

Maintenance Manual for BG Coaches

WHEELS AND AXLES

1. General

Wheel is one of the very important safety items of Rolling Stock. It is, therefore essential to provide meticulous maintenance attention to all the components of the wheel set during POH in the workshops.

2. Pre-inspection of Wheels

- 2.1 Wheel sets are removed from bogies should be sent to the roller bearing section. The axle boxes and roller bearings are stripped off the wheel journals if required as per the maintenance schedule or condition of the bearings and the wheel sets are then sent to the wheel shop for maintenance.
- 2.2 All incoming wheels are first inspected for assessing the condition of the components of wheels such as axle, wheel disc.
- 2.3 During pre-inspection following checks are made :

Type of wheel	Tread Diameter in mm.		
	New	Minimum Shop Issue	Condemning Size
ICF Solid	915 mm	837mm	825mm

2.3.1 Measurement of wheel gauge (distance between two wheel flanges on the same axle)

The road gauge (wheel gauge) measurement should be $1600 \pm 2/-1$ mm. Measurement is made with the help of adjustable road gauge. The readings are taken at 3 different locations 60 degrees apart. If the measurement is not within limits or difference in readings taken at the three locations is observed, the axle is termed as loose/bent axle. The wheel should then be marked for necessary corrective action.

2.3.2 Measurements of Wheel Diameter (Tread diameter)

The wheel diameter is usually measured with the help of Trammel gauge with least count of 0.5mm to check the diameter of incoming wheel set on both wheels. A wheel diameter measuring gauge with least count of 0.1mm. is recommended, as the measurement of diameter would be more accurate with this gauge. The flange on both sides if wheel set are checked with the help of a profile gauge and the thickness and height of flanges are measured. With the profile gauge, accurate measurement of flange height and flange thickness is not possible. It is therefore; recommended to use a wheel profile gauge with accurate measurement of flange height and flange thickness to the extent of 0.1mm can be made. The maximum diameter, shop-condemning diameter is given in accompanying table. The difference in tread diameters if the two wheels on the same axle should not exceed 0.5mm. After recording the diameter of wheels and the flange measurements, the wheel set is marked for necessary repairs.

2.3.3 Inspection of axle

Axle journals should be thoroughly cleaned for inspection to detect flaws, pitting, dent marks, etc. Each axle should also ultrasonically tested for detecting internal flaws and defects as per the Code of Procedure issued by RDSO. Axles found flawed, pitted, dented, or worn out beyond limits should be replaced.

ICF axle journal

- 1) Taper must not exceed 0.015
- 2) Out of roundness (ovality) must not exceed 0.015.

The wheels are categorized after pre-inspection as below:-

i) Normal repair Wheels:

If all the components are within the acceptable range of limits, these wheels are taken directly for wheel profiling and servicing of roller bearings.

ii) Wheels requiring replacement of axle:

If the axle is condemned during pre-inspection due to bent axle, dimensional deviation of journal/wheel seat, axle having groove marks in the middle due to rubbing of pull rod, dents, corrosion, pitting marks on the surface of axle or found flawed in ultrasonic flaw detection test, the wheel set is taken for replacement of axle and categorized as **RA** wheels.

iii) Wheel requiring replacement of solid discs:

If the tread diameter of a solid wheels is approaching the condemning limit or wheel treads have heavy skid marks which are likely to cause tread diameter going below shop condemning size on tyre profiling, the wheel set is taken for replacement of discs and are categorised as **RD** wheels.

3. ICF WHEEL REPAIR

Detailed procedure for carrying out repairs to different categories of wheels is described below:

3.1 Normal Repair Wheels

- 3.1.1 If a normal repair wheel set is fitted with roller bearings, axle boxes are first dropped and are taken for ultrasonic flaw detection test before sending it for wheel profiling on a wheel lathe.
- 3.1.2 The wheel treads should be checked and machined to the standard or intermediate worn wheel profile and machining standard N11. The root radius is an important dimension of any contour and most of the lateral wears takes place at this location. It is, therefore, very important that the full root radius specified be obtained and a particularly fine finish given at this location.

3.1.3 Normal repair wheels are of two categories:

I) With roller bearing mounted, and (ii) with roller bearings removed.

- i) If the wheels are sent for wheel profiling without dismounting roller bearings from the journal, special protective covers should be fitted on the bearings on either side of wheel to avoid entry of metal chips/dust or damage to the bearing during machining. Wheels with roller bearings, after wheel profiling and inspection of tread diameters, wheel gauge, if passed are taken for roller bearing attention. Roller bearings other components are cleaned in position. The roller bearing maintenance work is then carried out as laid down in RDSO maintenance manual for roller bearings.
- ii) Normally Spherical Roller Bearings are dismounted every alternate POH from the journal or on deteriorated condition of grease/ felt ring. Whenever it is required to dismount the bearing from a normal repair wheel set for roller bearing maintenance it should be dismounted bearing sending the wheel set to wheel lathe.

Activities involved in Normal Repair Wheels :

- Pre-inspection of incoming wheels.
- Drop axle boxes, Clean and inspect axle boxes. If required, repair them.
- Flaw detection test of axle.
- If required, dismount roller bearing from the journal.
- Machine wheel profile to the prescribed dimensions.
- Inspection of wheel profile.
- Clean roller bearing and assemble components in position, if not Dismounted.
- Inspect roller bearing and assembly in position.
- Check radial clearance and confirm to be within specified limit.
- Pack fresh grease.
- Mount cleaned and inspected axle boxes.
- Fit covers and dispatch.

3.2 RA (Re-axling) Wheels:

- 3.2.1 During pre-inspection, if it is found that axle is rejected for any reasons such as bent axle, journal/shoulder undersize, detected flawed in ultrasonic test, the wheel set is taken for replacement of axle.
- 3.2.2 The wheel set is taken on wheel press for separating the rejected axle from the wheels.
- 3.2.3 New axle should be machined as per the correct drawing dimensions. When journal, journal fillets, and shoulder are machined each should be finished smooth, concentric and without ridges, burrs or chatter marks. Fillets in both ends of journals must be finished to the dimensions given in the respective drawings.
- 3.2.4 The dimensions of the finished journals must be measured with micrometer. The diameter should be measured at 3 points along length of the journal both on the vertical and horizontal axis. The ovality and taper must not exceed the prescribed limits. Surface finish of the axle on journal, wheel seat, shoulder, and middle portion should be as prescribed (0.8 micron for journal, 1.6 micron for wheel seat and 3.2 micron for middle portion).
- 3.2.5 The axle should be given ultrasonic flaw detection test before pressing on the wheel.

- 3.2.6 The serviceable wheel center (separate from the RA Wheel) are rebored on the vertical boring machine. Care should be taken to ensure that the finished bore is straight, concentric to the tread of the wheel and has a smooth surface free from ridges, scores and chatter marks. The radius of 2.5 mm which is provided on the hub to facilitate mounting must be made after the finishing cut. Inside micrometer should be used for measuring wheel bores to ensure consistent results. Each wheel bore must be checked at not less than 3 points in its length and on the different diameters at each of these points to ensure roundness and absence of taper. The variation for any of these measurements must not exceed 0.05mm.
- 3.2.7 If any taper does exist, the small diameter must be at the outside end of the Hub bore (reverse taper is not allowed). Surface finish of the bore should be within the prescribed permissible limits.
- 3.2.8 The wheel sets are machined to suit the bore of the wheel centers keeping Interference allowance as specified.
- 3.2.9 The bore and the wheel seat should be maintained to the specified surface finish and diameters to achieve correct interference fit and pressing-in pressure.
- 3.2.10 Before pressing-in operation, wheel seat on the axle and bore on the wheel should be carefully cleaned to remove rust, grit, swarf, dirt, etc. The wheel Seat and bore should be lubricated with a mixture of white Lead and boiled Linseed oil, in the proportion of 5.5 kgs of white lead paste to 4.5 liters of boiled Linseed oil. The wheel and axle should be carefully aligned on the wheel press.
- 3.2.11 Wheel press should be equipped with a dial pressure gauge and pressure Recording gauge with graph to record mounting pressure diagram for each assembly. Wheel should be mounted within the prescribed pressure limits. Wheel should be mounted carefully on the axle such that the gauge distance is maintained. The axle end should be stamped the required detail on the axle ends as per instructions, to enable identification of wheel.
- 3.2.12 After mounting, the wheels should be rotated on a lathe to make sure that they are not eccentric nor out of plane with respect to the axle. The wheel gauge should be checked by gauging at three points around the circumference.

Activities involved in RA wheels:

- Pre-inspection of incoming wheels.
- Drop axle boxes.
- Press off the wheel to separate axle and wheel centers.
- Machine new axle for rejected axle and inspect.
- Bore the wheel discs and inspect the same to confirm as per drg. Size
- Machine wheel seat on the axle to suit the bore of wheel discs keeping the interference allowance as per prescribed limits and inspect.
- Press on the wheels discs on the axle to the respective wheel seats.
- Record the mounting pressure and the pressure graph for each side of wheel seat.
- Maintain the wheel distance with the gauge to the prescribed limit.
- Stamp the required detail on the axle ends as per instructions.

3.3 RD(Re-discing) wheels.

- 3.4.1 During pre-inspection, if the diameter solid disc wheels are found to be nearing condemning size, the wheel is taken for replacement of disc.
- 3.4.2 After dropping of axle boxes the roller bearings are dismounted. Journal diameters should be checked to confirm to be within permissible limits. The wheels should also be ultrasonically tested for flaw detection and confirmed to be flawless.
- 3.4.3 The wheel is then taken to wheel press for separating the condemned discs from the axle.
- 3.4.4 New discs are bored on the vertical-boring machine. Care is taken to ensure that the finished bore is straight, concentric to the tread of the wheel and has a smooth surface free from ridges, scores, and chatter marks. The radius of 2.5 mm which is provided on the hub to facilitate mounting must be made after the finishing cut. Inside micrometer should be used for measuring wheel bores to ensure consistent results. Each wheel bore must be checked at

not less than 3 points in its length and on the different diameters at each of these points to ensure roundness and absence of taper. The variation among any of these measurements must not exceed 0.05 mm. If any taper does exist, the small diameter must be at the outside end of the hub bore (reverse taper is not allowed)

- 3.4.5 The wheel seats on the old serviceable axle released from RD wheels are machined to suit the bore of the wheel centers keeping interference allowance as prescribed.

Interference allowance should be maintained between 0.211mm to 0.286mm.

Surface finish on wheel seat and wheel center bore should be 1.6 micron.

Pressing –in pressure should be 71.2 tonnes to 106.8 tonnes.

The bore and the wheel seat should be machined to the Specified surface finish to achieve correct interference fit and pressing-in pressure.

Before pressing-in operation, wheel seats on the wheel should be properly lubricated. The wheel and axle should be carefully aligned.

- 3.4.6 Wheel press must have a dial pressure gauge and pressure assembly. Wheel should be mounted within the prescribed pressure limits. Wheel sets should be mounted carefully on the axle so as to maintain the gauge distance.
- 3.4.7 The axle end should be stamped the required detail on the axle ends as per instruction and also on the outer periphery of the wheel disc on the area below the condemning diameter line, for tracing the history of the wheel.
- 3.4.8 After mounting, the wheel should be rotated on a lathe to make sure that it is not eccentric nor out of place with respect to the axle. The wheel gauge must be checked by gauging at three points around the circumference.

Activities involved in RD wheel

- Pre-inspect incoming wheels.
- Drop axle boxes.
- Press off the wheel to separate axle and wheel centers.
- Bore the wheel discs and inspect.
- Machine wheel seat on the axle to suit the bore of wheel disc keeping the interference allowance as per prescribed limits and inspect.
- Press on the wheel discs on the axle to the respective wheel seats.
- Records the mounting pressure and the pressure graph for each wheel seat.
- Maintain the wheel distance with the gauge to the prescribed limit.
- Stamp the required details on the axle ends as per instruction.

LIST OF TOOLS AND PLANT

1. EOT crane 5 tonnes
2. Wheel profiling lathe
3. Axle journal turning and burnishing lathe
4. Hydraulic wheel press with facility for mounting pressure diagram
5. Axle turning lathe
6. Vertical turning lathe
7. Axle end drilling machine
8. Axle grinder

ROLLER BEARINGS

1. Period of Inspection

1.1 All roller bearings must be cleaned, inspected and re-lubricated with fresh grease at every POH (Periodic Overhaul) and Rajdhani and Shatabdi wheel sets at every IOH.

1.2 Dismount roller bearings at every alternate inspection in the Workshops for renewal of Felt sealing ring. If any defect in roller bearing or its component is suspected and/or the rear cover is damaged, bearing should be dismantled and sent for inspection.

2. Roller Bearing Maintenance

The roller bearing shop should be well laid out for easy workflow and careful bearing handling. Clean surroundings and dust free atmosphere should be maintained in the shop. It should have adequate equipment and facilities for cleaning, handling, Mounting/dismounting, inspection, repair and storage of roller bearing

List of Tools and Plant

1. Roller bearing cleaning plant
2. Axle box cleaning plant
3. Axle box extractor
4. Hydraulic dismantling equipment for direct mounted spherical roller bearing
5. Magnifying glass with light
6. Induction heater with demagnetizing device
7. Torque wrench and torque wrench tester
8. Feeler gauge set
9. Outside micrometer for journal and shoulder diameter measurement
10. Engraving/ etching machine
11. Volumetric containers for grease
12. Thread ring gauges for end locking screw inspection
14. Thread plug gauges for end locking holes

3. Precautions.

3.1 Following precautions should be observed during maintenance of roller bearing axle boxes in the shop:

- Only specified tools should be used for attention to bearings.
- Tools and bearings should be kept on dry surface.
- Bearings should be handled carefully. Bearing should not be dropped.
- Only cotton cloth, free from fluff, should be used for cleaning of bearings.
- Cotton waste should never be used while cleaning and handling bearings.

Spare bearings should be stored in a dry place. They should be opened only at the time of mounting so as to protect them from dust and moisture.

4. Inspection of Roller Bearings in position.

4.1 After thoroughly cleaning the exterior of the axle box, the front cover and the axle box housing should be removed, using a mechanical screw type extractor. While using the extractor, care should be taken to ensure that the end of the screw does not directly rest on the axle center and thrust bearing by using a pad suitably located to protect the axle center from any injury.

4.2 The grease should be examined for consistency, color, contamination with water, foreign particles, etc. If the grease is in good condition, the bearing need not be dismantled, provided its felt sealing ring and the rear cover do not require renewal. The grease should cover should be thoroughly washed and cleaned with kerosene and then with petrol / white spirit.

4.3 All components, viz., rollers, cage, outer and inner rings, roller tracks of the outer ring, etc, of the bearing should be examined after swiveling the outer ring. Similarly, roller tracks of the inner rings should also be examined after mechanically pulling out a few rollers.

4.4 Bearing should be rejected for the following defects:-

- Pitted or flaked roller tracks and rollers.
- Cracked / deformed or badly worn out cage.
- Cracked inner or outer race.
- Scored or damaged outer surface of outer race.
- Indentations on races or rollers.

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

Radial clearance of bearing in mounted position should be measured with feeler gauge. The blades of the feeler gauge should be inserted between the outer race and the unloaded rollers. While measuring the clearance, the rollers should not be allowed to roll over the blade. The acceptable ranges of radial clearance in the bearing in position on journal for different types of bearings are given below:

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 to 0.190 mm	0.270 mm Maximum	0.080 to 0.160	0.220 mm maximum
NEI/NBC	0.145 to 0.190 mm	0.295 mm Maximum	0.080 to 0.160	0.245 mm Maximum

If on inspection, the bearing is found fit to continue in service, the end locking plate should be removed for examination and While reassembling, new locking plate should be fitted in position and bolts tightened with a torque wrench to the correct torque value specified in the roller bearing maintenance manual issued by RDSO and the tabs folded over on to the bolt heads.

Torque wrench should be periodically checked for their accuracy with torque wrench testers.

Then the date, the month and the year of attention and workshop code should be punched on the locking plate.

Fresh grease should be packed between the rollers and the space between the rear cover and the roller bearing. Correct quantity of grease is filled in each axle box for which volumetric containers having unique shape and size are used.

A truncated cone of grease should be formed in front of the bearing. The 'V' grooves in the rear cover also should be filled up with fresh Grease after thorough cleaning. The axle box housing and the front cover, and in particular, the '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 Invariably be secured with split pins. Month, year and workshop code counted then is stenciled on the front cover, the axle box checked by hand for free rotation and the axle box sealed.

Inspection of Roller Bearings in dismount position

After dropping the axle boxes, the end locking bolts/retaining rings (end caps) are removed from the axle end. For dismounting roller bearings, a special hydraulic dismounting equipment is used with which, oil is injected between the journal and bore of inner race at a high pressure which expands the inner race resulting in breaking of interference. Thus the bearing becomes loose on the journal and slides over it. The bearing is then removed from the journal and sent to cleaning plant. Bearings, after cleaning, are thoroughly inspected for defects.

All bearing components such as inner race, outer race, cage and roller are examined for any damage, crack, breakage. Roller track of outer race of the bearing is examined by swiveling the outer race. Roller track of inner race is examined by mechanically pulling out a few rollers from the cage. Bearings are rejected in case of any of the following defects :

- Pitted or flaked roller tracks or rollers.
- Cracked/deformed or badly worn out cage.
- Cracked inner or outer racer.
- Scored or damaged outer surface of outer race.
- Indentation on the racers and rollers.
- Smearing of roller tracks and 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 low radial clearance.

These inspections are to be done under sufficient light, with magnifying glass. After

Inspection, if all components are found satisfactory, the radial clearance is measured with proper feeler gauge and checked whether it is within permissible limits prescribed by RDSO in the maintenance manual for different makes of roller bearings. If any of the component is found to be

defective or radial clearance is not within prescribed limits, the bearing is rejected and discarded from service. Retention of any component of one bearing for use in another bearing is totally prohibited.

4.5 Lubrication

4.5.1 **1.75 kg** of grease should be filled per axle box during lubrication.

4.5.2 Only lithium base grease of approved brands should be used.

4.5.3 The grease drums should be stored in vertical position in covered space. Once a drum is opened, special precautions should be taken to avoid any possibility of contamination of grease by moisture, dust, dirt, foreign particles, etc., and it should be exhausted before opening another drum. Since shelf life of grease is short, very old supplies of grease should not be used unless tested for consistency, moisture content, and percentage of oil separation and certified fit for use.

4.6 Inspection of Other Roller Bearing Components.

Axle end hole: The axle end holes should be checked with GO-NO GO thread plug gauge.

4.6.1 **Locking Plates:** - Locking plates should be invariably replaced every time its folds are opened to unscrew the bolts.

4.6.2 **Locking bolts:** - The end locking bolts should be of high tensile steel and manufactured by 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 damage and should have proper spanner grip. Bolts in service should not be reused unless they meet with the above standards.

4.6.3 **Retaining ring:** - The retaining ring should be cleaned and inspected for flatness and correct dimensions.

4.6.4 **Collar:** -The collar should not be dismantled unless it is damaged of the interference fit with the axle is lost. Once dismantled it should be invariably replaced.

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

4.6.6 **Rear and front cover:** - These covers should be cleaned inspected for any crack, correct dimensions and concentricity of bolt holes. In case the cover is worn out, it should be replaced.

4.6.7 **Axle box housing:** -The axle boxes should be thoroughly cleaned in the axle box cleaning plant and inspected. The bore should be free from scoring marks and excessive corrosion. 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. Axle box faces should be even. The width of the box should be 216+/-0.1mm between faces.

For mounting the bearing on the journal, after inspection of journal/shoulders, first the sealing collar are fitted by heating on induction heater. Rear cover fitted with fresh felt rings, is attached. Bearing is then mounted on the journal by heating on induction heater the temperature of 120°C.

Retaining ring is fitted and locking bolts are tightened with the help of torque wrench to the correct torque value 11-12 kg-m for M16 bolts and Torque wrenches should be periodically checked for their accuracy with torque wrench testers. Specified quantity of grease is filled in each axle box with volumetric Container specially made for the purpose with unique shape and size to avoid any mistake from the staff. Every time the bearing is dismantled from the journal, felt ring should be replaced with new one and old felt rings scrapped. It should also be ensured that sealing rings used on rear and front covers are replaced every time the axle boxes are opened and serviced. End locking plates should also not be reused and care should be taken to see that the notches are bent on such away that they are on the flat sides of the bolt heads.

EXAMINATION AND REPAIR PRACTICE IN CARRIAGE MAINTENANCE DEPOT

Depot maintenance staff should ensure the following things in respect of proper functioning and safety of Rolling gear:

Wheel and axle

Wheel profile should be checked with Tyre defect gauge to ensure the profile dimensions are within the permissible limits. Coaches with wheels having thickness and profile worn below condemning limit should not be allowed to continue in service and the coach should be marked sick for change of wheels in the sick lines.

Limits for flat tyres

The limits for permissible maximum flat surface on tread for BG ICF coaches is 50 mm.

Guidelines for wheel inspection in open line depots (Ref RDSO CMI-K003)

In addition to normal checks exercised on wheel condition during primary/secondary maintenance of coaches, a detailed inspection of wheels should be done when the coaches are received in sick line for attention for either schedules or out of course attention. The wheels sets shall be inspected for the following conditions and action taken as indicated for each condition:

1. Shattered Rim – a wheel with a fracture on the tread or flange must be withdrawn from service. This does not include wheels with localized pitting or flaking without presence of any rejectable condition.



2. Spread Rim- If the rim widens out for a short distance on the front face, an internal defect may be present. Spreading of the rim is usually accompanied by a flattening of the tread, which may or may not have cracks or shelling on the tread. Such wheels must be withdrawn from service.

This condition should not be confused with a uniform curling over of the outer edge of the rim around the entire wheel, which is called rim flow. Rim flow is not a defect.



3. Shelled Tread - Shelling can be identified by pieces of metal breaking out of the tread surface in several places more or less continuously around the rim. Shelling takes place when small pieces of metal break out between the fine thermal checks. These are generally associated with small skid marks or "chain sliding.". Such wheels should be withdrawn from service and sent to workshops for re-profiling.



4. Thermal Cracks – Thermal cracks appear on a wheel tread due to intense heating of the wheel arising out of severe brake binding. Such cracks occur on the tread and generally progress across the tread in a transverse & radial direction. Whenever such a crack becomes visible on the outer face of the rim or tread crack has reached the outer edge (non-gauge face) of the rim, the wheel should be withdrawn from service. If a crack becomes visible on the outer flange face, the wheel should be withdrawn from service. Such wheels should be sent to workshop for examination and subsequent rejection. Wheels involved in service brake binding should be examined carefully during the maintenance to rule out the possibility of rejectable thermal cracks. Such wheels may be identified by presence of flats (even within acceptable limits) and severe discoloration or blue black heating marks on the tread.



5. Heat checks – Thermal cracks are deeper and need to be distinguished from fine superficial cracks visible on the tread on or adjacent to the braking surface. These are called heat checks, which are usually



denser than the thermal cracks. Heat checks are caused on the tread due to heating and cooling cycles undergone by the wheel during normal braking. Such wheels do not need to be withdrawn but should be carefully distinguished from the rejectable thermal cracks.

Note: All wheel sets withdrawn from service for any of the conditions mentioned above must be sent to the associated workshops for detailed investigations and further disposal.

The date and station code of the maintenance depot where the wheels are changed should be stenciled on the end panels. An entry should also be made in the maintenance card of the coach.

The defective wheel should be sent to workshop for repairs after entering in the maintenance card details of the work order and date of dispatch to workshop.

No repairs, except wheel profiling of wheel sets is permitted to be done in the maintenance depot.

Roller Bearing Axle Boxes

A coach should invariably be detached from service for the following defects

- a) Hot axle box
- b) Damaged axle box
- c) Damaged front or rear cover
- d) Seized roller bearing
- e) Coach involved in accident, derailment, fire, flood etc.

Care should be taken not to keep a coach fitted with roller bearing stationary for a long time. Coaches grounded for a long time should be shunted up and down at regular intervals.

Coaches fitted with roller bearing should be checked to ensure that :-

- i) No wash basin drain hole / discharge pipe is directly above the axle box
- ii) The front and rear covers of the axle boxes are not damaged, cracked or loose
- iii) Clearance between axle box and wheel is such that the axle box does not bind against the wheel.
- iv) Brake gear is properly adjusted to avoid possibility of brake binding

Carbon % of Wheel Disc

For Cast Wheel :-

Carbon - 0.47 to 0.57%

Hardness value to be 255 to 320 BHN

For Forged Wheel :-

Carbon – 0.47 to 0.52%

Hardness value to be 241 to 277 BHN

Carbon % of AXLE

Carbon - 0.37% Maximum

COACHING AXLE DATA

Axle length	Journal diameter	Shoulder diameter	Wheel seat diameter	Middle diameter	Surface finish value		
					Journal & Shoulder	Wheel seat	Middle portion
2316 to 2316.5 mm	130.043 to 130.068 mm	145.134 to 145.174 mm	For 16 T axle 178 to 175mm and for 13 T axle 172 to 169 mm	152 mm for 16T axle and 145 mm for 13T axle	N6 =0.8µm	N7 =1.6 µm	N8 =3.2 µm

Axle Journal Taper	Axle Journal ovality	Press-in pressure	In mounting wheel on axle compound to be used
0.015 mm max ^m	0.015 mm max ^m	71.2 T to 106.8 T	Mixture of 5.5 kgs white lead and 4.5 kgs of boiled Lin- seed oil OR Moly Kote GN Plus

AXLE DEFECTS

The following axle defects are :-

- 1) Journal under size
- 2) Wheel seat damaged
- 3) Body pitted
- 4) Body corroded
- 5) Axle bend
- 6) Journal bend
- 7) Deep dent mark
- 8) Axle end thread worn out
- 9) Ultrasonic defect

COACHING WHEEL DATA

SERVICE LIMIT	Maximum	Minimum
Flange thickness	29.4mm	22 mm
Flange height	35mm	28.5mm
Flange top radius	14.5mm	5mm
Radius at root	16mm	13mm
Wheel diameter	918mm	825mm
Between Gauge	1602mm	1599mm

Difference of Wheel diameter

Same Axle	0.5mm max ^m
Same bogie	5mm max ^m
Same coach	13mm max ^m

WHEEL DEFECTS

The following wheel defects are:-

- 1) Thin flange
- 2) Deep flange
- 3) Flat places on tread
- 4) Less root radius
- 5) Wheel loose on axle
- 6) Wheel crack
- 7) Flaking on tread
- 8) Hollow tyre
- 9) Material deposited on tread
- 10) Sharp flange
- 11) Difference in wheel tread diameter

BEARING DATA

RADIAL CLEARANCE

Bearing Make	Radial clearance in un-mounted condition(mm)		Radial clearance in mounted condition(mm)	
	New bearing	In service bearing	New bearing	In service bearing
FAG/NORMA	0.145 to 0.190mm	0.270mm Maximum	0.080 to 0.160mm	0.220mm Maximum
NBC	0.145 to 0.190mm	0.295mm Maximum	0.080 to 0.160mm	0.245mm Maximum

Bearing bore diameter		Amount of interference		Bearing Outer diameter		Axle box bore diameter	
max ^m	min ^m	max ^m	min ^m	max ^m	min ^m	max ^m	min ^m
130.000mm	129.975mm	0.093mm	0.0430mm	280.000mm	279.965mm	280.052mm	280.030mm

GREASE AND AXLE END BOLTS

Brand of Grease	Amount of Grease	Axle end bolts	Tightening Torque value
Servogem RR3/Balmarol LL3	1.75 kg per axle box bearing	High tensile M16x40x1.5P for 13 T Axle And M16x50x1.5P for 16 T Axle	11 to 12 kg-m

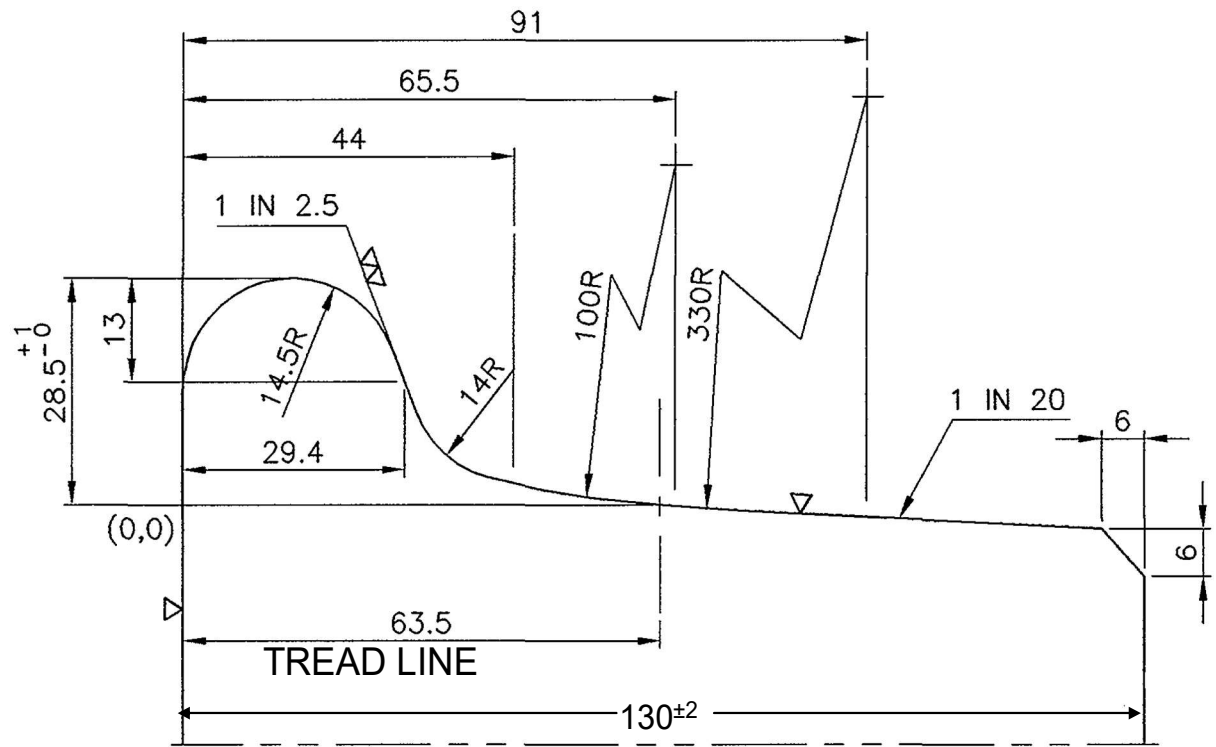
BEARING DEFECTS AND ITS CAUSES

Sl no	Defects	Causes
1	Racer crack	a) Excessive interference b) Rapid heating during mounting c) Excessive shock load d) Over size housing bore and excessive ovality
2	Flaking	a) Excessive loads and metal fatigue b) Contamination with foreign metal c) Passing of electric current through bearing d) Insufficient clearance
3	Rust and corrosion	a) Improper storage b) Improper packaging c) Insufficient anti rust compound
4	Fretting	a) Over size housing bore b) Insufficient lubrication
5	Seizure	a) Insufficient radial clearance b) Insufficient grease c) Bad quality of grease d) Excessive load e) Slippage of inner race over journal due to failure of clamping plate f) Cage broken
6	Cage damaged	a) Trapping of foreign objects b) Excessive vibration c) Improper mounting (misalignment) d) Excessive fluctuation of speed
7	Indentation	a) Ingress of small solid foreign objects such as dirt, dust b) Trapping of flaked particles
8	Electric current damage	Electric current flowing through raceway
9	Discoloration	a) Temper color by overheating b) Lack of lubrication
10	Excessive radial clearance	Due to worn out of rollers, inner and outer racer
11	Roller path skewing	a) Deformation or tilt of bearing b) Improper mounting
12	Smearing	a) Improper lubrication b) Ingress of foreign materials

TROUBLE SHOOTING ON ROLLER BEARING

SOME OF THE IMPORTANT DEFECTS, THE LIKELY EFFECT ON THE BEARINGS AND THE NECESSARY REMEDIAL MEASURES TO BE TAKEN ARE IN THE FOLLOWING TABLE.

Sr. no	DESCRIPTION OF DEFECTS	LIKELY EFFECT ON BEARING	REMEDIAL MEASURES
1	Felt ring perished	1) Grease may ooze out from rear cover. 2) Dust and water may enter into the axle box.	Renew the felt ring every alternative attention.
2	Rubber 'O' ring of the cover perished.	Dust and water may enter into the axle box.	Renew the rubber 'O' ring every attention.
3	'V' Grooves on rear cover front cover & axle box faces not filled with grease.	Dust and water may enter into the axle box.	At the time of maintenance attention, clean out the old grease and apply fresh grease.
4	Improper and/or excessive/inadequate lubrication of bearing.	Excessive temperature seizing or complete failure of the roller bearing.	1) To be used only approved brands of grease. 2) To be used specified quantity of grease.
5	Bearing clearance not within prescribed limits.	Excessive wears of rollers and races leading to bearing failure.	The bearing clearance during attention to be checked with feeler gauge.
6	Fitment of substandard locking bolts	This may cause failure of locking arrangement and there by cause failure of bearing.	Always use cap screws of properly class P8.8 or higher.
7	Improper locking of and locking bolts.	This may cause failure of locking arrangement and there by cause failure of bearing	The end locking bolts should be tightened with a torque wrench to a torque value. 1) 11 to 12meter kg for M16 Bolts 2) 22 to 23 meter kg for M20 Bolts.
8	Excessive or inadequate lateral clearance between axle box cover and bearing.	1) Excessive clearance may result in damage to roller bearing or covers. 2) Inadequate clearances may result in gap between axle box housing and front rear cover through which dust and water may enter into the axle box ultimately leading to bearing failure.	To be maintained correct lateral clearance.



STANDARD WORN WHEEL PROFILE AS PER RDSO SKETCH NO 91146 ALT 2

FIGURE-1
(20mm THICK FLANGE)

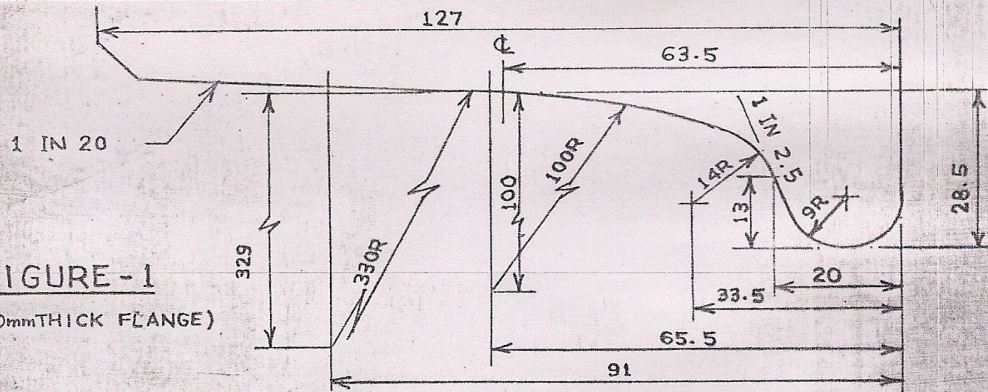


FIGURE-2
(22mm THICK FLANGE)

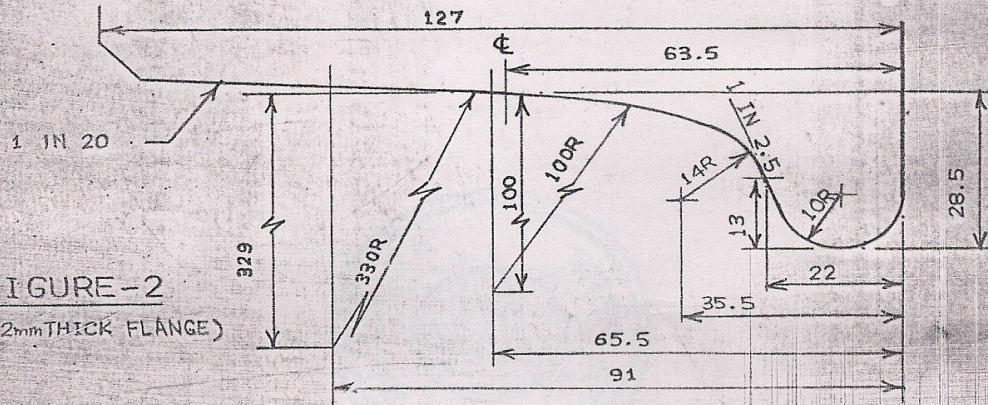
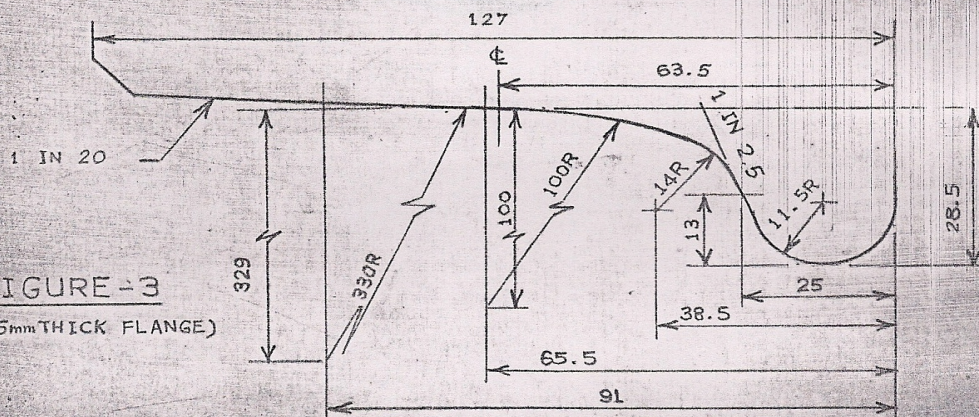


FIGURE-3
(25mm THICK FLANGE)



1. FIG.3 SHOULD BE THE LAST INTERMEDIATE WHEEL PROFILE FOR THE WHEELS MEANT FOR THE COACHES TO RUN AT MAX. PERMISSIBLE SPEEDS OF 110 kmph AND ABOVE.
2. ALL THE THREE INTERMEDIATE WORN WHEEL PROFILES (FIG.1,2 & 3) CAN BE USED FOR THE WHEELS FOR OTHER TYPES OF COACHES.

SUPERSEDED BY:-	
SUPERSEDES:-	
SCALE	P
	C
1:1	D S4/- 3/92
	T
	JS

B.G. RDSO
(C)

INTERMEDIATE
WORN WHEEL PROFILE
FOR COACHING STOCK

SKETCH - 92082

STAMPING PARTICULARS								
1	MANUFACTURER'S CODE.							
2	YEAR OF MANUFACTURE.							
3	CONSECUTIVE NO.							
4	BATCH NO.							
5	INSPECTOR'S APPROVAL STAMP							
6	MT FOR ULTRASONIC TESTING							
7	MANUFACTURER'S MARKS/STAMP CODE							
8	MONTH & YEAR OF ASSEMBLY							
9	PRESSING OR PRESSURE INTERFERES.							

PCD OF STAMPING OF DIFFERENT WHEELS	
TYPE OF WHEEL	PCD OF STAMPING ON RIM
COACHING	
WTACB-O-2-501	788 mm
T-O-2-622	788 mm
W/M-L-1660	788 mm
WAGON	
W/M-L-4764	870 mm
W/M-L-4771	780 mm
WD-89025/S-5	830 mm
WD-89025/S-9	960 mm
CONTAINER FLAT	
CONTR-9404-S/15	755 mm

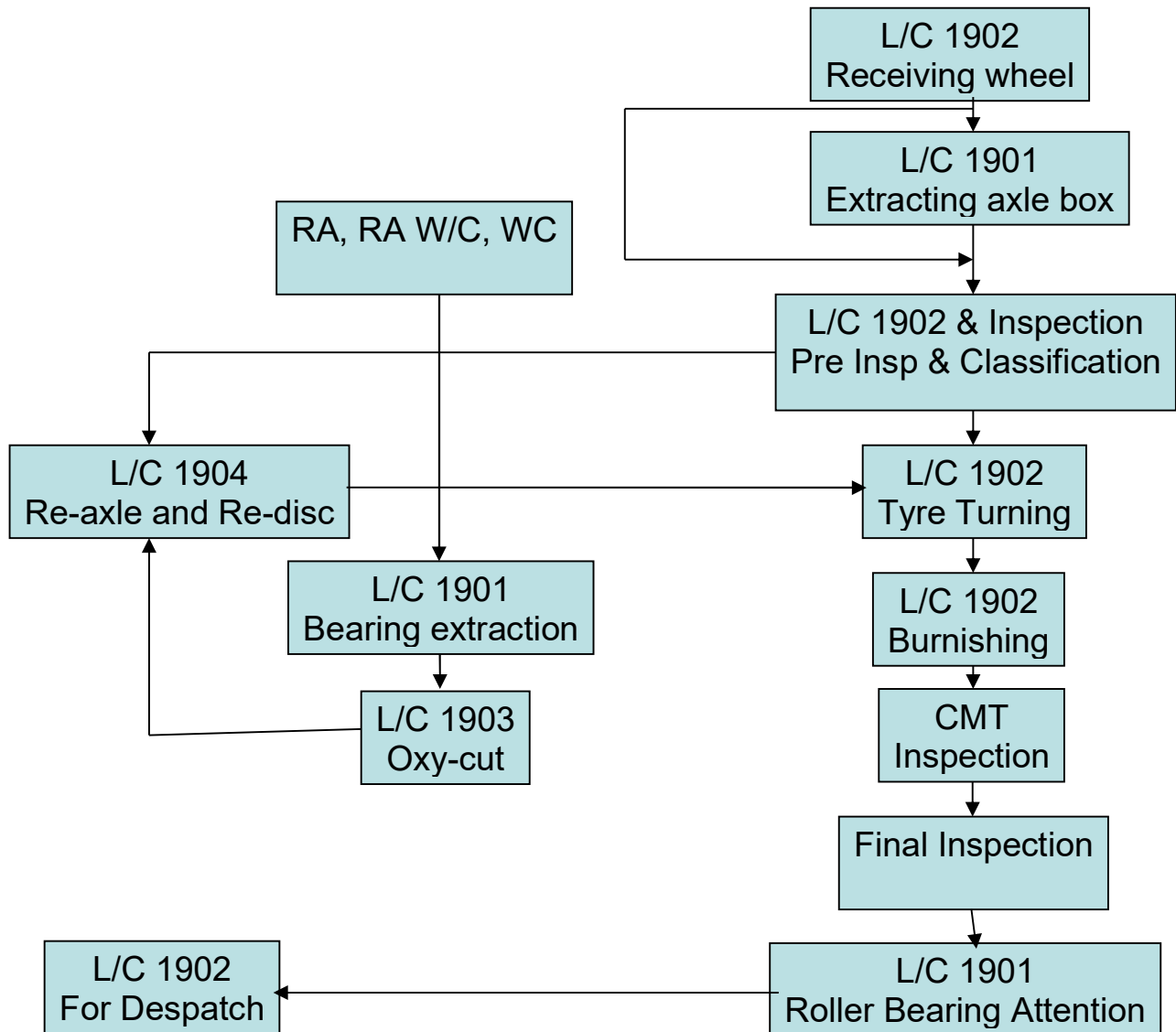
SUPERSEDED BY:	
SCALE	P Sd
7	C Sd
	D Sd
	T Sd
	J Sd

BRANDING DETAILS ON WHEEL & AXLE	
B.G.	R.D.S.O. [5]
SKETCH-92114	

ALT	ITEM	AUTHY	DESCRIPTION	DATE
④	SS/13/03		DRAWING REVISED	3/03
③	SS/13/02		DRAWING REVISED	2/02
②	CG/17/99		DRAWING REVISED	8/99
①	CG/15/97		DRAWING REVISED	9/97

NOTE:-

1. WHEEL DETAILS
TO BE HOT/COLD STAMPED OR MARKED BY ELECTRIC ETCHING IN 10 mm LETTERS ON OUTER FACE OF THE RIM OF ROUGH TURNED OR FINISH TURNED WHEELS.
2. WHEEL CENTRE DETAILS
TO BE COLD STAMPED OR MARKED BY ELECTRIC ETCHING IN 10 mm LETTERS AT THE HATCHED LOCATIONS ON OUTER FACE OF THE HUB.
3. AXLE DETAILS
1. TO BE STAMPED COLD OR MARKED BY ELECTRIC ETCHING ON BOTH ENDS IN 5 mm LETTERS IN CASE OF ROUGH TURNED OR FINISHED AXLES.
2. TO BE STAMPED IN 10 mm LETTERS IN CASE AXLES ARE SUPPLIED IN AS FORGED CONDITION.
4. ASSEMBLY DETAILS
TO BE STAMPED COLD OR MARKED BY ELECTRIC ETCHING IN 10 mm LETTERS ON THE OUTER FACE OF THE WHEEL/WHEEL CENTRE HUB.
5. IT IS MANDATORY TO STAMP THE RESPECTIVE MARKINGS AT THE LOCATIONS INDICATED ABOVE



Causes of Hot Box:

The main causes of hot box are

1. Defects of lubricants:
 - a. Use of bad quality of grease.
 - b. Use of excessive or inadequate quantity of grease.
 - c. Foreign material contaminated with grease
2. Mechanical disorder
 - a. Defects in journal.
 - b. Defects in bearing.
 - c. Defects in axle box.
3. Irregular loading

- a. Uneven loading
 - b. Overloading
- 4. Miscellaneous defects
 - a. Derailment.
 - b. Defects in track.
 - c. Excessive speed

Main causes of failure in roller bearing:

The main causes of failure in roller bearing are:

1. Any foreign material contaminated with grease.
2. Damaged felt ring
3. Excessive radial clearance.
4. Inner race and outer race crack.
5. Cage worn out or broken.
6. Due to roller skidded.
7. Due to lack of grease
8. Due to excessive grease.
9. Bad quality of grease.

Causes of axle box canting.

1. Excessive packing on spring seat.
2. Leakage of dashpot oil.
3. Wheel discs are not in proper position
4. Breakage of rear cover.
5. Misalignment of bogie and its components.
6. Excessive wear on axle box spring seat.

Overheating due to excess grease:

Too much volume will cause the rotating bearing elements to churn, agitate the grease trying to push it out of the way. This results in parasitic energy losses and high operating temperatures and increase the risk of oil separation and bearing failure.

When too much grease is added the grease is compressed between the bearing surfaces increasing pressure and resulting into heat.

Advantages of solid wheel.

1. It is lighter in weight.
2. It is very strong.
3. There is no danger of tyre loose or key loose.
4. It's life is longer than that of tyre wheels due to increased condemning limit on diameter at tread.
5. The heat caused due to braking and service run is dissipated at faster rate in solid wheels.

VISUAL INSPECTION

Roller bearing should be given a visual inspection at terminals at lubrication intervals and when equipment is or repair track or in the shop for any reason. Inspect for overheating, excessive leakage, broken, loose or missing parts such as loose cap screws loose or defective seals, cracked or broken cups, end caps, housing or adapters. Examine the housing or adapters for proper sealing on the bearing and for excessive wear defective parts must be reaped or replaced before the equipment is returned to service.

1. **Loose or missing cap screws.**
 - a. Check for loose and/or missing cap screws.

- b. Be sure that all tabs of the locking plate are properly bent up against the flats of the cap screw heads.
 - c. Inspect for damage or wear to the end cap from a displaced adapter.
 - d. If one cap screw is found loose or missing, remove all the cap screw, apply a new locking plate properly torque tighten all the 3 cap screws and bent all tabs against the cap screw heads.
 - e. If 2 or more cap screws are found loose or missing, the wheel set must be removed from the bogie. Remove the end cap. If there is any evidence that the bearing is not properly heated or if the lateral ply is within 0.03 to 0.38 mm; remove the bearing from the axle for a complete inspection to determine the cause and possible resulting damage.
- 2. Excessive accumulation of fresh grease around and seam may indicate a loose, damaged or defective grease seal.**
- a. A grease seal that can be moved laterally (back or forth) or rotated by hand using a suitable prove such as screw drive.
 - b. A grease seal that is cocked or displaced out of position in the bearing outer ring.
 - c. A grease seal case that is damaged (bent) from an external source.
 - d. Grease seal lips that are damaged.
 - e. The appearance of grease welfare is not in itself an indication of and problem if inspection shows the grease seal is not damaged, loose or displaced out of position.
- 3. Bearing running temperature:**
- Running temperature upto 38 degrees centigrade above atmosphere may be expected under normal operating conditions.
- If the bare hand cannot be held on the housing, adapter or bearing cup for a few seconds and the bearing is noticeably warmer than other bearing on the car, the bearing should be checked with a temperature indicating cray on or a direct reading pyrometer. If the bearing temperature is in excess of 90 degrees centigrade the bearing should be removed for further examination.
- 4. Grease leakage:** A small amount of Grease leakage around the seals may be expected during the initial run in period. This leakage will reduce to normal “weeping ” after the initial run in period.
- In service centrifugal force due to bearing rotation will move some grease out from between the end cup and axle into the bearing. When the space between the cone and grease seal is full of grease this action may cause a seal to leak temporarily.
- a. When a bearing is found which appears to be leaking excessively check for loose seals.
 - b. Subsequent inspections will determine if further attention is required.
 - c. Over lubrication should be avoided. Over lubrication will cause the bearing running temperature to increase. This increased running temperature along with the increased churning action will break down and deteriorate the grease.
- 5. Backing ring and adapter:**
- a. If a backing ring can be moved or rotated by hand, remove the bearing from service.
 - b. Check the backing ring for damage or wear from and displaced adapter.
 - c. An adapter out of position causes a load concentration on the bearing and if continued in service for any length of tome may result in serious bearing damage.
- 6. Accidental damage:**
- Roller bearing assemblies under equipment involved in derailment or collision or subject to damage by fire, floods or other cause must be shopped for inspection before being returned to service.
- Bearing must be removed from the axles and sent to shop for disassembling, cleaning and inspection in accordance with instruction. After the removal of the bearing all axles must be checked for bent condition in an axle lathe or with other suitable equipment. A bent axle will cause premature bearing damage due to the oscillation movement and uneven load distribution in the bearing.

7. **Electric welding:** When ever it is necessary to do any electric welding on cars or wheel and axle assemblies equipped with bearings, the ground cable must be clamped to or near the part being weld so that no current will pass through the bearings.