

***BRENCO* – NBC**

POCKET MANUAL

FIELD INSPECTION OF CARTRIDGE TAPERED ROLLER BEARINGS



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BEARING COMPONENTS

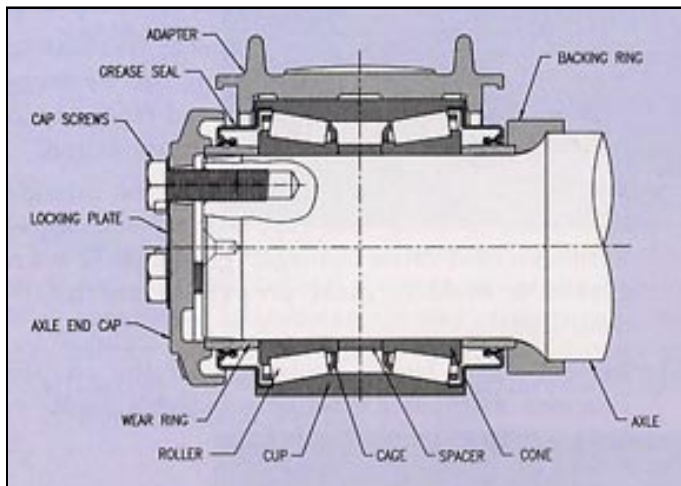


Fig 1: Cartridge Tapered Roller Bearing Assembly



Fig 2: Exploded View of Cartridge Tapered Roller Bearing Assembly

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INSPECTING INSTALLED ROLLER BEARINGS

Visual Inspection

- (i) Inspect bearing for any damage due to overheating, Water submersion, fire or welding arc damages. Damaged bearings must be removed from service Immediately and sent for internal examination.

Fig. 3-5 illustrates heat damages on the car-side, side-frame, bearing end cap, adapter and wheel. Excessive heat cause damaged grease seals, burnt grease & metallurgical properties are totally destroyed.

- (ii) Inspect roller bearing adapters. If the adapter becomes worn in excess of acceptable limits or



Fig. 3 : Car body showing heat damages.



Fig. 4 : Burned side frame, adapter, bearing and car body.

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Fig. 5 : Wheel & bearing assembly showing evidence of excessive heat.



becomes displaced from its correct location on the cup, then mechanical damage, off-center loading, accelerated fatigue damage and premature bearing failure can result. Replace worn-out adapters and correct the position of displaced adapter immediately (Refer Fig. 6,7, & 8).

Fig.6 : Adapter properly positioned in side frame



Fig.7 : Adapter properly located on bearing cup



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Fig. 8 : Adapter crown (cast) relief area

- (iii) Inspect bearing components for any mechanical damage caused by displaced adapters. Many times adapter related damages are difficult to detect as adapters can return to their normal position during service. Some of the external damages on the bearing of the adapter having been displaced are illustrated in Fig. 9 to 13.



Fig. 9 : Adapter has been displaced to outboard end of bearing. Thrust shoulders has been riding on the end cap flange and rim (A) and has also been point loading the outer race at two points (B)

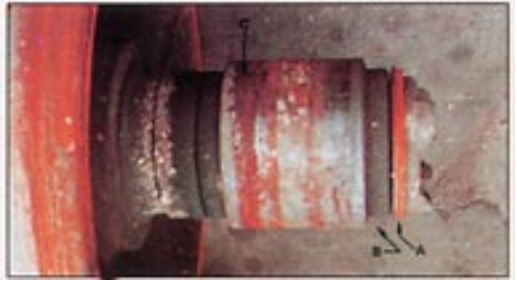


Fig. 10 : Adapter has been displaced to outboard end of bearing. Thrust shoulders has worn away the end cap rim (A) and has displaced the outboard seal (B). Inboard thrust shoulder has been riding on the outer race over the inboard load zone



Fig. 11: Adapter has been displaced to outboard end of bearing. Thrust shoulders have been in contact with end cap flange (A) and rim (B) have broken the cup counter bore (C). At one time the adapter was also correctly positioned as indicated by contact patterns on cup outside diameter.



Fig. 12: Adapter has been displaced to inboard end of bearing. Adapter thrust shoulders have been in contact with outer race over the load zone outboard (A & B) and with the backing ring and journal fillet radius inboard (C & D) indicating multiple displacements.



Fig 13: Adapter has been displaced to outboard end of bearing and has cut away the end cap flange (A) and grease seal case (B). This condition would require inspection from the side of the bearing to be detected. Inspection from the end of the bearing would not reveal the damage.

- (iv) Any wear or damage to the end cap or backing ring is an indication that adapter has been out of position and bearing may have sustained damage. Bearings

having external parts visibly cracked, damaged or bent must be removed from service and for re-conditioning.

- (v) Inspect for 'Loose backing ring'. A backing ring that can be rotated by hand is considered as loose. Bearings with loose backing ring must be removed from service.
- (vi) If grease seal/s of the cartridge tapered roller bearing is found loose, cocked or visibly damaged, bearings must be removed from service.
- (vii) One or more missing cap screw, or missing locking plate are also reasons for removal of bearing from service.
- (viii) For any other damage which is detrimental for the bearing performance or which may result into unsafe conditions, bearings must be removed from service, and sent for internal examination.

Grease Leakage

During service, some grease leakage is normal and comes from purging of seal pre-lube and relieving of internal bearing pressure. This should NOT be wiped away as it will "set up" and prevent further leakage. However following conditions must be carefully examined:

- (i) Grease leakage between cup counter bore and seal outside diameter may be an indication of loose seal. Use suitable probe or a screw driver to check if the Seal is loose in cup counter bore (Fig. 14 & 15). Bearing having loose grease seals must be removed from the service, and sent for re-conditioning.



Fig.14: Grease leaking between cup counter bore and grease seal case

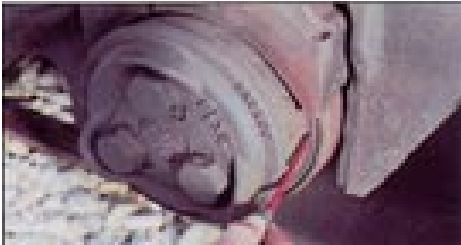


Fig. 15 : Probing for a loose grease seal

- (ii) Grease leaking between the backing ring and axle fillet radius is an indicator of loose backing ring. Bearings with loose backing ring must be removed from service and sent for re-conditioning (Fig. 16).



Fig. 16 : Grease leaking between backing ring and journal fillet radius

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Wheel Condition

Wheel conditions which can generate high impact forces into the bearing are indicators of possible internal damage. Built up tread and several slid flats are two such conditions, which can be detrimental to the bearings (Refer Fig.17 & 18).

Fig. 17 : Built up treads



Fig. 18 : Slid - flat tread



Abnormal Noise

When the bearing rotates try to listen for any unusual/ abnormal noise or grinding. Remove the bearing in case bearing produces abnormal noise, and send for internal parts examination / re-conditioning.

Running Temperature

Check operating temperature of the bearing by touching the adaptor 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 adaptor or the cup it means that the bearing is running hot. Cross check the bearing temperature with

temperature indicating crayons suitable for 90 degree Centigrade. Any alternate method can be used to find out bearing temperature. If bearing temperature is more than 90 degree C the bearings must be removed from the service immediately and sent for internal part examination / re-conditioning.

Bearings Involved in Derailment / Accident

All wheel sets of wagons involved in accident must be removed from the truck and inspected for condemnable defects. Bearings must be marked as "ACCIDENT INVOLVED" on cup outside diameter and must be sent to workshop for detailed examination. It is recommended that exterior inspection of roller bearings is made together with the wheel sets & the adaptors, side frame key, side frame etc.

INSPECTION OF ROLLER BEARING ADAPTER

Narrow Jaw Adapter

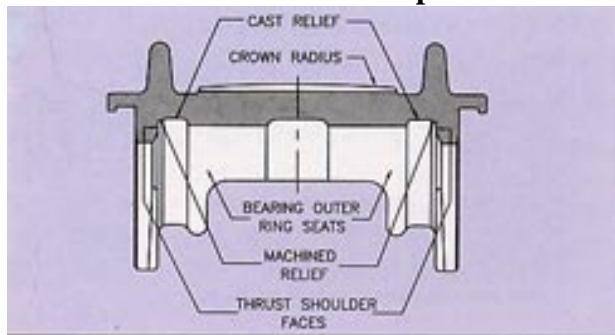


Fig. 19 :

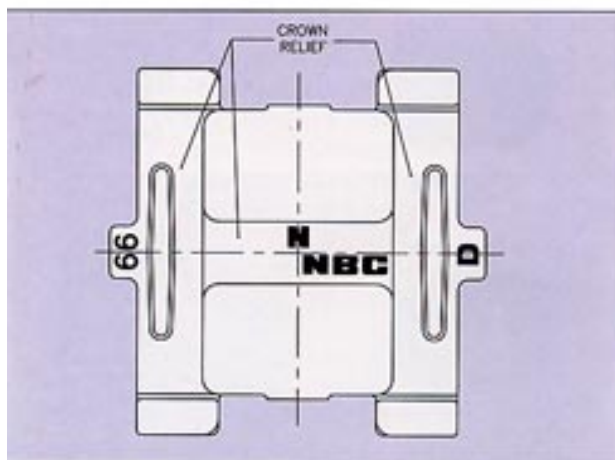


Fig. 20 :

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Inspection of Adapters Fitted in Trucks

- (i) Adapters must be properly seated on the bearings & in side frame.
- (ii) Inspect for cracked or broken adapters.
- (iii) Inspect for displaced or distorted adapters.
- (iv) Inspect cup outside dia for any indication of adapter wear. Fig. 21 shows normal wear bands present on cup O.D. generated from a serviceable adapter. Wear bands formed due to excessively worn-out adapter are illustrated in the Fig. 22, where wear bands extend to the edge of cup, and machined relief area makes contact with cup.

Normal wear bands



Deep Relief

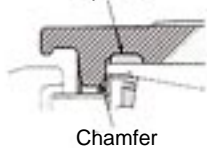


Fig. 21 : Normal Wear Bands

Normal wear band width



Abnormal extension of wear band
Indication of contact with shoulder

Contact due to excessive wear of adapter



Fig. 22 : Abnormal Wear Bands

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Inspection of Adapters Removed from Trucks

Whenever trucks are dismantled for any reason, adapters must be inspected for damage and wear, using specified gauges. Following applies during adapter inspection :

- (i) Cracked or broken adapters must be scrapped. Repair by weld or brazing is not permitted.
- (ii) Warped, twisted or distorted adapters must be scrapped. To check this, place the adapter on cup and it must seat firmly on the bearing cup without rocking or pinching when hand pressure is applied.
- (iii) Adapters worn to the extent that ridges / grooves prevent proper seating in the side frame or over the cup, must be scrapped.
- (iv) If the crown on the adapter top has worn out to such a condition that side frame would bear on crown relief portion, adapter must be scrapped.
- (v) Thrust shoulder of the adapter may show wear due to contact of cup face. If depth of such groove exceed 0.7 mm at any location adapter must be scrapped (use of Adapter Wear Gauge is shown in Fig. 23).

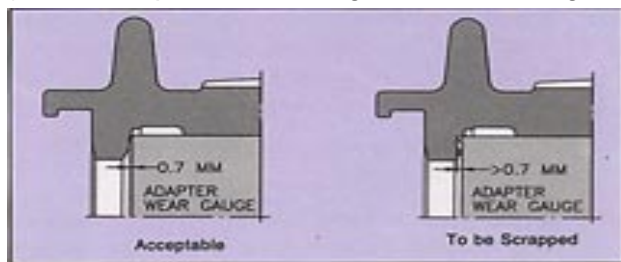


Fig. 23 : Checking Wear of Thrust Shoulder Faces

- (vi) Adapters having depth of machined relief less than 1/32" (0.8mm) when checked by 'Adapter Wear Gauge' must be scrapped (Refer Fig. 24).

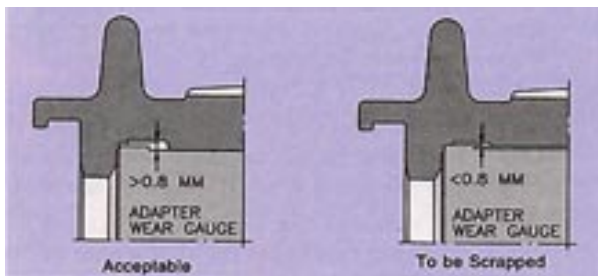


Fig. 24 : Checking Wear of Bearing Seat Areas

- (vii) Check entire bearing seating areas by moving 'Adapter Wear Gauge' on bearing seats. Damaged, distorted or worn out adapters must be scrapped.
- (viii) Adapters must be checked for proper fit in side frame.
- (ix) Adapters which are worn on one side between lugs from break reaction, but otherwise satisfactory for reuse, should be reversed when reapplied into the frame pedestal with worn portion towards springs. if wear on both sides exceeds 1/8" (3 mm) do not reuse the adapter.
- (x) Any adapter not meeting the gauge specification is condemnable and must be removed from service.

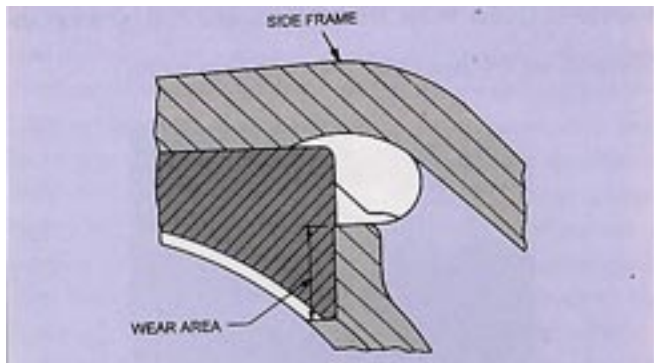


Fig. 25

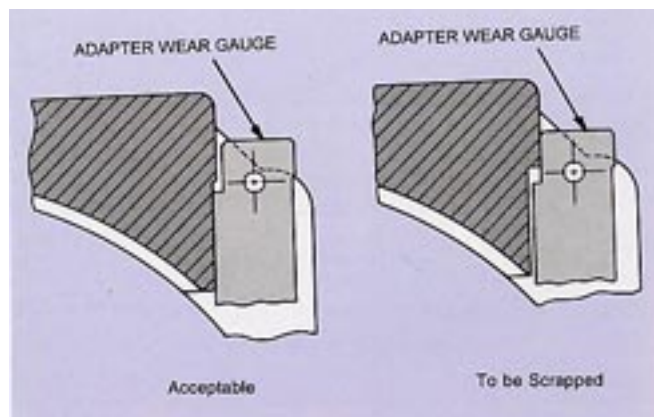


Fig. 26-27 : Checking Adapter Body Wear

GUIDELINES FOR BEARING INSTALLATION

Method of Measuring Journal Diameter



Fig. 28 : Use of Dial snap gauge

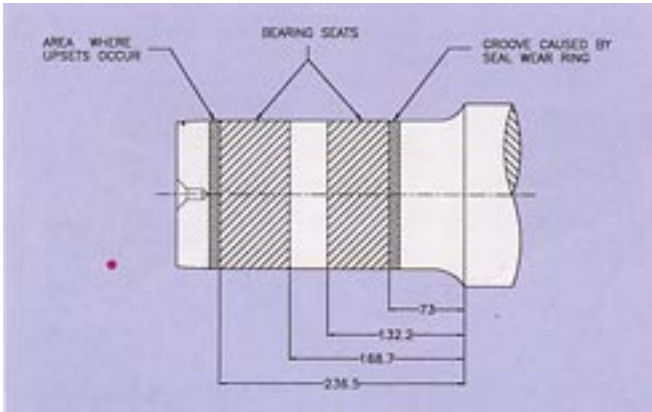


Fig 29 : Locations of Bearing seat Areas, Wear Ring groove and upset ends on 6 x 11 journal. **BRENCO-NBC**

(a) Bearing Seat Areas

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. The average diameter of each bearing seat must be within tolerances. Care must be taken when using temperature compensating snap 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.

(b) Journal Grooving from Inboard Seal Wear Ring

The inboard wear ring can cause a groove on the journal due to axle flexure. Refer Fig.29 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.

(c) Measuring for Upset Journal Ends

Area where upsetting of the journal occurs is shown in Fig. 29. 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" (0.08 mm) above maximum tolerance but may be below the minimum tolerance. Upset ends over 0.003" (0.08 mm) may be corrected.

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Axle Preparation

| Parameter | Specification |
|--|---|
| Journal Size | 6 x 11 Class 'E' |
| Journal Diameter (bearing seat locations) | 5.6905" to 5.6915" (144.539 mm to 144.564 mm) |
| Tapped Hole Thread Size | 1" –8 UNC - 2B |
| Journal Groove depth | 0.002" (0.05 mm) Max. |
| Upset Journal End Diameter | Must never exceed 0.003" (0.08 mm) above the maximum tolerance |
| (a) Axle Fillet Radius (b) Check with 0.005" (0.130 mm) feeler & axle fillet radius gauge | (a) Radius 1.5" (38.1 mm) (b) Max. depth of gauge insertion 3/8" (10 mm) |

Notes :

- Mounting and maintenance work must be done by qualified personnel and procedures laid down in accordance with AAR Manuals of standards must be followed.
- All axle journal must be verified for size. Dial or digital snap gauge, must be used for accurate measurement. (refer "Method of Measuring Journal Diameter").
- Tapped holes in the axle must be clean & free from dirt, rust, debris, burr, metal chips etc. Tap run through, if necessary.
- Lubricate threads before bearing installation.
- Be extremely cautious about conditions such as Oversize cone bores Undersize axle journals, Absence of cap screw clamp load etc.

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Maintenance Specifications for Brenco-NBC Bearing

| Parameter | Specification |
|--|--|
| Cone Bore (a) Avg. ID not to exceed (b) Out of Round | 5.6885" (144.4879 mm) 0.003" (0.076 mm) Max. |
| Cup Outside Diameter (a) Minimum O.Dia. (b) Out of Round | 8.675" (220.345 mm) Min. 0.005" (0.127 mm) Max. |
| Cup Counter Bore (a) Maximum (b) Minimum | 8.254" (209.6516 mm) 8.245" (209.423 mm) |
| Wear limits for Seal Wear Ring O. Dia | Seal Lip contact path less than 0.005" (0.127 mm) deep |
| Backing Ring Breakout Diameter | Average I.D. not to exceed 7.030" (178.562 mm) |
| Bench Lateral Play (Hand Lateral) | 0.020" to 0.026" (0.51 mm to 0.66 mm) |
| Grease Qty. per bearing | 455 ± 30 Grams |

* RDSO approved brands of Grease for use in CTRBs for Indian Railways.

| Grease Brand | Supplier |
|-------------------------|-------------------------|
| Servo grease RR-1 | Indian Oil Corporations |
| Balmerol Multigrease RB | Balmer Lawrie |

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Bearing Mounting

| Parameter | Specification |
|--|---|
| Journal Coating (a) Fillet & Collar Dia. (b) Bearing Seats | - Quick drying anti-rust compound (lead free) - Mineral Oil (SAE-40 or SAE-50) or Caster Oil |
| Mounting Pressure before abutment | 10 to 16 tons |
| Final Seating Pressure | 50±5 tons (Hold for 5 seconds) |
| Cap Screw Size | 1" –8 UNC –2A Class P8.8 of IS: 1367 |
| Cap Screw Torque | 40 Kg –m (290 ft-lbs). (Apply minimum 2 passes) |
| Torque Wrench Accuracy | Must be within ± 4% |
| Mounted Bearing Lateral play (apply hand pressure only) | 0.001" to 0.015" (0.03 mm to 0.38 mm) if bearing rotates freely by hand but indicates less than 0.001" (0.03 mm) on dial indicator, application is satisfactory for service |
| Locking Plate | Bent all tabs properly |

Notes :

- Follow proper mounting procedure.
- Always use New locking plates.
- It is recommended to use new cap screws to ensure maximum clamp. In case of used cap screws, inspect for any mechanical damage or rust.
- Lubricate both new & used cap screws prior to installation.

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Deletions as per AAR & RDSO

| Deletion | Recommendation |
|--|---|
| Use of Cap Screw Sealing Rings discontinued from June-1988 | Remove Cap Screw Sealing Rings if still found in service |
| Relief Valve & Vent hole deleted from Backing Rings in July-1992 | Remove Relief Value & use Plug / Sealant for plugging hole or use new Backing Ring without vent hole. |
| Vent Holes from Seal Wear Ring deleted in July- 1994 | Replace with new Seal Wear Rings without vent hole, if found in service. |

Revisions as per AAR

| Parameter | Revision |
|---|--|
| Cap Screw Torque for 6 x 11 Bearing | Increased from 35-37 Kg-m (250-270 ft-lbs) to 40 Kg-m (290 ft-lbs) |
| Manufacturers Allowable Tolerance for Mounted Lateral | Revised from 0.001" –0.020" (0.03 –0.51 mm) to 0.001"–0.015" (0.03–0.38mm) |

RELIABILITY RECOMMENDATIONS

- Mounting and maintenance work must be done by qualified personnel and procedures laid down in accordance with AAR Manuals of standards must be followed.
- All shops performing repair/re-conditioning of cartridge tapered roller bearings must meet requirements as per AAR.
- Bearing parts of different roller bearing manufacturers must never be mixed together in same bearing assembly.
- Whenever bearings are pulled out of service at the time of POH or wheel changing, bearings must be reconditioned.
- Initiate a program for re-torquing of cap screws to avoid possibility bearing failures due to loose components. Remove loose bearings found in the field.
- Improve fleet reliability.
- Make Frequent Field Inspections.
- Be extremely cautious about conditions such as (a) Oversize cone bores, (b) Undersize axle journals, (c) Absence of cap screw clamp load etc.
- At the time of weld repair of wagons earthing cable should be attached at such a place that electrical current does not pass through the bearing.
- Wheel sets with mounted bearings must be handled carefully in order to avoid cup breakage or damage of grease seal.

For any further information, please contact NEI Ltd., Jaipur and refer followings:

- (a) General Assembly Drawing BP-200923-1-NBC (Narrow)
- (b) General Assembly Drawing BP-200923-1-NBC (Wide)
- (c) AAR Manual of Standards
- (d) RDSO Specification G-81
- (e) AAR Field Manual of Interchange Rules

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