will be responsible for proper packing methods and should ensure that these packing methods are adequate for handling at Indian Ports and Inland Rail/Road Transport and Railway workshops.

2.0 BEARING INSTALLATION AND REMOVAL

2.1 GENERAL PRECAUTIONS

Cartridge Tapered Roller Bearings and all other components are manufactured with high degree of accuracies and require utmost care in handling. Without careful handling, the bearing may fail to fulfill its desired performance, even if it is of highest possible precision grade. The following are some important cautions that must be borne in mind during installation work to prevent damages:

1. Installation of bearings on the wheel sets should be done by qualified and trained personnel, inside a separate dust proof shed.
2. The installation shop must be clean.
3. The bearing assemblies should be stored in a clean and dry place and should be protected from heat, dust and moisture until they are installed on the axle.
4. Bearing assemblies should not be removed from the package and the protective wrapping should also not be removed until just ready for installation.
5. Use older stock first i.e. principle of first in, first out (**FIFO**) must be followed.
6. Pick up/take out the cartons of assembled bearings, wear rings, backing ring, axle end cap, cap screws and locking plate.
7. Remove the bearing assemblies from the carton and place them on a clean bench adjacent to the wheel and axle assembly.
8. Do not remove the cardboard triangular packing tube from the bore of the bearing assembly. This cardboard tube is required to hold the cone spacer in alignment with the cone assemblies till installation of the bearing assembly on the axle.
Removal of this tube can cause the cone spacer to slide down causing grease leakage and troubles during installation.
9. Bearings and all spare parts must be handled with utmost care and by all means prevented from being hit or dropped.
10. Check caps screw for any thread damage or wear, reject for burrs extending beyond the washer face on the underside of the cap screw head as these will damage the locking plate.
11. All the tools required must be ready and conveniently located.

2.2 AXLE PREPARATION

It is important that the axles offered for mounting bearings are thoroughly inspected before mounting the bearings. The following procedure should be employed to ensure optimum mounting conditions:

1. Ensure that the axle journal is free from sharp edges, burrs, scratches or high spots and rust spots. Axle end tapped holes should be cleaned. The thread size of the tapped holes must also be checked with a master plug gauge to ensure proper clamping.
2. Measure the journal at three points along the length and diameter to ensure that it is within the allowable tolerance range (Refer Sheet No. 1). Three readings should be noted to arrive at the mean reading.
3. Check axles on shoulders and radii with proper gauges to determine that finished axle dimensions are within prescribed tolerances to obtain proper fit on axle assembly (Refer Sheet No. 2).
4. To ensure proper seating of the backing ring, the fillet should be checked with a fillet gauge (Refer Sheet No.3). In case of excessive fretting of the fillet, the axle will have to be machined or scrapped as specified by the dimensional allowances.
5. It may be noted that the bearing cones, wear rings and backing ring have got an interference fit with the axle journal.



Fig: 3

6. Although the wear ring is rotated with the axle, yet over a period, the in-board wear ring seating wears off a groove on the axle due to flexing of the axle. If the depth of this groove is up to 0.05 mm (0.002”), then the groove can be polished with the fine emery paper (80 grit or finer) to ensure that all sharp corners or edges are removed (Refer Sheet No. 1).

2.3 MOUNTING LUBRICANTS

Before mounting the bearing, axle must be coated as below:

- (a) Journal fillet and portion of axle between wheel hubs and fillet should be coated with lead free rust preventive. (See Fig 4)
- (b) Then bearing seat of the axle should be coated with Castor oil or heavy mineral oil (SAE 40 or SAE 50) before mounting. White lead should not to be used, as it may be detrimental to lubrication grease by acting as an oxidation catalyst. Mounting lubricants must be kept free from contaminants.



Fig: 4

The treatment not only prevent the axle from rusting but also allows the bearing assembly an easy push on or pull off during mounting and dismounting operation without scratching the axle surface.

2.4 METHOD OF MEASURING ROLLER BEARING JOURNALS

Bearing Seat Areas (Sheet No.1)

Dial or Digital snap gauge must be used for checking journal diameter accurately. Rotate the snap gauge around the journal diameter by 180 degrees within the bearing seat locations to obtain the maximum and minimum journal diameters (See fig 5). The average diameter of each bearing seat must be within tolerances. Care must be taken when using temperature compensating span gauges that rotation speed does not create sufficient heat, due to friction to effect the readings. There shall be no abrupt changes or steps over the length of the journals, including tapered end, except journal grooving from inboard seal wear ring is permissible when repaired as specified below.



Fig: 5

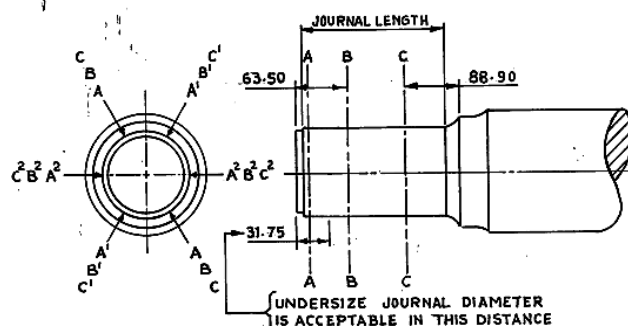


Fig: 5a

JOURNAL CLASS (Size)	ACCEPTABLE TOLERANCES FOR JOURNAL DIAMETER		BEARING SEAT LOCATIONS			
	MAXIMUM	MINIMUM	A	B	C	D
E (6"x11")	144.564 mm (5.6915")	144.539 mm (5.6905")	73.0 mm (2.88")	132.2 mm (5.20")	166.7 mm (6.56")	236.5 mm (9.31")

Journal Grooving from Inboard Seal Wear Ring

The inboard wear ring cause a groove on the journal due to axle flexure. Refer adjacent sketch (Fig.5b) and table showing location of the groove. If the groove in the axle is not deeper than 0.002" (0.05 mm), it can be repaired by polishing with an abrasive cloth (80 grit or finer). No abrupt changes or sharp edges are permissible.

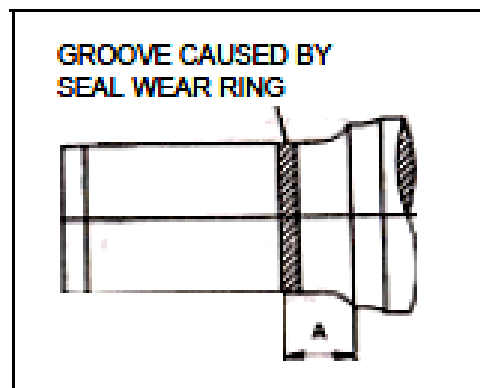


Fig: 5b

Measuring for Upset Journal Ends

The adjustment sketch (Fig. 5c) shows area where upsetting of the journal occurs. Dial or digital snap gauge must be rotated by 180 degrees around the area where upsets occur. In order for a journal to be acceptable, the diameter in the area where upsets occur must never exceed 0.003" (0.080 mm) above maximum tolerance specified in the adjoining table, but may be below the minimum tolerance. Upset ends over 0.003" (0.080 mm) may be corrected.

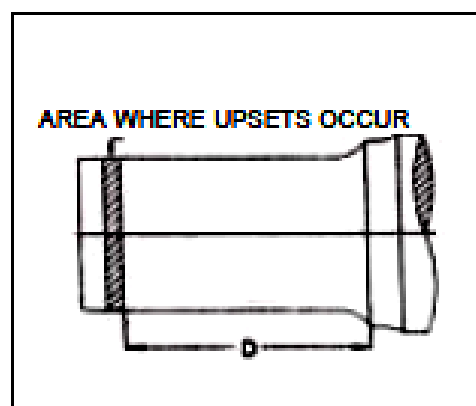
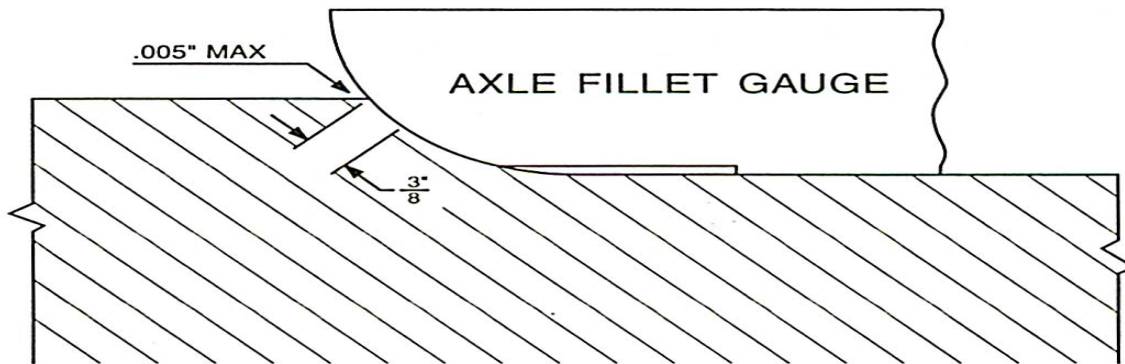
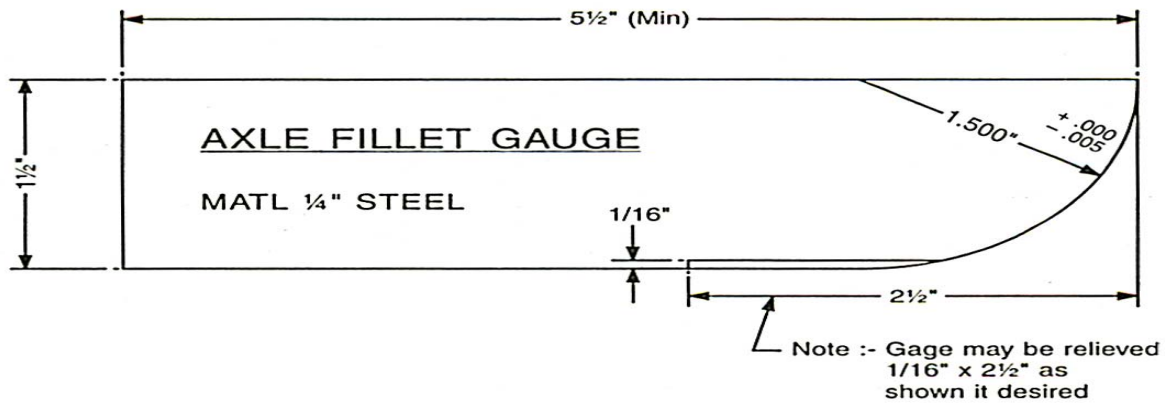


Fig: 5b

Gauge for Checking Axle Fillet of Roller Bearing Axles (Sheet No. 3)



Note: The journal fillet area of a roller bearing axle is critical. To ensure proper fit and proper seating of the backing ring on the axle fillet, the journal fillet gauge must be used to check the fillet radius. If a $0.005"$ feeler gauge can be inserted more than $\frac{3}{8}"$ (10 mm) down from the dust guard seat, at all points around the axle periphery, the axle fillet must be corrected.

2.5 EQUIPMENTS FOR BEARING INSTALLATION AND REMOVAL

Bearing Mounting

The bearings are mounted on the axle journal with aid of a Puller/Installer Service Equipment, as shown:

The Puller/Installer is a self-contained portable fixture equipped with a pump for installing or removing roller bearings.

The Puller/ Installer Service Equipment have the following toolings suitable for CTRB 6x11 Class "E":

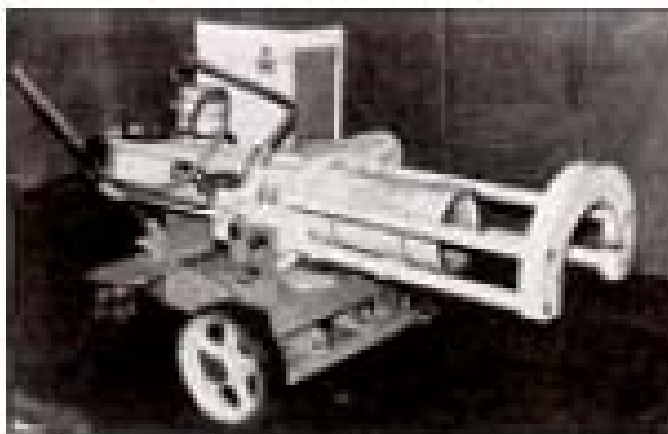


Fig: 6 Bearing Puller/Installer

Toolings used for installation the bearing on axle journal	Toolings used for dismounting the bearing from axle journal
Guide Tube Cap Screws Installing Adapter Connecting Pin Piston Rod Coupling Installing Tube Adapter Ring Installing Tube Installing Tube Cradles	Pulling Shoe Guide Tube Cap Screws Guide Tube Adapter Forcing Plug Adapter Piston Rod Coupling

2.6 BEARING INSTALLATION



After coating the axle as mentioned, the bearing is slipped over the guide tube, automatically ejecting the cardboard tube insert. As the cardboard tube insert is ejected, the wear ring should be held in place by hand so that it will not be pushed from the seal.

Fig: 7



lips

Fig: 8



Fig: 9

If the wear ring slips out of the assembly it must be inserted into the enclosure seal correctly and carefully pushing chamfered end first.

Do not insert any tool or other instrument between the seal element and wear ring. This may damage the

seal element lips or scratch the wear ring resulting in bearing lubricant leakage.

Pressing Bearing Assemblies on Axle

When the bearing is ready for mounting, care should be taken to align the bearing, axle and the mounting press on the same centerline. Failure to do this could result in damage to the bearing or axle. The entire bearing (except end cap, locking plate & cap screws) should be mounted all at one time. During installation of the bearing, press force is applied on the out board wear ring face only (See fig. 10).

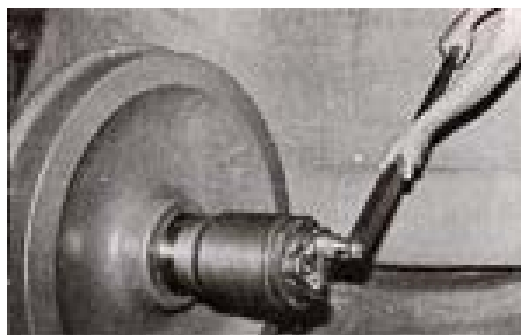


Fig: 10

The bearing will require approximately 10 to 16 tons to be pressed in to the place due to interference fits between journal and bearing components. The press force should be allowed to climb to “Seating Pressure” of 50 ± 5 tons and held for 5 seconds to fully seat the bearing. This seating pressure ensure that the bearing is fully seated against the axle fillet (See fig 11).

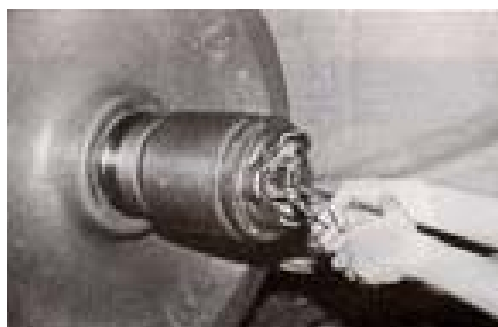


Fig: 11

After the mounting procedure is complete, bearing assembly must be rotated by hand to ensure freedom for movement. The bearing will turn freely feeling the grip of the rubber seals. If the bearing fails to rotate by hand it is to be removed from the axle for re-inspection, to determine the cause.

Apply the end cap, locking plate and cap screws. The cap screws should rotate freely into the threads until they are snug against locking plate. Tighten the cap screws to the recommended torque. Repeat the torque wrench passes until no further screw movement is detected. Apply minimum of 2 passes and maximum 5 passes. If any screw movement persists after 5 passes check for any irregularity. Bend the tabs of the locking plate against sides of the bolt head using adjustable rib joint pliers as shown (Refer Fig.9, 10 & 11).

New recommended values of various mounting parameters for Cartridge Tapered Roller Bearing (6 x 11) Class “E” are as below:

Final Seating Pressure (Hold for 5 seconds)	50±5 tons
Cap Screw size	1”- 8 UNC
Cap Screw Torque (Minimum 2 passes and maximum 5 passes)	40 Kg-m (290 foot-pound)
Torque Wrench Accuracy	± 4% Maximum
Mounted bearing lateral play (Apply hand pressure only)	(0.03 mm to 0.38 mm)

2.7 CHECKING BEARING INSTALLATION

Rotate the bearing assembly by hand to make sure that it will turn freely feeling the grip of the grease seals.

New bearing assemblies are pre-adjusted at the factory. No adjustment is necessary at installation to check lateral end play. In case of bearings and /or old journals it is essential to check lateral play in all assemblies.

Apply a dial indicator gauge having a V-shaped magnetic base to the outside diameter of the bearing cup and position the feeler against the wheel hub face. Push the bearing cup in the direction of wheel hub and pull it in the opposite direction to measure the bearing lateral play which should be between (0.03 mm & 0.38 mm).

Note: If a bearing rotates freely by hand but indicates less than 0.001”(0.03 mm) Lateral on Dial indicator, the application is satisfactory for service.

2.8 LUBRICATION

Cartridge Tapered Roller Bearings are pre-lubricated at the factory. No additional lubricant is to be added after the bearing is applied to the axle. Only approved brands of grease must be used in specified quantity when greasing bearing assemblies during inspection & reconditioning.

Quantity of grease plays an important role in bearing performance. Over greasing or under greasing may result into poor performance or premature bearing failure. Quantity of grease and names of approved brands are specified in table below.

It is essential that the seal lips are also lubricated before the seal wear rings are inserted. New grease seals are supplied in pre-lubricated condition.

The measured quantity of grease is filled by a special greasing fixture. In the workshop the same can be checked by weighing the bearing on an accurate weighing machine, before & after grease filling.

Grease to RDSO's Specification No. WD-24- MISC-2003 is to be used in CTRBs. Before applying the grease, clean all the equipment to be used for lubrication. Apply grease to each single assembly and between the roller and cage assemblies in the quantity as given below:

Amount of grease to be applied

To Single Roller Assembly (Each Cone Assembly)	Between Roller Assembly (Around spacer)	Total ± 30 gm
115 gm	170 gm	400 gm

2.9 BEARING REMOVAL

The procedure is reverse of bearing mounting.

Bearing are normally withdrawn from the axle only when wheels are removed or during POH of wagons.

In order to remove Tapered Roller Bearing, first remove the side frame key from the pedestal opening and lift the adapter assembly off the axles. The bearing assembly is removed by the bearing Puller-Fig. 6. Bearings should never be dropped on the floor. Slide off on a supporting stand of suitable height.

After the bogie frame and adapter have been removed, thoroughly clean the outside of bearing assembly. Bend the tabs the locking plate away from the flat of the cap screw heads. Unscrew the axle cap screws; remove the axle end cap, axle cap screws and locking plate. It may be necessary to tap end cap lightly for removal.

When the bearing assembly is removed from the guide tube, a tube similar to the cardboard packing tube should be inserted in the bore of bearing assembly to hold the internal bearing parts in place. Particular attention should be given to keep the wear rings in position inside the grease seals. Discard all used locking plates.

2.9.1 Discontinuing Mounting & Dismounting of CTRBs in ROH depots/Open Line

Mounting and dismounting of CTRBs in ROH depots should not be permitted and RDSO's instructions in this regard should be strictly followed. Railways which have been following the practice of mounting and dismounting of CTRBs in ROH Depots should discontinue the practice and make necessary arrangements for sending wheelsets with defective CTRBs to Workshops for necessary attention.

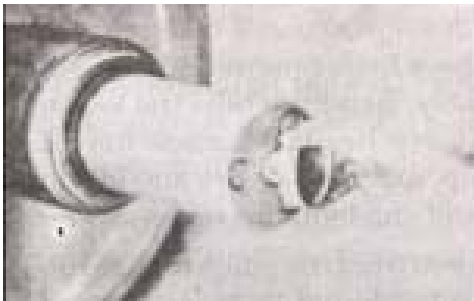
(Railway Board's Letter No. 2005/M(N)/951/49 Dated 01.11.2012)

2.10 BEARING REMOVAL USING PORTABLE ROLLER BEARING PULLER



When bearing Assembly is to be removed, the guide tube is to be fastened to the end of the axle.(Fig. 12)

Fig: 12



Insert the guide tube adapter in the threaded hole in the guide tube (Fig.13). This adapter is retained by a spring-loaded ball and is not threaded.

Fig: 13



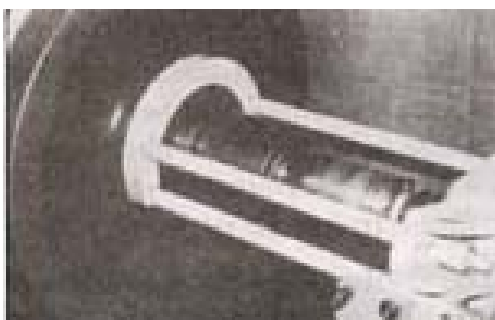
Select the pulling shoe adapter insert for the size of the bearing (6x11 Class "E") to be removed and fasten it to the pulling shoe (Fig. 14).

Fig: 14



Place the forcing plug adapter in the ram head as shown in Fig 15.

Fig: 15



Position the bearing removal fixture on the bearing assembly to be removed by tilting the pulling frame as shown in Fig. 16.

Make sure that the fixture is in alignment with the axle and hold the pulling shoe down in position behind the backing ring until initial pressure has been applied, extend the ram to remove the bearing from the axle.

Fig: 16

3.0 MAINTENANCE AND REPAIR OF CARTRIDGE TAPERED ROLLER BEARINGS

3.1 RECOMMENDED PRACTICES

The following are the recommended practices for long life and trouble-free operation of Cartridge Tapered Roller bearings:

3.1.1 Recommended Practices for Railway Workshops:

- i) Cleaning, inspection and assembly of cup & cones to be done in controlled environment to avoid in-grass ingress of dust particles.
- ii) 100 % checking of groove depth of seal wear ring and re-use of only correct wear ring or replace with new one. Use of seal wear rings with vent holes needs to be stopped immediately. Use of proper measuring instrument is required for seal wear ring groove depth.



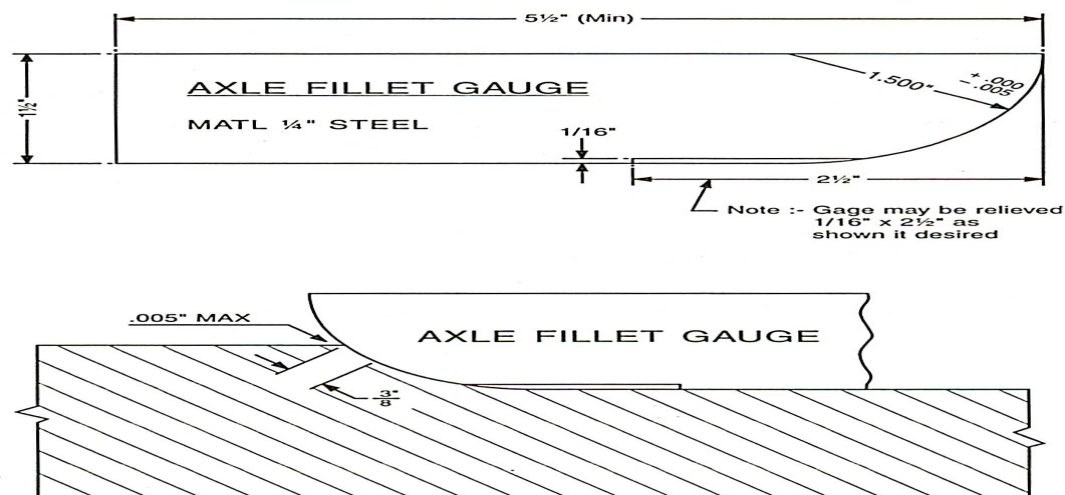
- iii) Bearing mounting machine needs to be periodically calibrated for its proper working at specified force (50 +/- 5 Tons) with ensuring holding for specified time (5 seconds). Use of the proper fixture (tooling) needs be ensured. The pressure – force conversion configuration for the specified machine may be prominently displayed near the mounting area for the benefit of the mounting staff.



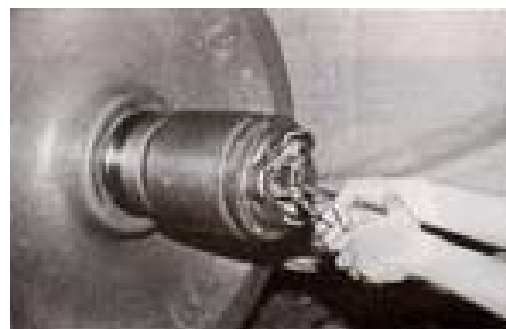
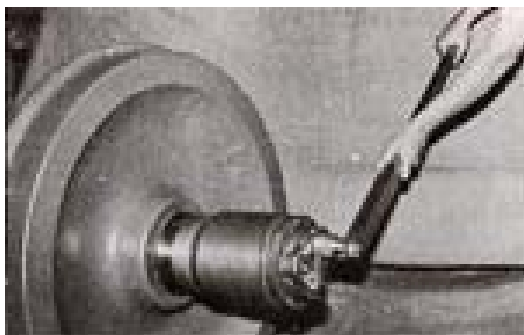
- iv) Checking of journal diameter at three locations with snap gauges may be enforced for ensuring specified fits to obtain the desired mounting force.



- v) Checking of fillet radius after proper cleaning for correct seating/ fitment of backing ring may be ensured. Backing rings with vent holes should not be reused. They should be replaced with plugged backing rings or new backing rings



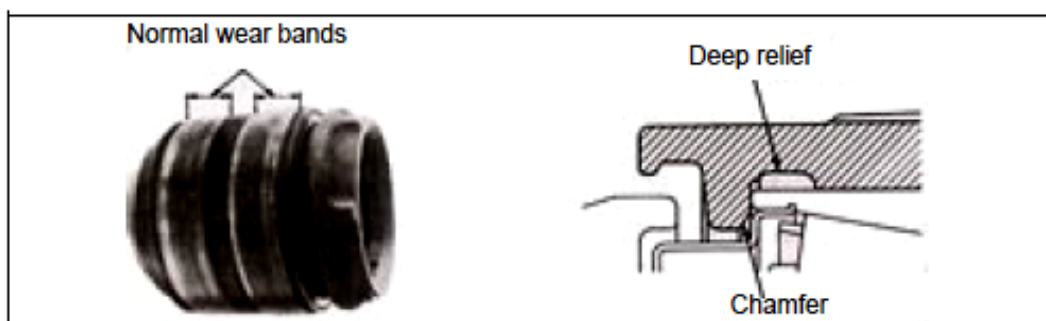
- vi) Proper tightening of end cap screws with periodically (monthly) calibrated torque wrench at specified torque may be ensured on wheel sets. The specified torque should be maintained to 40 Kg – m (290 foot-pound). The torque wrench must be maintained with an accuracy of +/- 4% (Maximum). Minimum 2 passes and maximum 5 passes to be applied to ensure proper clamping. If any screw movement persists after 5 passes check for any irregularity.



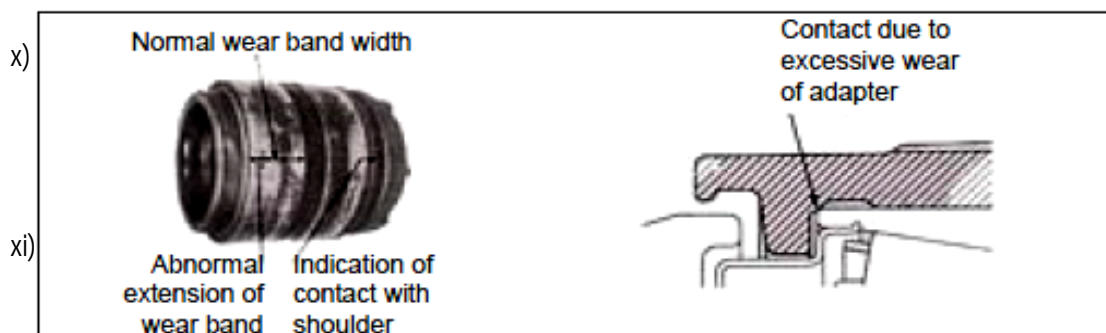
- vii) Axle threads to be checked with Go- No Go gauge and Axle thread holes should be cleaned by compressed air.
- viii) Inside surface of Adapter is required to checked for wear on thrust shoulder and bearing seating area/adapter machined relief with proper gauges (Sample gauge is depicted below). Gauging as per G 95 may be ensured.



- ix) Assembly of bogie using properly checked adapter may be ensured. Railway workshops must manufacture/procure specified gauges for this checking. Cups should be checked for wear patterns seen on the cup outside diameter as it reveals excessive wear of the adapter. The figure below shows normal wear bands present on cup OD generated from a serviceable adapter.



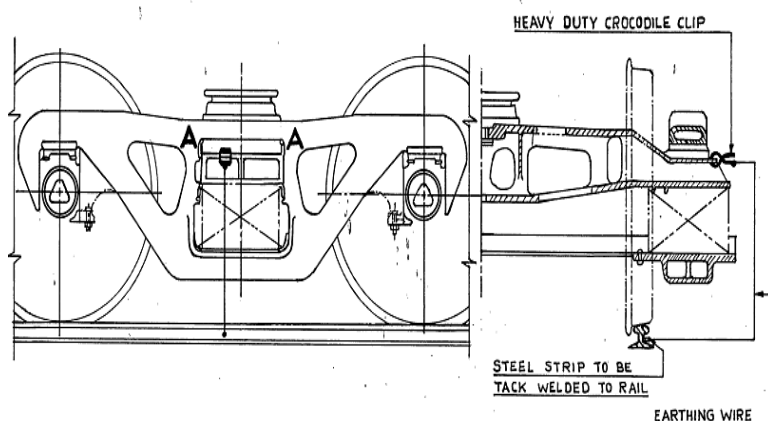
Wear bands formed due to excessively worn out adapter are illustrated below. In case of fully worn out adapter, the cup starts contacting the adapter at the ends also. Worn out adapters must be scrapped. Displaced adapters also form two distinguished marks on the cup outside diameters. And such cups must be examined for spalls being generated on raceways under the adapter contact areas.



- xii) Checking of the mounted end lateral play may be ensured on each mounted CTRB. This is critical to bearing performance. With correct mounted lateral more roller share the load. As a result, peak load on individual rollers are less. Excessive mounted lateral causes high peak roller loads. As a result of fewer rollers sharing the load. This reduces fatigue life.



- xiii) Welding on the wagon after lowering of bogie shall be avoided as far as possible. If any welding work is done after assembly of wagon proper earthing shall be ensured (specifically in odd hours) so that electric current does not pass through the bearings. The earthing should be done very close to welding area and the earthing wire should be tightly secured at both ends. Alternatively the earthing can be done with a earthing wire/strip running parallel to the track instead of earthing with the rails. If wagon is not properly earthed the current passing through the bearings will cause arcing in between the rollers and the raceways leading to failure. All the earthing ports may be properly grounded through periodically calibrated earth pits. One of the recommended scheme of earthing is shown below:



- xiv) Separate investigation of defective CTRBs coming from divisions may be done.
- xv) The fitment of cup and cones of same make in overhauled CTRBs may be ensured. To the extent possible they may be maintained with similar age profile.
- xvi) The stamping of overhauling date & workshop code may be done on backing ring of CTRB also as per RDSO letter no. MW/WA/Genl dated 26/04/2012.
- xvii) Handling of wheel sets with proper lifting tackles shall be ensured. Use of wire slings for lifting of wheel sets may be avoided. Similarly, securing wire ropes near bearing area while pulling the wagon may also be avoided.

Periodic audits of CTRB fitment/maintenance including wheel handling to be done using check sheets already circulated vide RDSO letter no. MW.CTRB.D dated 23/12/2010 may be done.

3.1.2 Recommended Practices for ROH Depots:

1. Area where bearings are opened for UST of axle must have controlled environment.
2. Proper visual examination of bearings to be done. Some important aspects to be checked are as under:
 - 2.1 Overheating, such as discoloration or parts fused together.



- 2.2 Check for loose and/or missing cap screws.



- 2.3 Check that all tabs of the locking plate are properly bent up against the flats of the cap screw heads in the loosening direction.



- 2.4 Inspect for damage or wear to the end cap from a displaced adapter.



- 2.5 Examine the bearing for welding damage or exposure to extreme heat, such as from a cutting torch. Remove the bearing from service if you find any damage.



- 2.6 Check for cracked or broken outer rings (also called bearing cups).



- 2.6 Inspect for a loose backing ring. If you can move or rotate the backing ring by hand, remove the bearing from service.



2.7 Check the backing ring for damage or wear from a displaced adapter.



2.8 Check whether the grease seal is displaced or cocked or has external damage



3. While carrying out wheel turning, the prescribed dummy/protective covers (as mentioned in clause 6.22 & shown in Drawing No. WDIIA-8514/S-1, included in Annexure of G-81) on bearing may be used
4. Proper tightening of end cap screws with periodically (monthly) calibrated torque wrench at specified torque may be ensured on wheel sets. The specified torque should be maintained to 40 Kg – m (290 foot-pound). The torque wrench must be maintained with an accuracy of +/- 4% (Maximum). Minimum 2 passes and maximum 5 passes to be applied to ensure proper clamping. If any screw movement persists after 5 passes check for any irregularity.
5. Handling of wheel sets to be done by using the prescribed lifting tackle and not wire ropes which can damage the grease seals.
6. In case bogie(s) are dismantled for any purpose, the adapter must be thoroughly inspected for soundness and wear. Gauging must be done as specified in G 95.
7. Ensure the Adapter is properly placed on CTRB. Most bearings will “creep” in service, creating two wear bands as pictured below. This is a normal condition that also causes wear to the adapter’s seat pads



Wear bands that extend to the end of the outer ring, as shown on the left side of the image below, indicate an excessively worn adapter seat. A shiny edge at the extreme end of the outer ring, as shown on the right side of the image below, is an indication that the thrust shoulder is worn. Replace the adapter if either of these conditions exist.



8. Whenever wagons or bogies fitted with CTRBs require welding in ROH Depots/Sicklines, special attention should be paid so that electric current does not pass through the bearings. The earthing should be done very close to welding area and the earthing wire should be tightly secured at both ends. Alternatively the earthing can be done with a earthing wire/strip running parallel to the track instead of earthing with the rails. If wagon is not properly earthed the current passing through the bearings will cause arcing in between the rollers and the raceways leading to failure.
9. The stamping of overhauling date on backing ring of CTRB has been advised to be done by workshops on each overhauled bearing to ensure traceability. In case CTRBs fitted wheel are found to be overdue overhauling in course of ROH/Sick line examination to the wagon, such wheels must be sent to nominated workshop for overhauling.

3.1.3 Recommended practices during incoming train examinations in yards

1. Detection of warm bearings on arrival of the train. Check operating temperature of the bearing by touching the adapter or underside of the bearing cup with bare hands immediately after the vehicle is halted. If it is found impossible to hold the hand for a few seconds on the adapter or the cup it means that the bearing is running hot. Cross check the bearing temperature with temperature sensing hand held pyrometers/sensors giving direct reading of the bearing. If bearing temperature is more than 90 degree centigrade the wagon should be detached and bearings should be removed from the service.
2. Check for any abnormal sound and/or grinding noise.
3. Visually inspect the bearing for defects like broken cup, loose or damaged grease seals, broken adapters, missing cap screws, broken /distorted end cap, broken locking plate. Check for loose backing rings, missing side frame key. Any of these conditions are reasons for bearing removal.
4. Checking of displaced adapters [as mentioned in clause 6.1.1(d) of G-81].
5. Availability of adapter retaining nut & bolt in wide jaw bogies.

3.1.4 Axle Box Feeling of Freight Trains

The procedure of axle box feeling is as under:

1. Axle box feeling should be done immediately after the arrival of the train and two technicians, one from the left and another from the right side should do the job.
2. Axle Box feeling must be done on the adapter or the underside of the CTRB cup.
3. Hand held pyrometers should be used for detecting the temperatures; in addition the practice of feeling the boxes with back side of palms should be followed. Such pyrometers should be calibrated regularly. The wagons with axle boxes having temperature more than 90 Degree Celsius should be detached.
4. The axle boxes having grease oozing, burning smell, missing/lose end cap bolts, loose backing rings, grease seals and burnt EM pads are the indicators of potential hot box cases.

The above instructions should be displayed at the axle box feeling points for the guidance of the technicians.

(RDSO Letter No. MW.RB.Genl Dated 20/21.11.2012)

3.1.5 Cup and Cone Rejection Proforma:

RDSO has been instructed by Railway Board to circulate suitable Proforma for reporting rejection of cups and cones of CTRB in workshops so that percentage of cups and cones rejected of different ages should be calculated on the basis of CTRBs checked of that particular age (and not as a percentage of total checked).

The same may be used for reporting for reporting rejection of cups and cones of CTRB in workshops on a quarterly basis. (Annexure III)

3.2 BEARING DAMAGES

Following are some of the most common damages found in cartridge tapered roller bearing at the time of inspection in bearing shop. If a bearing has failed it is recommended that the reason for bearing failure should be investigated so that corrective actions may be taken.

Flaking / Spalling:

Minute surface cracks are the first visible indication that flaking on the rolling surface has started. It spreads up due to increase in stresses at edges of the spall. Metal fragments those separated from the spalled area are carried in lubricant and causing increase in size of the flaked area.

There are so many reasons for flaking e.g. metal fatigue, abnormal loading conditions, displaced adapters, grease contamination, lack of lubricant, impact load on the bearing etc.

Flaked / Spalled Cone Assembly:

If the raceway of cone or a roller surface is spalled, the complete cone assembly should be scrapped. However small pinhead size spalls on the cone raceway $3/32'' \times 3/32''$ (2.4 mm x 2.4 mm) are acceptable as exception for further service.

Flaked / Spalled Cup:

As specified in AAR Roller Bearing Manual, incipient spalls on cup or cone can be repaired using pencil grinder and fine abrasive wheel to grind away loose material and to remove sharp edges of the spall. It is recommended to use spall limit gauge to determine maximum repairable spall size.

Not more than two spalls of maximum size $3/8'' \times 3/8''$ (10 mm x 10 mm) should be repaired in a 2'' (50 mm) circumferential section of the raceway and not more than four spalls $1/16'' \times 1/16''$ (1.5 mm x 1.5 mm) or less in an equally large section. A bridge of $3/16''$ (5 mm) must be left between two spalls after grinding, except where the spalls can be run together within the maximum dimension if one spall $3/8'' \times 3/8''$ (10 mm x 10 mm). The maximum acceptable depth for spall is $1/8''$ (3 mm). If the spall size is more than $3/8'' \times 3/8''$ (10 mm x 10 mm) the cup must be rejected.



Fig: 19

Incipient spall acceptable after



Fig: 20

Incipient spall acceptable after repair



Fig: 21

Large Spall (Rejectable)

Brinelling:

Brinelling are the surface indentation marks in raceways made by roller under impact load. In other words, when rollers are forced into surface of either raceway while the bearing was subjected to heavy impact loading beyond its capacity.

If the length of a faint brinell mark is less than half the width of raceway and if its width at the widest point does not exceed $5/32''$ (4 mm) the part is acceptable for service. If the length of the faint brinell mark is more than half the width of raceway and its width at widest point does not exceed $3/32''$ (2.4 mm) the part is satisfactory for further service. Any number of brinell marks is permissible. If the brinell mark exceed either of the limitations the cup must be rejected. Also if the part has heavy brinell marks having length more than half raceway width the ring must be rejected.



Fig: 22 Acceptable Brinelling



Fig: 23 Acceptable Brinelling

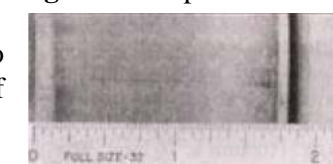


Fig: 24 Acceptable Brinelling

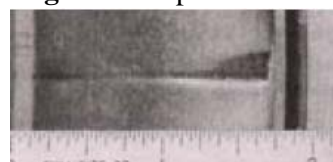


Fig: 25 Brinelling not acceptable

Smearing & Peeling:

Smearing is transfer of metal from one surface to another as a result of galling. This may be due to sliding of rollers on raceways due to adverse lubricating condition. If the cup, cone or rollers has very shallow smearing less than $0.001''$ (0.025 mm) depth it may be returned to service after polishing.

Peeling is the condition caused by minute particles of metal peeling away from original metal surface. Cup, cone & rollers having very shallow peeling depth $0.001''$ (0.025 mm) or less on rolling surface may be returned to service.

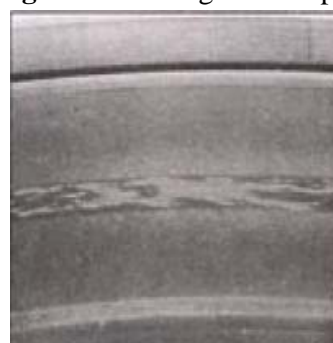


Fig: 26 Smearing-Acceptable after Polishing

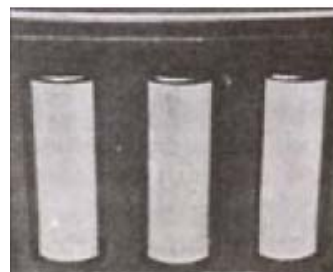


Fig: 27 Peeling-Acceptable

Stain Discoloration, Corrosion Pitting & Rust

The adjacent figure shows surface corrosion damage on raceways and rollers, of three different intensities. Stain discoloration are caused by etching due to moisture or acidity in the lubricant.

Superficial stains & discoloration having no depth and which can be removed by 180 grit abrasive or finer or wire brush are acceptable after polishing. Care should be taken that metal is not removed from rolling surfaces.

Corrosion pitting or rusting (black corrosion lines or pit marks) which has advanced to severe pitting must be repaired by polishing raceways and rollers. Slight pitting after polishing is acceptable.



or cone assembly which can not be repaired satisfactorily by polishing must be rejected.

Heat Discoloration

Color from faint straw to dark blue may be indication of overheating of bearing. Heat discoloration should not be confused with lubricant stains or phosphate coating. If there is evidence of overheating, parts must be rejected.

Fragment Indentations

Fragment indentations in the bearing may be caused due to lubricant contamination e.g. dirt, dust and spalling debris passing over rolling surfaces. Bearing parts should not be rejected for indentation marks present on raceways unless the damage is such that roughness can be detected when the bearing can be rotated by hand (See fig 31).



Fig: 31

Electric Burns

Surface damage from passage of electric current through bearing cause electric burns. These are localized craters, pits, fluting or corrugations (refer Fig. 32,33 & 34). Electric burns may occur at several places simultaneously or any or all of the bearings of the vehicle. Affected bearing parts must be rejected. It is important that at the time of welding, ground cable must be attached in such a way that current will not flow through the bearing.

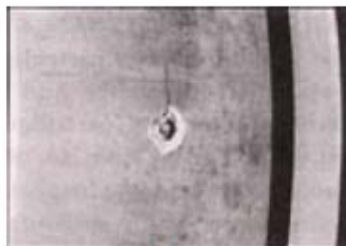


Fig: 32

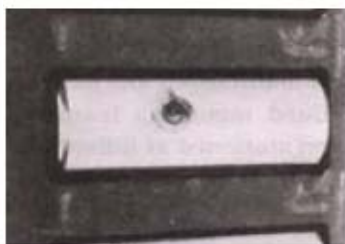


Fig: 33

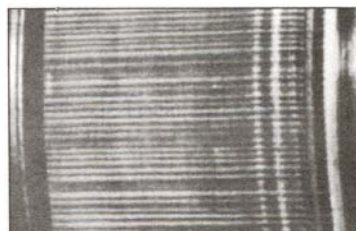


Fig: 34

Nicks

Nicks are surface damages caused due to rough handling of bearing parts. Nicks present on component can be corrected by use of oil stone, provided part is repairable and functioning of part is not affected after repairing.

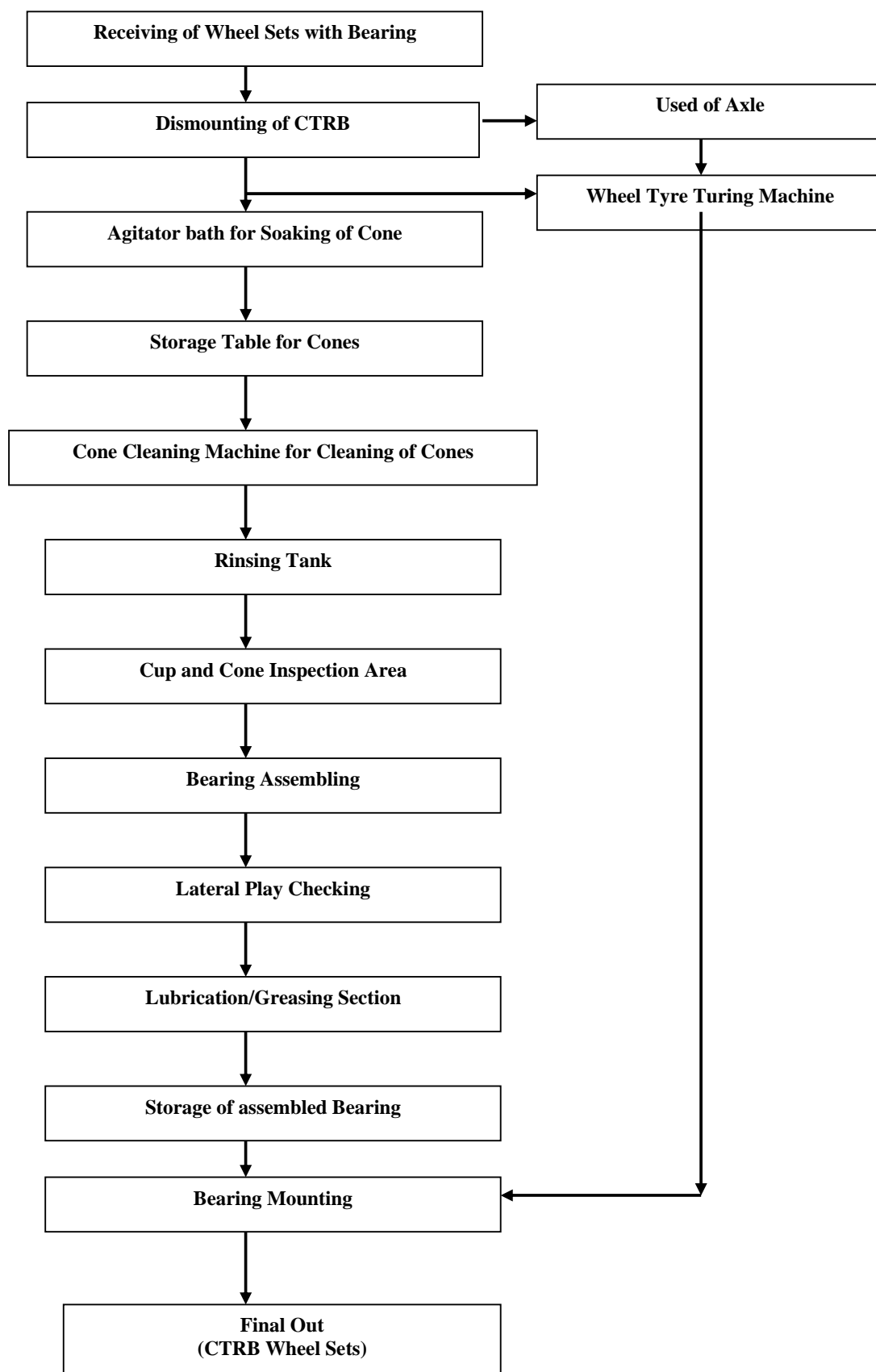
Cracks & Fracture

A crack of any size /length is found on any roller, cone, cage or cup, the component should be scrapped.

3.3 PRECAUTIONS DURING HANDLING OF MOUNTED WHEEL SETS, DURING TRANSIT

1. It is very important that the wheel sets are handled carefully during transportation before and after mounting the cartridge bearings. RDSO has designed suitable lifting tackles for loading and unloading of the wheels sets, from the ships and the railway wagons, and for handling in railway workshops and yards.
2. RDSO has also issued a drawing of the loading arrangement of the axles in the wagons. The above instructions must followed at all stages of handling.

4.0 Flow chart for CTRB Maintenance in workshop



5.0 STANDARDIZATION OF FACILITIES FOR CTRB SHOP

CTRB is vital safety component of wagons and has immense effect on the safety and reliability of rolling stock. RDSO had issued instructions for inspection & maintenance of CTRBs vide report No. G -81 dated July 93 Amendment 1 of Feb. 2000.

The facilities proposed are for a typical CTRB shop attending 2000 CTRBs per month.

1.0 CTRB Shop

The shop layout is shown as annexure 1. It will consist of three distinct areas, as follows-

- A. Bearing Dismounting and Cleaning/Washing area.
- B. Inspection and assembling area.
- C. Bearing Mounting Area

The CTRB shop (especially Inspection and assembly area) should be air-conditioned and maintained dust free. The floor should be epoxy painted for easy maintainability.

A. Bearing Dismounting and Cleaning/Washing area.

This area shall have following activities-

- viii) Dismantling of CTRB.
- ix) Soaking of Cone (agitator Both)
- x) Grease purging
- xi) Washing/Cleaning of Cone/Cup
- xii) Rinsing of Cone/Cup/Spacer

As far as possible, the cleaned components should be prevented from contamination, and should be transferred to Inspection/assembly area immediately after cleaning, through a transfer window.

B. Inspection and assembling area.

This area is the most important area of the CTRB shop. This area should be air conditioned, should have good illumination and should be maintained dust free. This area shall contain facilities for the following activities-

- i) Inspection of Cup (Dial Bore Gauge, Magnifying Glass, Scribing Tool)
- ii) Inspection of Cone (Cone Inspection Fixture, Feeler Gauge, Dial Bore Gauge)
- iii) Bench Lateral play checking
- iv) Pre-lubrication/Greasing.
- v) Bearing Assembly (Bearing Seal Pressing)

Defective components shall be stored separately (and marked suitably) so as to prevent their reuse. After inspection/ Assembly, the Bearing shall be transferred to Bearing Mounting Area for mounting on the wheel sets.

C. Bearing Mounting Area

This area shall have facilities for mounting of Bearings on wheel sets.

- i) Bearing Mounting Equipment
- ii) Torque Wrench

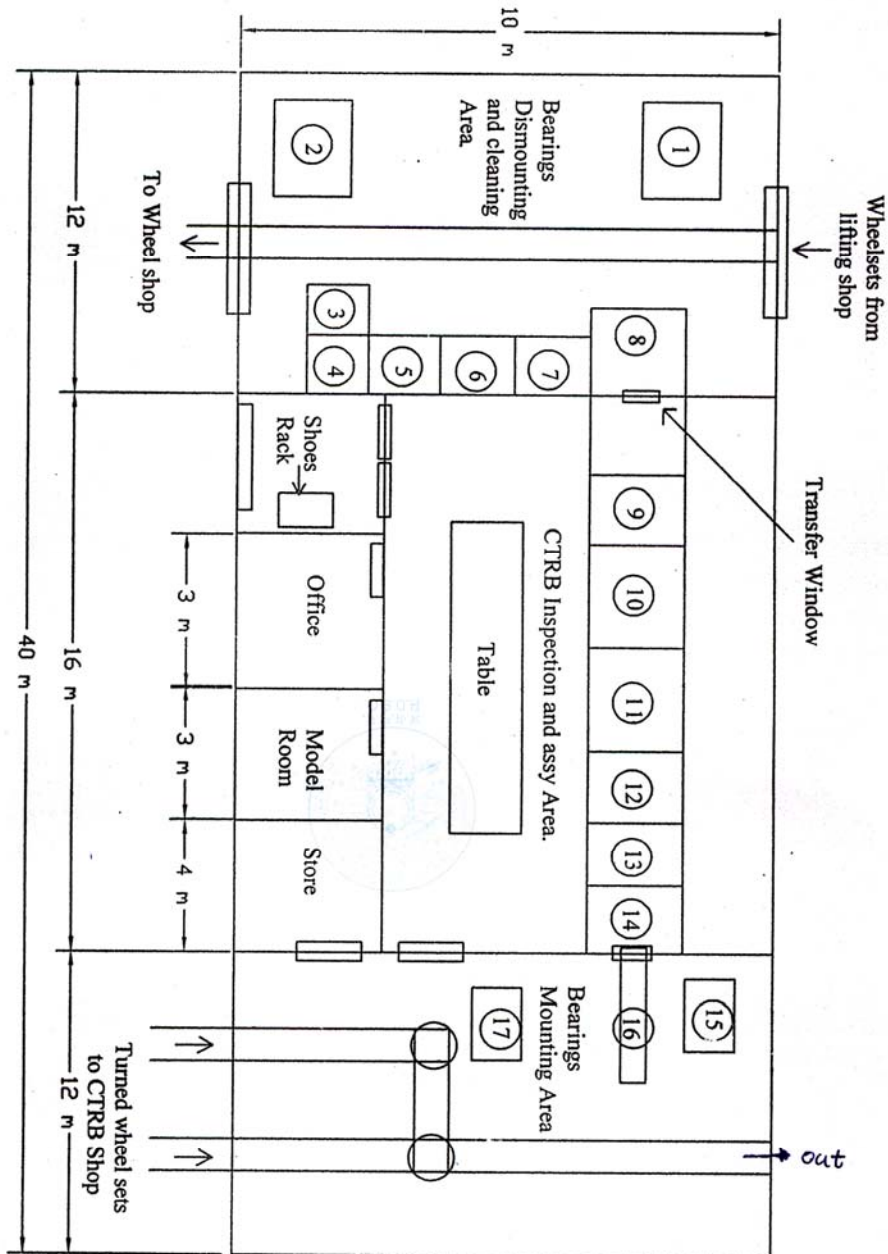
2.0 Shop Layout

Schematic Layout of CTRB shop is enclosed as Annexure 1

4.0 facilities

The facilities required for the CTRB shop are enclosed as Annexure 2

Schematic Layout of CTRB Shop



CTRB Maintenance Shop

1. Bearing Dismounting Equipment
2. Agitator Bath (For Soaking of Cone)
- 3&4. Storage Table
5. Grease Purging Equipment
6. Cone Cleaning Machine
7. Washer for Cup/Spacer
8. Rinsing Tank
9. Cup Inspection
10. Cone Inspection
11. Lateral Play Checking
12. Pre-Lubrication/Greasing
13. Bearing Assembly (Seal Installation)
14. Assembled Bearings
15. Grease Barrel
16. Transfer Chute
17. Bearing Mounting Equipment

ANNEXURE - II

List of Tools and Equipment for CTRB shop

A. Bearing dismounting and cleaning area-

- | | | |
|----|--|-----------|
| 1. | Bearing mounting/Dismounting equipment | - 02 Nos. |
| 2. | Agitator Bath (for soaking of cone) | - 01 No. |
| 3. | Grease purging m/c | - 01 No. |
| 4. | Cone cleaning m/c | - 01 No. |
| 5. | Washer for cup/Spacer | - 01 No. |
| 6. | Rinsing tanks | - 02 Nos. |

B. Inspection and assembly Area

- | | | |
|-----|--|-----------|
| 7. | Dial bore gauge (100-150 mm) | - 02 Nos. |
| 8. | Dial Bore gauge (200-250 mm) | - 02 Nos. |
| 9. | Outside micrometer | - 02 Nos. |
| 10. | Inspection stand for cone | - 01 No. |
| 11. | Bench Lateral Play checking Fixture | - 01 No. |
| 12. | Magnifying glass | - 02 Nos. |
| 13. | Feeler gauges | - 02 Nos. |
| 14. | Pencil grinder/polisher | - 02 Nos. |
| 15. | Scribing Tool | - 02 Nos. |
| 16. | Pre-lubrication/greasing equipment | - 01 No. |
| 17. | Electronic weighing machine (0-50 Kg) | - 01 No. |
| 18. | Equipment for Bearing Assembly
(Bearing seals pressing) | - 01 No. |
| 19. | Gravity chute | - 01 No. |
| 20. | Inspection Tables/storage racks - As per requirement | |
| 21. | Roller track inspection by projected light | - 02 Nos. |
| 22. | Seal wear ring measuring device | - 02 Nos. |
| 23. | Grease seal measuring device and master piece | - 02 Nos. |
| 24. | Cone degreasing machine | - 02 Nos. |
| 25. | Magnetic base with dial indicator for measuring mounted lateral play of CTRB | |

C. Bearing mounting Area

- | | | |
|-----|--|-----------|
| 26. | Bearing mounting/dismounting equipment | - 02 Nos. |
| 27. | Torque wrenches (14 -57 KGM) | - 02 Nos. |
| 28. | Backing Ring gauges | - 02 Nos. |

D. Others

- | | | |
|---|---------------------------------|----------------------|
| • | CTRb shop | - As per lay out |
| • | Air Conditioning | - As per requirement |
| • | Elect. Fittings & illuminations | - As per requirement |
| • | Working Benches | - As per requirement |
| • | Computer with Printer | - 01 No. |

6.0 Proforma for Reporting Hot Axle in Freight Stock

1	Occurrence Particulars			Other end	
(a)	Date of Failure		(g)	Bearing Cup Make	
(b)	Station		(h)	Sr. No. of Cup	
(c)	Section		(i)	Mfg date of Cup	
(d)	Division		(j)	Grease Seal Make	
(e)	Rly		(k)	Grease Seal Mfg date	
2	Train Particulars		(l)	Bearing overhauling particulars (marked on inside of Cup)	
(a)	Tr. No.				
(b)	Load		6	Bearing Condition	
(c)	CC/Premium/End to End		(a)	Rollers/Cone Assembly	
(d)	Last Examination station		(b)	Cup	
(e)	Last Examination date		(c)	Grease	
(f)	BPC No.		(d)	Grease Seals	
(g)	Distance travelled since last examination		(e)	End Cap Screws	
3	Failure Particulars		(f)	Locking plate & tabs	
(a)	Description of failure		7	Condition of Adapter	
(b)	Whether failure resulted in derailment?		(a)	Whether Canted/displaced	
(c)	How failure detected?		(b)	Whether in service limit	
4	Wagon Particulars		(c)	Availability of adapter retaining bolt (in wide jaw)	
(a)	No.				
(b)	Type		(d)	Name of manufacturer	
(c)	Built by		(e)	Mfg Date	
(d)	Name of Wagon builder		8	Bogie Particulars	
(e)	Built Year		(a)	Wide jaw or Narrow jaw	
(f)	POH Date		(b)	Name of manufacturer	
(g)	POH Shop		(c)	Mfg Date	
(h)	R/Date		(d)	Sr. No.	
(i)	Last ROH Date		9	Wheel Particulars	
(j)	Last ROH depot		(a)	Any flat place in wheel	
(k)	Whether overdue POH/ROH		(b)	Wheel Diameter	
(l)	Position of affected wagon (from loco)		(c)	Whether affected wheel changed in sick line	

m)	Tare/CC of Wagon			after POH/ROH	
(n)	Commodity loaded		(d)	Position of affected wheel in wagon	
5	Bearing Particulars				
	Affected end		(e)	Journal Stamping particulars	
(a)	Bearing Cup Make		(f)	UST Particulars	
(b)	Sr. No. of Cup		10	Failure Analysis	
(c)	Mfg. date of Cup		(a)	Whether warranty claim lodged?(if applicable). If yes, details to be given	
(d)	Grease Seal Make		(b)	Whether Joint Investigation done? If yes, details to be given	
(e)	Grease Seal Mfg date		(c)	Concluded Cause of failure	
(f)	Bearing overhauling particulars (marked on inside of Cup)		11	Responsibility	
			(a)	Rly/Depot/Shop/Mfrer	
12	Action Taken:				
Name of Reporting Officer		Designation			Signature

7.0 Check Sheet for Quality Audit of Cartridge Tapered Roller Bearings Class ‘E’ (6” X11”) & Wheel Sets (Freight Stock)

(Based on Maintenance Manual G -81 and CAMTECH MANUAL)

During audit, activities have been checked with regard to maintenance manual G-81. Wherever the activities are not performed correctly, the method adopted is indicated or the nature of non-compliance is recorded.

S.No	ACTIVITIES	CLAUSE NO.	OBSERVATIONS
1	Removal of Bearing from Axle		
1.1	Ensure that the removal of bearing is done as specified.	7.2.2 7.2.3	
1.2	Check whether bearings are kept in a clean and dry place in a covered room.	7.2.4	
1.3	Check that bearings are stacked properly and not thrown one over the other.	7.2.5	
2	Dismantling of bearing		
2.1	Check that dismantling is done properly.	7.3	
2.2	Ensure that the tools are available for dismantling of the bearing as specified.	7.3	
3	Cleaning of components		
3.1	Ensure proper cleaning	7.4	
3.2	Check that washing medium is filtered before use at least once in a day.	7.4	
4	Inspection of Bearing Components		
4.1	Ensure that the system exists to check each component carefully and measure the dimension of components as per Annexure-VI.	7.5	
4.2	Area of inspection should be well lighted		
4.3	Measurement sheet of various components, having permissible limits, should be available		
5	End Cap		
5.1	Inspect end cap for cracks, breakage, wear and distortion of machined surface.	7.5.1	
6.	Cone (Inner rings with Roller Cage assemblies)		

6.1	Inspect the race ways for staining corrosion, pitting, heat discoloration, false brinelling, spalling, indentation, electrical burns, cracks and embedded contamination.	7.5.2	
6.2	Check inner bore, out of roundness of cone.	7.5.2	
6.3	Check gap between small flange of inner ring and bore of cage flange		
6.4	Inspect the inner ring with roller and cage assembly properly as fig.7.	7.5.2	

7	Outer ring/Cup		
7.1	Check inside dia. of counter bore, out of roundness and cup outer dia.	7.5.3.1 7.5.3.2	
7.2	Check wear pattern on the outside of cup and inspect rolling surface for brinelling, sapling, smearing or peeling, fragment indentation or electric burns and intensity of corrosion.	7.5.3.3	
8	Rollers		
8.1	Inspect Rollers for the defects such as brinelling sapling, smearing, indentation and corrosion.	7.5.4	
9	Cage		
9.1	Check cage pocket clearance and cracks.	7.5.5	
9.2	Cage once taken out should not be reused.	7.5.5	
10	Seals		
10.1	Ensure that seals are not reused.	7.5.6	
11	Spacer		
11.1	Check spacer for cracks nicks and burns and also check parallelism of end faces.	7.5.7	
12	Seal wear ring		
12.1	Inspect the outer surface for cracks, nicks, scratches and also check for wear.	7.5.8	
13	Vent fittings		
13.1	Check that there is no vent hole in backing ring if required it should be plugged.	7.5.10	
14	Backing ring		
14.1	Check backing ring break out diameter and for excessive corrosion.	7.5.9	
14.2	Check that distorted, cracked and heavily pitted rings are scrapped.	7.5.9	
15	Cap screw and Locking plate		
15.1	Check cap screws for wear on threads and for stretching or elongation.	7.5.11	
15.2	Check that cap screw threads are properly cleaned and lubricated before fitment.	7.5.11	
15.3	Ensure that cap screws are tightened with torque wrench set at 40 Kg-m	7.5.11	

SN	ACTIVITIES	CLAUSE NO.	OBSERVATIONS
15.4	Ensure that locking plates are not reused.	7.5.12	
16 Assembly of Bearing			
16.1	Check that all the inspected parts are free from dust and foreign particles.	7.7	
16.2	Ensure that all the parts, tools and workbenches are thoroughly cleaned.		
16.3	Ensure that all the inspected parts are covered with polythene sheet whenever reassembly work is discontinued for delayed.		
17 Bench lateral			
17.1	Check bench lateral and ensure that this is within limits.	7.7.1	
18 Lubrication			
18.1	Ensure that grease container is always kept closed.	7.7.2	
18.2	Ensure that approved brand of grease is used.	7.7.2	
18.3	Ensure that specified quantity of grease is used i.e. 400±30 gms. and verify by measuring two samples per day.	7.7.2	
19 Mounting of Roller and Cage Assembly and Fitment of seals			
19.1	Ensure that all the components are properly mounted with due care.	7.7.3	
19.2	Check the fitment of seal wear ring & backing ring.	7.7.4	
19.3	Ensure that seal wear ring and backing ring are fitted according to clause.	7.7.5	
20.	Storage and Packing of Bearings	8.0	
20.1	Outer surface of overhauled bearings to be coated with rust preventive and triangular card board inserted in bore and wrapped in polythene bags	8.0	
20.2	Packed bearings to be kept in specified container		
21. Mounting of Taper Bearing on Axle		9	
21.1	Check journal dia at three points as described in case of new axle.	9.1	
21.2	Measure the journal dia at the two bearing seat location locations at three equidistant points around the journal in case of old axles.	9.2	
21.3	Check the grooves on axle.	9.2.1	
22. Measuring for Upset Journal Ends			
22.1	Measure the journal dia at end. Take three readings at 120° apart around the journal.	9.2.2	

22.2	Check fillet radius for proper seating of backing ring, with template.	9.3	
22.3	Before mounting, coat the journal fillet and portion of axle between wheel hub and the fillet with lead free rust preventive & then coat bearing seating on the journal with heavy mineral oil.	9.4	
22.4	Ensure the final mounting pressure i.e. 50 ± 5 tonnes.	9.5	
23.	Mounted lateral		
22.1	Check the mounted lateral play with a magnetic base dia indicator.	9.6	
24.	Locking plate fitment		
24.1	Ensure that tabs of locking plate are properly bent flat against sides (not on corners) of caps screws		
25.	Fitment of Axle under the Bogie		
25.1	Ensure that proper care has been taken while fitting axle under bogie to avoid hitting.	10.0	
25.2	Ensure rotation of bearing, if adapter seating marks are found to be confined on a limited circumferential length on outer cup.		
26.	Interchangeability		
26.1	All components, except locking plate and cap screws of the same manufacturer are being used in the bearing assembly		
27.	Bearing Marking		
27.1	Ensure that proper marking of POH/repair particulars have been marked at the locations prescribed.	13	
28.	Maintenance Workshop		
28.1	Ensure that working area is duly clean, dust free & dry.	14	
29.	Handling of Bearing Mounted Wheel Sets	15	
29.1	Check that bearing mounted wheel sets are handled properly.	-do-	
29.2	Not more than one wheel set to be slinged, while lifting.	15	
29.3	Flange does not hit outer cup when loading in wagon	15	
29.4	Slinging of wheel set should not be done over bearing cup	15	
29.5	Specified lifting tackle for wheel set to be used.	15	

29.6	Storage of overhauled wheelsets to be done properly	15	
29.7	Ensure that all the measurement/checks properly recorded as per check list of G-81.	-do-	
29.8	Ensure that all gauges have been calibrated/checked with master gauge at least once in a month.	-do-	
30.	Adapters		
30.1	Inspect adapter for soundness, wear (on crown, thrust shoulders, machined reliefs and sides) and distortion	7.5.13	
31.	Welding of Wagons fitted with CTRB		
31.1	Proper earthing to be ensured	16	
32.	Outturn and Manpower		
32.1	Average outturn of CTRB per day		
32.2	Working in one shift or more		
32.3	Manpower per shift, separately for cleaning, inspection and dismounting/mounting		

CHECK SHEET

FOR ATTENTION TO CTRB AND CTRB MOUNTED WHEELSETS DURING ROH AT ROH DEPOTS

As per G-81(Instruction for inspection and maintenance of CTRB fitted on cast steel bogies)

Name of the ROH Depot	Railway	Done on dates (s)

In ROH depot, ensure that the activities mentioned below should be done as specified in the maintenance manual G-81. Wherever the activities are not performed correctly indicates the method adopted or the nature of non- compliance.

S. No.	Activities	Observations
UST of Axle		
1.	Checked that the area where CTRBs are opened for UST of axle have a controlled environment.	
2	Inspect the end cap for cracks, breakage, wear and distortion of machine surface.	
3.	Rotate the bearing for unusual sound check up for crack/chipping.	
4.	Check seal for external damage/dent.	
5.	Check the backing ring for looseness.	
6.	UST of axle should be done accordingly to RDSO specification. Prescribed marking to be done after UST	
Wheel Turning		
1.	Before tyre turning, open out the axle end cap and replace it with a dummy cover. The dummy cover can be made as per RDSO Drg. No. WDIIA-8514/S-1	
2.	Ensure that bearing should be protected from chipping/ other hazardous elements while turning.	
3.	After tyre turning, clean the axle end thoroughly, taking special care to see that no grit or swarf is left.	
4.	Check axle end cap screw holes for any grit/swarf. Compressed air may be used for cleaning axle end holes.	
Re-fitment		
1.	Check cap screws for wear on threads and for stretching or elongation	
2.	Check that cap screw threads are properly cleaned and lubricated before fitment. Axle end holes must also be lubricated before fitment.	
3.	Ensure that cap screws are tightened with torque wrench (set at 40 Kg-m). Minimum 2 passes and maximum 5 passes to be applied to ensure proper clamping. If any screw movement persists after 5 passes check for any irregularity.	
4.	Bending of tabs of locking plate is to be ensured.	
5.	Ensure that locking plates are not reused.	

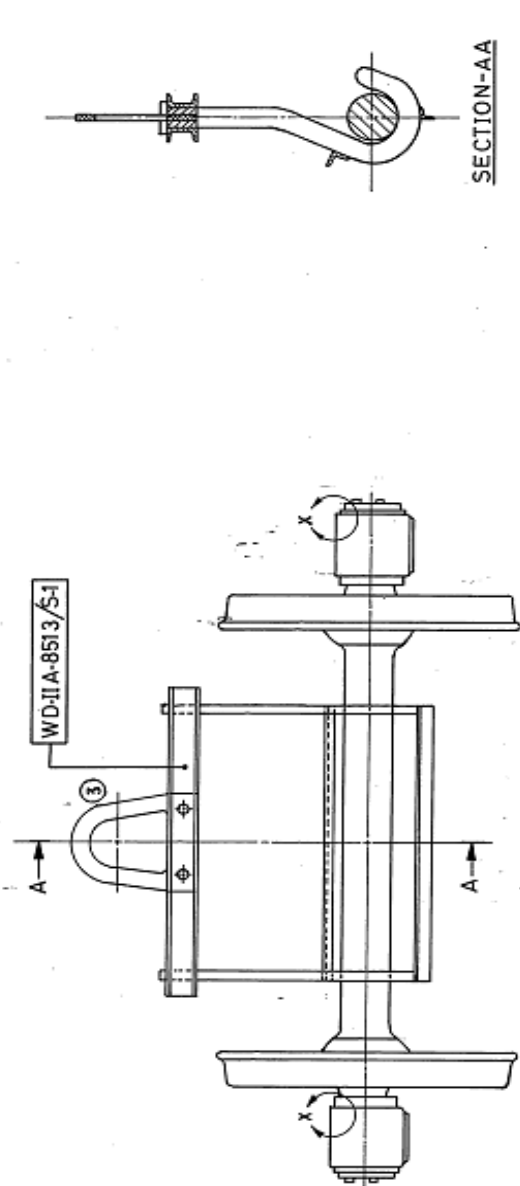
Adapters		
1.	Inspect Adapter for soundness, wear (on crown, thrust shoulders, machined reliefs and sides) and distortion.	
2.	Ensure that all the measurement/checks properly recorded as per G-81 and G-95.	
3.	Ensure that adapter is properly placed on CTRB.	
4.	Ensure that the load zone area of the cup is changed while lowering bogie side frame.	
Handling of Wheel Sets mounted with CTRB		
1.	Not more than one wheel set to be slinged, while lifting.	
2.	Ensure that flange does not hit outer cup when lowering in wagon.	
3.	Slinging of wheel set should not be done over bearing cup or grease seal.	
4.	Specified lifting tackle for wheel set to be used. There have been instances of bearing failures in which a wire was found stuck in the grease seal. This wire can come from the slings which must have been used for lifting of the wheel set or pulling of the wagons	
5.	Storage of overhauled wheel sets to be done properly.	
6.	Ensure that the gauges have been calibrated/checked once a month	
Welding of Wagons fitted with CTRB		
1.	Whenever wagons or bogies fitted with CTRBs require welding in ROH Depots/Sicklines, special attention should be paid so that electric current does not pass through the bearings. The earthing should be done very close to welding area and the earthing wire should be tightly secured at both ends. Alternatively the earthing can be done with a earthing wire/strip running parallel to the track instead of earthing with the rails. If wagon is not properly earthed the current passing through the bearings will cause arcing in between the rollers and the raceways leading to failure.	

WHEEL SETS ASSEMBLY

Ref: Chapter 6 of CAMTECH Manual for Wagon

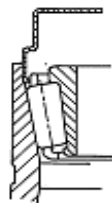
S. No.	REQUIREMENTS	CLAUSE	OBSERVATIONS
1.	Check that wheel gauge (1600+2/-1) is being measured at 3 location 120° apart.	606 H	
2.	Check that wheel dia is being measured with the help of trammel gauge with least count of 0.5mm or wheel dia measuring gauge of least count of 0.1mm. Check that wheel flanges are being checked with the help of wheel profile gauge and thickness and height of flanges is being measured. The difference in tread dia of the two wheels on the same axle permitted at the time of turning is 0.5mm max and this is being measured. Check that wheels turned out from wheel shop are according to shop issue sizes.	606 C& H	
	New Wheel Tread Profile as per RDSO Drg. No. WD- 88021 or Intermediate Profile as per RDSO Drawing WD- 89060-S/2		
3.	<p>Check that each axles are being thoroughly cleaned for inspection & inspected for pitting, ovality, taper, ridges & ultrasonically as per RDSO procedure.</p> <ul style="list-style-type: none"> ▪ Taper must not exceed – 0.015/0.01mm ▪ Out of roundness must not exceed- 0.015/0.02mm 	Para 606 A	
4.	<p>Check that wheels are being categorised into following categories after pre-inspection.</p> <p>(i) Normal repair wheels.</p> <p>(ii) Wheels requiring replacement of Axle.</p> <p>(iii) Wheels requiring replacement of Wheel disc</p>	Para 606	
5.	The wheel should be inspected for rejectable defects in accordance with CMI/K003.	CMI/ K003	
6.	Check that wheels are being turned to WWP & machining standard is N11 to IS:3073.	Para 606 E	
7	Check that new axles are being machined as per the correct drawing dimensions.	Para 606 A and B	

S. No.	REQUIREMENTS	CLAUSE	OBSERVATIONS
8	Check that dimensions of finished journals is being measured with micrometer at 3 points along length of the journal both on horizontal & vertical axis.	Para 606 A	
9	Check that axles are being given ultrasonic flaw detection test.		
10	Check that the bore & the wheel seats are having specified surface finish & correct interference fit and pressing in pressure interference allowed – 0.001 mm/ mm dia of the wheel seat Surface finish – 1.6 microns Pressing in pressure – 400 to 600 kg./mm dia of wheel seat.	Para 606 F	
11	Check that cleaned wheel seat and bore on wheel is being lubricated with a mixture of basic carbonate white lead and boiled linseed oil in the proportion of 1.2 kg of white lead to 1 lt. of boiled linseed oil.	Para 606 F	
12	Check that wheel press is equipped with a dial pressure gauge and pressure recording gauge with graph to record mounting pressure diagram and also is being recorded for each assembly.	Para 606 F	
13	Check that mounting particulars are being punched on journal face.	Para 606 F	
14	Pairing of wheels: Wheels are to be paired in wagons in accordance with clause 2..8.14.2 of IRCA Part III	Para 606 I	



SECTION-AA

- INSTRUCTIONS REGARDING LIFTING OF WHEELSET:-**
1. INDIVIDUAL WHEELSET SHOULD BE LIFTED WITH LIFTING TACKLE AS SHOWN. LIFTING TACKLE SHOULD BE GENERALLY TO R.D.S.O. SK-WD-IIA-8513/S-1.
 2. WHEELSET SHOULD NOT BE LIFTED BY SLINGING FROM JOURNAL/ BEARING PORTION.
 3. DETAIL AT 'X' SHOWS THE AREAS OF CARTRIDGE BEARINGS PRONE TO DAMAGES DUE TO HITTING OF FLANGE OF OTHER WHEELSET CARE MUST BE TAKEN DURING HANDLING/LOADING/UNLOADING OF WHEELSETS THAT THESE AREAS ARE NOT EFFECTED OR DAMAGED.
 4. MOUNTED WHEELSETS SHOULD BE LOADED IN WAGON FOR TRANSPORTING FROM W/SHOP TO DIVISION OR VICE VERSA AS PER R.D.S.O. SK-85016/S-2
 5. WHEELSETS LOADED IN WAGON SHOULD BE RIGIDLY WEDGED SO THAT THESE CAN TAKE SHUNTING/BRAKING FORCES DURING RUN AND WHEELSETS MAY NOT OVERRIDE ONE OVER THE OTHER.



DETAIL AT-X

SUPERSEDED BY	2031/22.91. CARTRIDGE BEARING
SCALE	PASSED
DATE	
DRAWN	→ 24 → 1/8c
TRACED	→ 24 → 1/8c
LOOSE	R.K.G.M. 1/8c
GROUP	
R.D.S.O.	
B.G.	[W]
WD-IIA-8513/S-2	

(3)	WT. 3/8	ANCHOR MODIFIED	7/83
ALT.	ITEM	DESCRIPTION	DATE



(Govt. of India)
(Ministry of Railways)

Technical Specifications of M&Ps For Spherical Roller Bearing for ICF Coaches, CTRB for Freight Stock & CTBU for LHB Coaches



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

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**Indian Railways
Centre for Advanced Maintenance Technology**

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TECHNICAL SPECIFICATIONS OF M&Ps For Bearing maintenance of ICF Coaches in Workshop

The technical specifications of M&Ps given in this Appendix “A” for bearing maintenance are only indicative and for guidance. The M&Ps may be procured as per requirement considering latest upgradation available in the market and suitability of the item for bearing maintenance.

1.0 AUTOMATED HYDRAULIC BEARING EXTRACTOR

Automated Hydraulic Bearing Extractor is required for the application of quick and safe dismounting of Direct Mounted Spherical Roller Bearings from ICF (BG) Coach/BVZI Wagon wheel set having 130 mm journal dia. (bearing No. 22326/C3) & Modified Tower Wagon Mark-II Wheel Set having 70 mm Journal diameter (bearing No. 22314/C3).

Design Features & Main Characteristics:

- The equipment should consist of a mobile workstation with compact hydraulic power pack having built-in controls and safety devices.
- The equipment should be provided with two fix wheels in front and two swivel castors at the rear of the basic oil tank frame for easy mobility. The equipment should be suitably designed to accommodate the standard accessories and tools for convenient operations.
- The equipment should consist of motorized hydraulic power pack with oil injection system consisting of two oil compartments. One compartment is housing the hydraulic components of primary pressure source of 150 bars max. and the other compartment should consists of an intensifier for oil injection to produce the pressure of 750-bar max.
- For quick, easy and effortless atomized dismounting the dismounting tools and accessories should be specially designed to facilitate oil injection at high pressure.
- For fast axial displacement of the bearing without use of manual force, the equipment should be provided with a fast acting self-retracting hydraulic withdrawal cylinder with fixture.
- In case of power failure or for field operations, when the automated hydraulic extractor’s power pack cannot be used, the unit should be provided with two sets of manually operated oil injectors with foot stands and other accessories and one cranking jack assembly to be used for manual bearing withdrawal procedure. These oil injectors should also be provided with matching mail connectors with QCC, so that same hydraulic hoses can be used which are provided along with the power pack.
- Electric supply: 3 phase, 440 V, 50 Hz.
- Electric motor: 3 or 4 HP motor of reputed make with ISI mark.
- Extension Adapter for Axle: An adapter of suitable design should be provided to fit with axle and so that it should give rigid support to the bearing and the withdrawal tool

Appendix A

during oil injection into the mating parts and then to the bearing after dismounting so that it may not drop down on the floor and cause damage.

- Extension adopter should be of suitable alloy steel, heat treated and ground finished. It should have a spring-loaded center for rigid fitment and self-alignment with the axis of the axle. Three nos. holes for counter sunk head screws should also be provided on the adapter to suit the tapped holes of the axle for clamping purpose. Minimum 6 nos. of counter sunk head screw or sufficient length must be supplied along with each extractor.
- Hydraulic Nut with Self-retracting Annular Piston:
- Hydraulic nut with self-retracting annular piston should ensure uniform force required for dismounting the bearing by injecting sufficient oil to spread out between the inner ring and the journal along with the whole width of the bearing.
- Bearing Holding Drum: It should be made out of suitable alloy steel casting duly heat-treated. The drum should essentially be in two-halves with integrated hinges and locking arrangements to cover the complete bearing over the outer ring and the hydraulic nut etc.
- Hydraulic Withdrawal Fixture: It should essentially be single acting, self-retracting Hydraulic Cylinder with withdrawal fixture for fast, safe and effortless axial displacement of bearing. It should be hydraulically actuated for automatic removal of bearing. Manual withdrawal fixture should also be provided for field operations and for use in case of power failure.
- Oil injection Pumps:
- The Oil injection pumps should be power operated consisting of electric motor driven hydraulic power pack capable to generate oil pressure 750 bar max. It should be integral part of the equipment mounted on the oil tank having two compartments. The hydraulic circuit should facilitate oil injection through special Hydraulic Nut to push the annular piston to generate pressure to look the system and also to force oil under sufficient pressure into the bearing seating area to separate the bearing. The hydraulic pump should also actuate the hydraulic withdrawal fixture for dismounting of bearing, which is already separated by oil pressure from its seating.
- Two nos. manually operated oil injection pumps along with its accessories should be provided as separate sets for bearing dismounting for field operations or in case of power failure.
- The hydraulic circuit should be provided with two nos. Pressure gauges to indicate the pressure in the hydraulic circuit.
- The equipment should be provided with steel wire braided or thermoplastic hydraulic hoses with QCC for connecting the oil injection accessories. The hydraulic lines should be of high quality, solid drawn, cold bent, seamless steel having their surface treated for rust prevention and capable of with standing the working pressures.
- The hydraulic unit should be capable of performing efficiently in the ambient temperature range, which may vary from 0° to 50° C & relative humidity 98% max.
- The hydraulic fluid used should be non-corrosive, stable and safe to the operator. It should be available indigenously. Particulars of the hydraulic fluid used should be

Appendix A

intimated in the offer. The successful bidder shall be required to indicate reputed Indian sources of supply for the hydraulic fluid.

- Universal Pump Cart: A rugged tubular framed handcart with rubberized wheels should form a part of supply of the equipment. Cart should be capable of stacking all the accessories including the hydraulic pack in proper order on it and transfer to place of work for operation. The cart should be easily moveable.

STANDARD ACCESSORIES REQUIRED:

The supply should include following Standard Accessories along with the equipment:

S.No.	Item description	Quantity required
1.	Hydraulic Power Pack complete with Control Valves, Regulating Valves, Safety Valves and High Pressure Hoses and Pressure Gauges.	1 set
2.	Withdrawal Fixture with Single acting, Self Retracting-Hydraulic Cylinder. (<i>One no. for 130mm dia. journal</i>)	1 no
3.	Service Tools consisting of Spanners, Allen keys and one Nylon Hammer. Spanner set consists of 9 pcs. and Allen Key set consists of 7 pcs.)	1 Set
4.	Extension Adaptor for axle with socket head screws M16X 1.5X 155mm with each adaptor (for 130mm journal dia)	3 nos.
5.	Hydraulic Nut with self-retracting annular piston. (<i>One for 130 mm dia journal & one for 70 mm dia journal</i>)	02 nos.
6.	Bearing Holding Drum in two halves. (<i>One for 130 mm dia journal</i>)	02 nos.
7.	'O' rings for various locations.- A set of assorted 'O' Rings, 20 nos. of each size	100 nos.
8.	Manually operated Oil injection Pumps with Foot-stand, two Pressure Gauges, two Flexible High Pressure Hoses and one Cranking Jack Assembly. This set of equipment is provided to dismount the Bearing in case of power failure. Please note that this is an essential part of the Equipment.)	2 sets.

2.0 BEARING CLEANING PLANT

As per COMFOW Specification No. COFMOW/IR/M/BCP/2012.

3.0 AXLE BOX CLEANING PLANT

As per COMFOW Specification No. COFMOW/IR/M/AB-CP/2012.

4.0 MOTORISED CONVEYOR SYSTEM

The roller conveyor system is required for handling and movement of Roller Bearing from inspection table and repair table to the next assembly room window in the process of cleaning & assembly of Roller Bearing. The conveyor system shall be suitable for production work round the clock six days a week.

General feature of rollers-

- Resistance to contamination by oil, grease, dirt, chemicals etc.
- Resistance to hot or cold temperature.
- Strong positive drive to force heavier loads into a definite orientation or location.
- Chain driven rollers.
- Heavy duty good quality steel.

All the roller conveyor and equipment designs shall take care and shall also be capable of handling of Roller Bearings.

Conveyor Speed

Conveyor Speed shall be 0.5-3 Meter/Minute and with continuously adjustable.

Conveyor length & height	–Length	- 12 Meter Approx.
	- Height	– 750mm Approx.

Utilities available

Compressed Air: 5 kg/cm²

Electrical power: 415 Volts 3 Phase 50 Hz AC .

The brought out items shall be of the following preferred makes:

- a) Geared Motor: Crompton-Greaves, Siemens, Kirloskar, GE or equivalent.
- b) Adjustable speed drive with motor: -----do-----
- c) Bearings Linear motion : Dodge, Fafnir, Garlock, Lit, Nice, Timken, Rex, SKF, FAG, NEI or equivalent.
- d) Bushings : Bunting, Carrlane, Olite or equivalent.
- e) Sprockets & Chains : Diamond/Rolon or equivalent.
- f) Camroll : Macgrill, INA or equivalent.
- g) Solenoid operated DC valves : Numatics, USA or equivalent.

The above mentioned brought out items shall be of specified make.

- All bearings of heavy duty and pre-packed with grease shall be used and shall be of SKF/FAG or equivalent
- Drawings with details for all equipments shall be furnished
- Gear drives shall have the motor protected by a steel cover plate.
- All equipment must meet factory safety and health requirement.
- The offer shall be complete with piping, wiring etc.
- All the conveyors & equipments shall be epoxy painted in Apple Green.

Power supply

A power supply of 415 V, 3 phase neutral 50 Hz AC shall be extended from nearest power panel to working site through protected cable.

5.0 CONTAINER TROLLEY

Container Trolley manually operated should have the following capabilities:

- (i) The equipment should be capable of heavy-duty usage of handling Roller Bearing and its components , handling of Scrap items with in the shop.
- (ii) It should be compact and simple in Design, sturdy in Construction, and with greatest reliability in service requiring minimum easy maintenance.

Technical specifications of container trolley:

Description	: Container Trolley manually operated, 4 wheeler, Capacity- 0.5 T
Model	: Mahindra Stiller Trolley, Model No. –11 or Similar model of reputed make.
Capacity	: 0.5 T
Platform Size	: 2500 X 1500 x 0.6 mm Mtrs from ground level.
Cage Height.	: 500 mm Angle iron & Weld mesh construction
Wheels	: Solid rubber wheels 4 nos, Size – 400 x 100 mm with ball bearings.
Towing Bracket	: The Trolley should be fitted with towing bracket/hook at suitable height on rear and front side for towing by towing truck.

- Leaf spring suspension on Front and rear axles shall be provided.
- The platform of the trolley shall be made of M.S Chequered sheet.
- Rear end of the Trolley downward openable.
- Ergonomically designed Suitable handle shall be provided for pulling and pushing manually.
- All joints to be welded should be suitably prepared and fixed before welding. Welds should be built-up by multiple beads or passes. Complete fusion and penetration of metal should be obtained. Burs-splatters and under-fusion will not be acceptable. There should not be any rough gas-cut face.
- Trolley components shall be designed with a suitable safety factor of minimum 1.67 with respect to yield stress.
- Trolley should be designed for Uniformly Distributed Load under static, dynamic loaded conditions for the specified load.

- Sufficient number of bearers/runners should be provided on Trolley so as to provide sufficient strength to trolley.
- The trolley shall be subjected to pretreatment process such as Degreasing, Phosphating and Rinsing. All surfaces to be painted with one coat of red oxide and two coats of synthetic enamel paint.
- Strict quality control and dimensional accuracy shall be maintained throughout. The construction shall be true to square with top and bottom faces flat and side at right angles with each other.

6.0 INDUCTION HEATER

Induction heating is quick, safe, energy saving and environment friendly process. In this system, bearing performs as a secondary winding whereas core winding is at primary side. Bearing is placed around a yoke. 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

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 takes 5 to 7 minutes to attain 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.

Technical specifications of Induction Heater:

Power Controls : 25%, 50%, 75% & 100% power
: 25%, 50%, 75% power for small size components

Temperature and time mode

Temperature Control : 0-250°C setting as per requirement.
Counting up step of 1°C

Accuracy : ±3°C

Time Control	: 0-99 minutes setting as per requirement Counting down in step of 0.1 minute.
Accuracy	: $\pm 0.01\%$
Temperature and Time	: Can be monitored at a time

Main equipment with reinforced fiberglass body

- **Automatic current ramping** – no surge in supply line.
- **Automatic Demagnetization** – after every heating cycle.
- **Feather touch** keyboard with **high bright display** mounted on main panel

Safety Devices

- MCB for overload protection.
- Thermal cutoff for over heating.
- Safety – No Probe monitoring with alarm for 4 -6 minutes.
- Safety – No Yoke monitoring with alarm for 4 – 6 minutes.
- In case of over range setting of time temperature error guide with beep.
- In case of improper use of equipment error guide alarm

Technical Data

- Supply Voltage : 440 V, 50 Hz, 10%
- Current Maximum : 28/30 Amps.
- Temperature Maximum : 400°C
- Residual magnetism : <1 A/Cm after demagnetization.

7.0 HYDRAULIC MOBILE LIFT TABLE

Hydraulic mobile lift table Scissor type shall be suitable for lifting Roller Bearing and its components to convenient height for easy handling.

Technical Details of Double Scissor type Hydraulic Lifting System:

- a) **Lifting Table Size** : 1200 x 1000 mm
- b) **Lifting Table Raised Height** : 2000 mm
- c) **Lifting table close height** : 500 mm
- d) **Capacity** : 500 kg
- e) **Nos. of lifting cylinder** : One or two
- f) **Ram stroke of lifting cylinder** : should be able to meet the max. lift table raised height)
- f) **Wheels** : 4 Nos. solid rubber.
- g) **Wheel clocking system** should be provided at backside.

8.0 DIAL BORE GAUGE

Dial Bore Gauges are required for measuring different dimension of direct mounted Roller Bearing components during overhauling forces.

Technical Specification of Dial Bore Gauge:

Description	Range	Least count in mm
a) Dial Bore gauge Mitutoyo make no. 511-703+2109S-10/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included.	50-150 mm	0.001
b) Dial Bore gauge Mitutoyo make no. 511-705+2109S-10/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included.	160-250 mm	0.001

9.0 DIGITAL DIAL SNAP GAUGE

Digital Dial Snap Gauges are required for measuring different dimension of direct mounted Roller Bearing components during overhauling forces.

Technical specification of digital dial snap gauge

Description	Range	Least count in mm
Digital Dial Snap gauge Mitutoyo make no. 201-106+543-690/ Tesa/ Forbs or equivalent with NAPL/NBL Calibration certificate shall be included:	125-150 mm	0.001

10.0 DIAL INDICATOR

Dial Indicator are required for measuring different dimension of direct mounted Roller Bearing components during overhauling process.

Technical specification of dial indicator

Description	Range	Least count in mm
Dial Indicator Mitutoyo make no. 543-690/691/694 / Tesa/ Forbs or equivalent with NAPL/NBL Calibration certificate shall be included:	00-10 mm	0.001

11.0 MAGNETIC DIAL INDICATOR

Magnetic dial indicator are required for measuring different dimension of direct mounted Roller Bearing components during overhauling process.

Technical specification of magnetic dial indicator:

Description	Range	Least count in mm
Magnetic Dial indicator with stand Mitutoyo make no. 7010S-10+2119S-10/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included:	00-10mm	0.001

12.0 FILLER GAUGE

Filler Gauges are required for measuring different dimensions of direct mounted Roller Bearing components during overhauling Process.

Technical specification of filler gauge:

Description	Range	Least count in mm
Filler Gauge Mitutoyo make no. 184-305S/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included:	0.05-01mm	0.05

13.0 MAGNIFYING GLASS WITH LIGHT/OPTICAL MAGNIFIER LAMP

Magnifying Glass is required for measuring the roller of direct mounted Roller Bearing components during overhauling Process.

Magnifying Glass solutions offered have a higher resolution that allows objects to be magnified properly. With the product in compliance with international quality standards, these are handy models and are made available with unbreakable fiber handle as well as with LED light option.



Technical specification Magnifying Glass (Handy Model)

High quality, low price, products have got through CE and RoHs authentication.

Magnification times: 20X

Glasses materials: Three kinds of materials are optional for you: common glasses (green glasses), optical glasses (white glasses), optical son-mother lenses (double multiplication: bigger ones are 5* while the smaller ones are 10*)

Light source: 22W circlip fluorescent lamp

Lenses diameter: 127mm

Power source: AC 220V/110V (220V is acquiesced, if you want to chose another one, please give an order)

Power plug: Chinese-standard plug base with three spigot.(you can give an order to make other kinds of plug as you wish)

Advantages

- * Can be easily fixed on the working table.
- * Angle can be adjusted as you wish.
- * Specially and broaden range of observation make it possible to observe things for a long time.
- * Can choose any kind of magnifying times according to your detail requirement.
- * Magnifying and lighting work well together.

- * Lightening shine is stable and credible and no glimpse.
- * Can make your eyes feel ease and have little impact on your eyesight.
- * Can allocate with high-quality white glasses, so that relief the visual fatigue resulted from long time observation.

14.0 NYLON FACED HAMMER

Nylon Faced Hammer are required for measuring the roller of direct mounted Roller Bearing components during overhauling Process.

Nylon faced striking hammers have no metal in the hammer faces that can mark the work piece. Each hammer has two replaceable screw-in nylon hammer faces that can be easily replaced when they become worn, without the use of any other tools - minimizing down time. The striking faces are reinforced for extra strength and to prevent fracturing from off centre strikes. The nylon hammerheads have a precision moulded screw thread that screws securely into the chrome plate zinc hammerhead, which in turn is fixed to a fully moulded polypropylene shaft with a shock absorbing soft dual material grip, for improved grip and control.



Technical specification Nylon Faced Hammer

SPECS: 1" (2.5cm) diameter faces. 11½" (29.2cm) hickory handle. Weighs approximately 6 oz. (170.1g).

15.0 BOX SPANNER SET

Box Spanner Set are required for mounting & dismounting of direct mounted Roller Bearing components during overhauling Process.

Technical specification Nylon Faced Hammer

High Grade Chrome Vanadium Steel. As per IS 6131-1980 & 7381-1986, Bi-hexagonal & Hexagonal



One Set

Product Item	Sockets (mm)
22 Sockets	10,11,12,13,14,15,16,17,18,19,21,22,23,24,26,27,28,29,30,32,33,34
5 Accessories	Extension bar 125mm,255mm, Universal joint T Handle , Ratchet Handle

16.0 TORQUE WRENCHES

Torque Wrenches are required for mounting & dismounting of direct mounted Roller Bearing components during overhauling Process.

Technical specification Torque Wrenches

The Torque wrench is a calibrated tool recommended for use in controlled tightening of nuts and bolts to avoid over/under stressing. To set simply turn an adjusting lever and set the reading on the scale. To operate, just pull the handle and when set torque is reached, the wrench will signal with an audible “click”. Release the wrench; it is set for the next operation.



Torque capacity	Square drive mm
1-7 kg.m 7-50 Lb.Ft.	12.5
7-35 kg.m 50-250 Lb.Ft.	12.5
14-56 kg.m 100-400 Lb.Ft.	12.5

TECHNICAL SPECIFICATIONS OF M&Ps For Maintenance of CTRB for Wagon Stock in Workshop

The technical specifications of M&Ps given in this Appendix “A” for bearing maintenance are only indicative and for guidance. The M&Ps may be procured as per requirement considering latest upgradation available in the market and suitability of the item for bearing maintenance.

1.0 TROLLEY MOUNTED BEARING EXTRACTOR

Trolley mounted Bearing Extractor (CTRB puller cum installer) is required for the application of quick and safe dismounting & mounting of CTRB Wagon wheel set having 130 mm journal dia.

Standard accessories:

Guide tube	01 No.
Guide tube adapter	01 No.
Pressure pad	01 No.
Auxiliary shoe (Pulling shoe insert)	01 No.
Tie bolt with distance bush	01 No.
Support frame	01 No.
Installing tube	01 No.
Installing tube adapter ring	01No.
Locking pin	01 No.
High tensile socket head screws (as per thread size of the axle face)	03Nos
Maintenance/operational tools	01set.
Suitable starter(DOL)	01 No.
Single phasing preventer for motor (Current sensing type)	01No.
Flexible copper cable 4 core 6 sq.mm	15 mtr.

Technical specifications of Trolley mounted Bearing Extractor (CTRB puller cum installer):

Type of cylinder	- Hydraulic double acting cylinder.
Capacity of bearing	Pulling – 100 Tons (Minimum)
	Installing - 70 Tons (Minimum)

Horizontal stroke - 350 -400 mm (Minimum)

Speed of RAM

Advancement of ram	280-500 mm/Minute
Pulling of bearing	50-100 mm/Minute
Installation of the bearing	100-150 mm/Minute
Working height of the hydraulic	From 300 to 800 mm above ground level.
RAM assembly for alignment with the journal	

Power pack unit:

HP of the motor	3 HP, 3 phase, 400V, 50 Hz
Pump type	Radial plunger
Type of cylinder	Hydraulic double acting cylinder
Working pressure	450-550 KG/CM ² (Max. 700 Kg/CM ²)
Starter	with push button D.O.L. starter
Delivery of the pump	1500 cm ² of oil at full pressure.(i.e 700 bars) (±5%) and 6500 cm ² of oil at low pressure. (i.e. 700 bars) (±5%)
Distance between the wheels	810±10 mm
Hydraulic pump	two stage pump, electrically operated, without remote control. Three way valve for actuation of Hydraulic cylinder.

2.0 MOTORISED CONVEYOR SYSTEM

The roller conveyor system is required for handling and movement of Cartridge Taper Roller Bearing (Size 6" x 11") Double Cup from inspection table and repair table to the next assembly room window in the process of cleaning & assembly of Cartridge Taper Roller Bearing(CTRB). The conveyor system shall be suitable for production work round the clock six days a week.

General feature of rollers-

- Resistance to contamination by oil, grease, dirt, chemicals etc.
- Resistance to hot or cold temperature.
- Strong positive drive to force heavier loads into a definite orientation or location.
- Chain driven rollers.
- Heavy duty good quality steel.

All the roller conveyor and equipment designs shall take care and shall also be capable of handling of CTRB Double Cups.

Conveyor Speed

Conveyor Speed shall be 0.5-3 Meter/Minute and with continuously adjustable.

Conveyor length & height	–Length	- 12 Meter Approx.
	- Height	– 750mm Approx.

Products to be handled

Product is CRTB Double Cup, Make 1)NBC BRENCO 2)TATA TIMKEN 3)KOYO 4)FAG 5) SKF

Double Cup Maximum Outer Dia. 220.66 mm and width is 163.05 mm. The maximum weight of a Double Cup is 10 kg. approx.

Utilities available

Compressed Air: 5 kg/cm²

Electrical power: 415 Volts 3 Phase 50 Hz AC .

The brought out items shall be of the following preferred makes:

- a) Geared Motor: Crompton-Greaves, Siemens, Kirloskar, GE or equivalent.
- b) Adjustable speed drive with motor: -----do-----
- c) Bearings Linear motion : Dodge, Fafnir, Garlock, Lit, Nice, Timken, Rex, SKF, FAG, NEI or equivalent.
- d) Bushings : Bunting, Carrlane, Olite or equivalent.
- e) Sprockets & Chains : Diamond/Rolon or equivalent.
- f) Camroll : Macgrill, INA or equivalent.
- g) Solenoid operated DC valves : Numatics, USA or equivalent.

The above mentioned brought out items shall be of specified make.

- All bearings of heavy duty and pre-packed with grease shall be used and shall be of SKF/FAG or equivalent
- Drawings with details for all equipments shall be furnished
- Gear drives shall have the motor protected by a steel cover plate.
- All equipment must meet factory safety and health requirement.
- The offer shall be complete with piping, wiring etc.
- All the conveyors & equipments shall be epoxy painted in Apple Green.

Power supply

A power supply of 415 V, 3 phase neutral 50 Hz AC shall be extended from nearest power panel to working site through protected cable.

3.0 HYDRAULIC PRESS (25 T)

Hydraulic Press will be capable of: Grease Seal Pressing-in and pressing-out during assembly & disassembly operations on Cartridge Taper Roller Bearing (Size 6 x 11, Class E).

Technical specifications of hydraulic press 25 t:

1.	Type of Press	Double pillar down stroke type Hydraulic Press
2.	Capacity of Press	25 Tons
3.	Working Table size (H x B x L)	750 x 750 x 1000 mm (+/-10 mm)
4	Pillar	Side pillar for holding of cylinder of 70 mm OD and 925 mm height (+/-10 mm)
5	Stroke	100 mm Max.
6	Daylight	550 mm (minimum)
7	Working height	750 mm (Approx.)
8	Flatness of surface	0.03/300 mm
9	Power Pack	(a)Standard make motor like Crompton Greaves ,NGEF etc of 3 HP ,3 phase. (b)Hydraulic positive displacement pump capable to give about 200 Kg/cm sq.
10	Hydraulic Cylinder	Own make hydraulic cylinder to give required 25 Tones
11	Control Panel	Consist of voltmeter ,Ammeter Power indicator off-on relay ,pressure indicator etc.
12	Power supply	415 V +/-10%, 50Hz +/-3%
13	Hydraulic oil tank capacity	40 liters (minimum)

Make of bought-out items:

1	Make of hydraulic circuits and systems	Rexroth/Vickers
2	Make of electric motor	ABB/ Siemens /NGEF/BBL/ KEC/ Crompton
3	Make of Hydraulic oil brands	Indian oil Corporation Servo System- 68, Hindustan Petroleum Enklo – 68,Bharat Petroleum Hydrol - 68
4	‘O’ Rings & rubber seals	Merkel/Parker/Busak/Hunger/FRUEDENBERG/ DICTOMATIC/GAPI/ECHONOMUS
5	Filters	Rexroth/Vickers/Hydac, Hydroline/EPE stainer
6	Cable/wire	Siemens/ Finolex /Indramat/Hubershnuer/ Lapp

4.0 CONE WASHING MACHINE

- Cone washing machine is required for final cleaning of cone cage assembly of Cartridge Taper Roller Bearing (Size 6 x 11 Class-E) by quick, safe and smooth operation.
- Machine should be capable of cleaning all the grease from the cone cage assembly including roller pockets.
- Cone assembly should be provided for cleaning after purging operation.
- Machine should be accommodate up to 6 cone assemblies at a time.
- Machine should be use other chemicals instead of kerosene oil.
- Principle of this machine shall be that all cone assemblies will be rotate and high speed, jets of kerosene/chemical and pneumatic pressure will be thrown on cone assemblies to get cone cleaned.
- Cleaning agent shall be recycled or filtered for reuse.
- Cleaning operation shall be visible.
- The equipment should be capable of performing efficiently in the ambient temp. ranging from 0 to 50°C & relative humidity up to 98% (max.).

Technical specifications of cone washing machine:

No. of cone assemblies to be cleaned at time : 6 nos. min.

1. Spray arrangement : Multiple sprays on each cone assembly.
2. Cleaning time per cycle : 3 minutes Max.
3. Chemical to be used : Kerosene oil or petroleum based Cleaning agent which shall be readily available in market
4. Visibility of operation : Covered by Perspex sheet to verify cleaning cones over hauling process.
5. Electrical : 3 phase, 440 volts. 3 hp motor and pump of reputed make.

5.0 CUP SCRUBBING MACHINE

- Double cups which receives for overhauling, outer portion of it are found very dirty and badly rusted required through cleaning for reuse and to visible the numbers, month and year which are in graving on it and for dimension measurements.
- Cup Scribing Machine is required for scribing outer portion and cleaning of inner portion of Double Cup of Cartridge Taper Roller Bearing (Size 6 x 11 Class E) by quick, safe and smooth operation..
- Machine should be capable of scribing and cleaning all the dirty mud, grease, rust etc. from the double cup.

- Pump should be provided with jet for cleaning cup.
- Machine conveyer should be accommodating at least 10 cup at a time.
- Cup support and retract system should be operate pneumatically .
- The equipment should be capable of performing efficiently in the ambient temp. ranging from 0 to 50°C & relative humidity up to 98% (max.).

Technical specifications of cup scrubbing machine:

- i) Washing media – Kerosene.
- ii) The machine should be semi automatic type except manual feeding of cup. The duration of cycle of operation should be approx. 3 minutes or less.
- iii) The Cup OD and the two end bores will be cleaned by the operation.
- iv) 1 HP Geared motor is to be used for rotating the cup on rollers.
- v) The top steel wire bristles brush is to be rotated by the 0.75 HP 900 rpm motor for cleaning the OD of Cup.
- vi) Two tapered nylon bristles side brushes are to be used for cleaning end bores each of which are rotates by 0.5 HP, 1440 rpm flange mounted motor.
- vii) All axial movements of the brushes are to be controlled by the pneumatic cylinder.
- viii) Used Kerosene is to be filtered and recycled till it is grease saturated.
- ix) Operations are controlled by a timer based control panel.

6.0 HYDRAULIC MOBILE LIFT TABLE

Hydraulic mobile lift table Scissor type shall be suitable for lifting CTRB bearing and its components to convenient height for easy handling.

Technical Details of Double Scissor type Hydraulic Lifting System:

- | | | |
|-----------------------------------|---|---|
| h) Lifting Table Size | : | 1200 x 1000 mm |
| i) Lifting Table Raised Height | : | 2000 mm |
| j) Lifting table close height | : | 500 mm |
| k) Capacity | : | 500 kg |
| l) Nos. of lifting cylinder | : | One or two |
| f) Ram stroke of lifting cylinder | : | should be able to meet the max. lift table raised height) |
| m) Wheels | : | 4 Nos. solid rubber. |
| n) Wheel clocking system | : | should be provided at backside. |

7.0 CONTAINER TROLLEY

Container Trolley manually operated should have the following capabilities:

- (i) The equipment should be capable of heavy-duty usage of handling Cartridge Taper Roller Bearing (CTRB) and its components, handling of Scrap items with in the shop
- (ii) It should be compact and simple in Design, sturdy in Construction, and with greatest reliability in service requiring minimum easy maintenance.

Technical specifications of container trolley:

Description	: Container Trolley manually operated, 4 wheeler, Capacity- 0.5 T
Model	: Mahindra Stiller Trolley, Model No. –11 or Similar model of reputed make.
Capacity	: 0.5 T
Platform Size	: 2500 X 1500 x 0.6 mm Mtrs from ground level.
Cage Height.	: 500 mm Angle iron & Weld mesh construction
Wheels	: Solid rubber wheels 4 nos, Size – 400 x 100 mm with ball bearings.
Towing Bracket	: The Trolley should be fitted with towing bracket/hook at suitable height on rear and front side for towing by towing truck.

- Leaf spring suspension on Front and rear axles shall be provided.
- The platform of the trolley shall be made of M.S Chequered sheet.
- Rear end of the Trolley downward openable.
- Ergonomically designed Suitable handle shall be provided for pulling and pushing manually.
- All joints to be welded should be suitably prepared and fixed before welding. Welds should be built-up by multiple beads or passes. Complete fusion and penetration of metal should be obtained. Burs-splatters and under-fusion will not be acceptable. There should not be any rough gas-cut face.
- Trolley components shall be designed with a suitable safety factor of minimum 1.67 with respect to yield stress.
- Trolley should be designed for Uniformly Distributed Load under static, dynamic loaded conditions for the specified load.
- Sufficient number of bearers/runners should be provided on Trolley so as to provide sufficient strength to trolley.
- The trolley shall be subjected to pretreatment process such as Degreasing, Phosphating and Rinsing. All surfaces to be painted with one coat of red oxide and two coats of synthetic enamel paint.

- Strict quality control and dimensional accuracy shall be maintained throughout. The construction shall be true to square with top and bottom faces flat and side at right angles with each other.

8.0 GREASE PURGING MACHINE

- i. Grease purging Machine is required for removing old grease from Cone assembly of CTRB during over hauling.
- ii. Machine should remove grease from Cone Assembly by centrifugal action.
- iii. The Machine should be double ended shaft motor, rotates two fixers carrying two Cone assemblies and will rotate at 2800 RPM. Due to its high RPM grease should splash out from the pocket of Cone assembly.
- iv. Breaking should be provided with A.C. solenoid brake.
- v. By using this machine about 98% grease should be removed.

This is a double ended Grease Purging Machine in which Kerosene soaked loose grease is thrown out from the Cones by centrifugal force. The two cones are rotated at a speed of 2800 rpm with the help of 5 HP or more intermittent duty 1380 rpm, 4" Pulley, 440 Volt Motor. A solenoid Brake is to be provided to stop the rotation of the Cones instantly, when the Motor is switched off after required time. Proper arrangement is to be done to arrest and collect the thrown out grease from the Cones with the help of 2- Hoods and 2-Trolleys.

Technical details of grease purging machine:

1	Motor	5 HP, 1380 RPM , S4 duty 440 V. of reputed Make (Bharat Bijli/Crompton greaves) with 4" pulley for maintaining 2800 RPM.
2	Brake	AC solenoid operated clutch brake.
3	Run time	Less than 3 minutes
4	Noise level	85db.
5	Safety Guard	Transperated sheet safety guard should be provided on both end of the Machine to protect workers during operation.
6.	Grease collection trolley	02 Nos.

9.0 DOUBLE END AUTOMATED GREASING MACHINE WITH WEIGHING MACHINE

The greasing machine should be fully tooled –up for overhauling of CTRB 6 X 11 Class 'E' Bearing used with CASNUB Bogies of Railway wagons.

The machine should be capable automatic, rapid and secure greasing of 02 cones simultaneously after assembly of bearing and is to be pneumatically operated.

The machine should be designed for infusing of the total amount of grease/ cycle (in grams)

Cone 1	Spacer	Cone2	Total
115	225	115	455 +/- 30 grams

The greasing machine should have the facility of automatic cut off provision after infusing the required quantum grease into the bearing .

The grease infused into the bearing should be distributed equally to all rollers of top and Bottom cones.

One digital electronic weighing machine to counter check the quantity of grease infused Should be provided.

The weighing machine should be mounted on suitable same height table.

Technical specification of double end automated greasing machine with weighing machine:

Semi Automatic Greasing machine should be capable of rapid and secure greasing of both the cones at a time in assembled condition.

The equipment will be consisting of the following :

- Grease Pump – 1 No. ELGI make, Model AH-4-200 or equivalent.
- Pneumatic Solenoid Valve – Make Schrader / Janatics or equivalent – 2 Nos.
- Speed Control Valve – Make Schrader / janatics or equivalent – 2 Nos.
- Air preparation unit – FRL ¼ BSP – Make Janatics / Schrader or equivalent – 1 No.
- Directional Control Valve – 4 Way Directional Control Valve – Vickers – Single Solenoid spring offset type model DG 4 S4 – D12 A or equivalent – 2 Nos.
- Metering Cylinder – 2 Nos. – SC Pneumatics / PTS or equivalent 40/50 dia bore x 100 mm stroke with foot mounting bracket.

10.0 MOTIRISED CONE CAGE CHECKING FIXGTURE

Gauge & fixtures is required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling forces.

Technical specification of motorised cone cage checking fixture:

Motorised Cone Cage checking fixture consisting of stand with seats for mounting cones to suit E class 6” x11” size bearings, one bearing at a time, magnifying glass and lamp with holder and drive motor. The drive allows the rollers to rotate in the cage during inspection and can be manually stopped for better scanning. The following accessories Mitutoyo make no. 184-305S/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included:

- Feeler gauge for roller inspection- 01 No.
- Feeler gauge for diameter clearance check of cage - 01 No.
- Feeler gauge for pocket clearance check- 01 No

11.0 CONE OUT OF ROUNDNESS CHECKING FIXTURE WITH DIAL INDICATOR

Fixture is required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling forces.

Technical specification of cone out of roundness checking fixture with dial indicator

Cone out of roundness checking fixture with Dial indicators for cone bore, consisting of fixture, dial gauge on spring loaded slide & master ring gauge. Mitutoyo make no.184-305S/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included.

12.0 CONE BORE DIAMETER & OVELITY MEASURING COMPARATOR

Comparator is required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling forces.

Technical specification cone bore diameter & ovality measuring comparator:

Cone bore diameter & ovality measuring comparators. Mitutoyo make no. 184-305S/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included: 144.4879 max.

13.0 CUP OD ROUNDNESS CHECKING GAUGE

Gauge is required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling forces.

Technical specification of cup OD roundness checking gauge:

Cup OD roundness checking gauge with stand two dial indicators fitted to measure two positions simultaneously. Mitutoyo make no. 184-305S/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included.

14.0 50-150 mm MICROMETER FOR SETTING CONE BORE COMPARATOR GAUGE

Cone bore comparator gauge is required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling process.

Technical specification of 50-150 mm micrometer for setting cone bore comparator gauge:

50-150 mm Micrometer for setting cone bore comparator gauge. Mitutoyo make no. 511-703+2109S-10/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included.

15.0 DOUBLE CUP COUNTER BORE GAUGE

Double cup counter bore gauge is required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling process.

Technical specification of double cup counter bore gauge:

Double Cup counter bore gauge size 160-250. Mitutoyo make no. 184-305S/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included.

Double Cup counter bore- Brenco	220.3450 mm Min.
Koyo	220.6625 mm Min.
SKF, Timken, Fag	220.4085 mm Min

16.0 SEAL LIP WEAR GROOVE CHECKING FIXTURE WITH DIAL INDICATOR

Seal Lip wear groove checking fixture with dial indicator is required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling forces.

Technical specification of seal lip wear groove checking fixture with dial indicator:

Seal Lip wear groove checking fixture with dial indicator mounted on slide, and master ring gauge for zero setting. Mitutoyo make no. 184-305S/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included.

Seal Lip wear groove - 0.13 mm Deep Max.

17.0 COMPARATOR EQUIPMENT FOR SPACER WIDTH MEASUREMENT

Comparator equipment for spacer width measurement is required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling forces.

Technical specification of comparator equipment for spacer width measurement:

Comparator equipment for spacer width measurement with base plate, dial indicator and master setting gauge. Mitutoyo make no. 184-305S/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included.

Paralleled of End Faces of Spacer - 0.025mm Max.

18.0 BACKING RING RADIUS & DIAMETER CHECKING GAUGE

Backing ring radius & diameter checking gauge is required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling forces.

Technical specification of backing ring radius & diameter checking gauge:

Backing ring radius & diameter checking gauge.

Backing ring Break out dia- 178.562mm Max.

19.0 LATERAL PLAY FIXTURE

Lateral play Fixture is required for checking bench lateral play of Cartridge taper roller bearing (size 6x11 class E) during assembly process.

Technical specification of lateral play fixture:

Cup assembly shall be mounted on a sleeve and a dial gauge will be fixed over the sleeve. The sleeve is mounted on a bracket, which can be tilted by 180°. Lateral play will be read using the dial gauge with cup assembly in tilted position. (Dial indicator Mitutoyo make no. 543-690/691/694 or similar with NAPL/NBL Calibration certificate shall be included.

Bench Lateral play to be measured – 0.51-0.66mm

20.0 DIAL BORE GAUGE

Dial Bore Gauges are required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling forces.

Technical Specification of Dial Bore Gauge:

Description	Range	Least count in mm
a) Dial Bore gauge Mitutoyo make no. 511-703+2109S-10/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included.	50-150 mm	0.001
b) Dial Bore gauge Mitutoyo make no. 511-705+2109S-10/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included.	160-250 mm	0.001

21.0 DIGITAL DIAL SNAP GAUGE

Digital Dial Snap Gauges are required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling process.

Technical specification of digital dial snap gauge

Description	Range	Least count in mm
Digital Dial Snap gauge Mitutoyo make no. 201-106+543-690/ Tesa/ Forbs or equivalent with NAPL/NBL Calibration certificate shall be included:	125-150 mm	0.001

22.0 DIAL INDICATOR

Dial Indicator are required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling process.

Technical specification of dial indicator

Description	Range	Least count in mm
Dial Indicator Mitutoyo make no. 543-690/691/694 / Tesa/ Forbs or equivalent with NAPL/NBL Calibration certificate shall be included:	00-10 mm	0.001

23.0 MAGNETIC DIAL INDICATOR

Magnetic dial indicator are required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling process.

Technical specification of magnetic dial indicator:

Description	Range	Least count in mm
Magnetic Dial indicator with stand Mitutoyo make no. 7010S-10+2119S-10/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included:	00-10 mm	0.001

24.0 FILLER GAUGE

Filler Gauges are required for measuring different dimension of Cartridge taper roller bearing (size 6x11 class E) components during overhauling process.

Technical specification of filler gauge:

Description	Range	Least count in mm
Filler Gauge Mitutoyo make no. 184-305S/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included:	0.05-01mm	0.05

25.0 MAGNIFYING GLASS WITH LIGHT/OPTICAL MAGNIFIER LAMP

Magnifying Glass are required for measuring the roller of direct mounted Roller Bearing components during overhauling Process.

Magnifying Glass solutions offered have a higher resolution that allows objects to be magnified properly. With the product in compliance with international quality standards, these are handy models and are made available with unbreakable fiber handle as well as with LED light option.



Technical specification Magnifying Glass (Handy Model)

High quality, low price, products have got through CE and RoHs authentication.

Magnification times: 20X

Glasses materials: Three kinds of materials are optional for you: common glasses (green glasses), optical glasses (white glasses), optical son-mother lenses (double multiplication: bigger ones are 5* while the smaller ones are 10*)

Light source: 22W circlip fluorescent lamp

Lenses diameter: 127mm

Power source: AC 220V/110V (220V is acquiesced, if you want to chose another one, please give an order)

Power plug: Chinese-standard plug base with three spigot.(you can give an order to make other kinds of plug as you wish)

Advantages

- * Can be easily fixed on the working table.
- * Angle can be adjusted as you wish.
- * Specially and broaden range of observation make it possible to observe things for a long time.
- * Can choose any kind of magnifying times according to your detail requirement.
- * Magnifying and lighting work well together.

- * Lightening shine is stable and credible and no glimpse.
- * Can make your eyes feel ease and have little impact on your eyesight.
- * Can allocate with high-quality white glasses, so that relief the visual fatigue resulted from long time observation.

26.0 NYLON FACED HAMMER

Nylon Faced Hammer are required for measuring the roller of direct mounted Roller Bearing components during overhauling Process.

Nylon faced striking hammers have no metal in the hammer faces that can mark the work piece. Each hammer has two replaceable screw-in nylon hammer faces that can be easily replaced when they become worn, without the use of any other tools - minimizing down time. The striking faces are reinforced for extra strength and to prevent fracturing from off centre strikes. The nylon hammerheads have a precision moulded screw thread that screws securely into the chrome plate zinc hammerhead, which in turn is fixed to a fully moulded polypropylene shaft with a shock absorbing soft dual material grip, for improved grip and control.



Technical specification Nylon Faced Hammer

SPECS: 1" (2.5cm) diameter faces. 11½" (29.2cm) hickory handle. Weighs approximately 6 oz. (170.1g).

27.0 BOX SPANNER SET

Box Spanner Set are required for mounting & dismounting of direct mounted Roller Bearing components during overhauling Process.

Technical specification Nylon Faced Hammer

High Grade Chrome Vanadium Steel. As per IS 6131-1980 & 7381-1986, Bi-hexagonal & Hexagonal



One Set

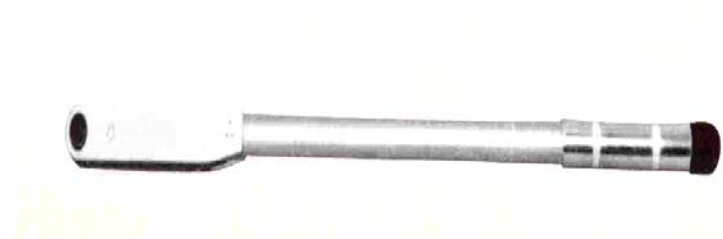
Product Item	Sockets (mm)
22 Sockets	10,11,12,13,14,15,16,17,18,19,21,22,23,24,26,27,28,29,30,32,33,34
5 Accessories	Extension bar 125mm,255mm, Universal joint T Handle , Ratchet Handle

28.0 TORQUE WRENCHES

Torque Wrenches are required for mounting & dismounting of direct mounted Roller Bearing components during overhauling Process.

Technical specification Torque Wrenches

The Torque wrench is a calibrated tool recommended for use in controlled tightening of nuts and bolts to avoid over/under stressing. To set simply turn an adjusting lever and set the reading on the scale. To operate, just pull the handle and when set torque is reached, the wrench will signal with an audible “click”. Release the wrench; it is set for the next operation.



Torque capacity	Square drive mm
1-7 kg.m 7-50 Lb.Ft.	12.5
7-35 kg.m 50-250 Lb.Ft.	12.5
14-56 kg.m 100-400 Lb.Ft.	12.5

TECHNICAL SPECIFICATIONS OF M&Ps For CTBU/TBU for LHB Coaches in Workshop

The technical specifications of M&Ps given in this Appendix “A” for bearing maintenance are only indicative and for guidance. The M&Ps may be procured as per requirement considering latest upgradation available in the market and suitability of the item for bearing maintenance.

1.0 TROLLEY MOUNTED BEARING EXTRACTOR

Trolley mounted Bearing Extractor (CTBU/TBU puller cum installer) is required for the application of quick and safe dismounting & mounting of CTBU/TBU for LHB Coach wheel set.

Standard accessories:

Guide tube	01 No.
Guide tube adapter	01 No.
Pressure pad	01 No.
Auxiliary shoe (Pulling shoe insert)	01 No.
Tie bolt with distance bush	01 No.
Support frame	01 No.
Installing tube	01 No.
Installing tube adapter ring	01No.
Locking pin	01 No.
High tensile socket head screws (as per thread size of the axle face)	03Nos
Maintenance/operational tools	01set.
Suitable starter(DOL)	01 No.
Single phasing preventer for motor (Current sensing type)	01No.
Flexible copper cable 4 core 6 sq.mm	15 mtr.

Technical specifications of Trolley mounted Bearing Extractor (CTBU/TBU puller cum installer):

Type of cylinder	- Hydraulic double acting cylinder.
Capacity of bearing	Pulling – 100 Tons (Minimum) Installing – 70 Tons (Minimum)
Horizontal stroke	- 350 -400 mm (Minimum)

Speed of RAM

Advancement of ram	280-500 mm/Minute
Pulling of bearing	50-100 mm/Minute
Installation of the bearing	100-150 mm/Minute
Working height of the hydraulic	From 300 to 800 mm above ground level.
RAM assembly for alignment with the journal	

Power pack unit

HP of the motor	3 HP, 3 phase, 400V, 50 Hz
Pump type	Radial plunger
Type of cylinder	Hydraulic double acting cylinder
Working pressure	450-550 KG/CM2 (Max. 700 Kg/Cm2)
Starter	with push button D.O.L. starter
Delivery of the pump	1500 cm2 of oil at full pressure.(i.e 700 bars) (±5%) and 6500 cm2 of oil at low pressure. (i.e. 700 bars) (±5%)
Distance between the wheels	810±10 mm
Hydraulic pump	two stage pump, electrically operated, without remote control. Three way valve for actuation of Hydraulic cylinder.

2.0 DIGITAL DIAL SNAP GAUGE

Digital Dial Snap Gauges are required for measuring different dimension of CTBU/TBU components during overhauling forces.

Technical specification of digital dial snap gauge

Description	Range	Least count in mm
Digital Dial Snap gauge Mitutoyo make no. 201-106+543-690/ Tesa/ Forbs or equivalent with NAPL/NBL Calibration certificate shall be included:	125-150mm	0.001

3.0 DIAL BORE GAUGE

Dial Bore Gauges are required for measuring different dimension of direct mounted Roller Bearing components during overhauling forces.

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Description	Range	Least count in mm
a) Dial Bore gauge Mitutoyo make no. 511-703+2109S-10/Tesa/Forbs or equivalent with NAPL/NBL Calibration certificate shall be included.	50-150 mm	0.001
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Magnifying Glass solutions offered have a higher resolution that allows objects to be magnified properly. With the product in compliance with international quality standards, these are handy models and are made available with unbreakable fiber handle as well as with LED light option.



Technical specification Magnifying Glass (Handy Model)

High quality, low price, products have got through CE and RoHs authentication.

Magnification times: 20X

Glasses materials: Three kinds of materials are optional for you: common glasses (green glasses), optical glasses (white glasses), optical son-mother lenses (double multiplication: bigger ones are 5* while the smaller ones are 10*)

Light source: 22W circlip fluorescent lamp

Lenses diameter: 127mm

Power source: AC 220V/110V (220V is acquiesced, if you want to chose another one, please give an order)

Power plug: Chinese-standard plug base with three spigot.(you can give an order to make other kinds of plug as you wish)

Advantages

- * Can be easily fixed on the working table.
- * Angle can be adjusted as you wish.

Appendix A

- * Specially and broaden range of observation make it possible to observe things for a long time.
- * Can choose any kind of magnifying times according to your detail requirement.
- * Magnifying and lighting work well together.
- * Lightening shine is stable and credible and no glimpse.
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5.0 NYLON FACED HAMMER

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Technical specification Nylon Faced Hammer

SPECS: 1" (2.5cm) diameter faces. 11½" (29.2cm) hickory handle. Weighs approximately 6 oz. (170.1g).



6.0 BOX SPANNER SET

Box Spanner Set are required for mounting & dismounting of direct mounted Roller Bearing components during overhauling Process.

Technical specification Nylon Faced Hammer

High Grade Chrome Vanadium Steel. As per IS 6131-1980 & 7381-1986, Bi-hexagonal & Hexagonal



One Set

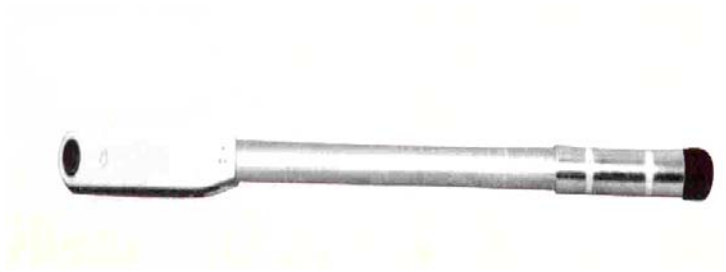
Product Item	Sockets (mm)
22 Sockets	10,11,12,13,14,15,16,17,18,19,21,22,23,24,26,27,28,29,30,32,33,34
5 Accessories	Extension bar 125mm,255mm, Universal joint T Handle , Ratchet Handle

7.0 TORQUE WRENCHES

Torque Wrenches are required for mounting & dismounting of direct mounted Roller Bearing components during overhauling Process.

Technical specification Torque Wrenches

The Torque wrench is a calibrated tool recommended for use in controlled tightening of nuts and bolts to avoid over/under stressing. To set simply turn an adjusting lever and set the reading on the scale. To operate, just pull the handle and when set torque is reached, the wrench will signal with an audible “click”. Release the wrench; it is set for the next operation.



Torque capacity	Square drive mm
1-7 kg.m 7-50 Lb.Ft.	12.5
7-35 kg.m 50-250 Lb.Ft.	12.5
14-56 kg.m 100-400 Lb.Ft.	12.5