



सत्यमेव जयते

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Government of India - Ministry of Railways
Research, Designs & Standards Organization,
LUCKNOW - 226011



No. EL/ 3.2.108(3-Phase)

Date: 15.01.2018

Chief Electrical Engineer,

मुख्य विद्युत अभियंता,

1. Central Railway, Mumbai, CST-400 001.
2. East Central Railway, Hazipur-844 101.
3. East Coast Railway, Chandrashekharapur, Bhubaneshwar-751 016.
4. Eastern Railway, Fairlie Place, Calcutta-700 001.
5. North Central Railway, Block-A, Subedarganj, Allahabad- 211 033.
6. Northern Railway, Baroda House, New Delhi-110 001.
7. North Western Railway, Jaipur- 302 006
8. North Eastern Railway, Gorakhpur-273001
9. North East Frontier Railway, Maligaon, Guwahati-781011
10. South Central Railway, Secunderabad-500 071.
11. South East Central Railway, Bilaspur-495 004.
12. South Eastern Railway, Garden Reach, Kolkata-700 043.
13. Southern Railway, Park Town, Chennai-600 003.
14. South Western Railway, Hubli- 580020
15. West Central Railway, Jabalpur-482 001.
16. Western Railway, Churchgate, Mumbai-400 020
17. Chittaranjan Locomotive Works, Chittaranjan-713 331
18. Diesel Locomotive Works, Varanasi-221 004

1. मध्य रेलवे, मुम्बई सीएसटी -400 001
2. पूर्व मध्य रेलवे, हाजीपुर-844 101
3. पूर्व तटीय रेलवे, चन्द्रशेखरपुर, भुवनेश्वर-751023
4. पूर्व रेलवे, फेयर्ली प्लेस, कोलकाता-700 001
5. उत्तर मध्य रेलवे, ब्लॉक ए-2, सुबेदारगंज इलाहाबाद - 211 033
6. उत्तर रेलवे, बड़ौदा हाऊस, नई दिल्ली-110 001
7. उत्तर पश्चिम रेलवे जयपुर- 302006
8. उत्तर पूर्व रेलवे गोरखपुर- 273001
9. उत्तर पूर्व फ्रंटियर रेलवे मालीगाँव गुवाहाटी-781011
10. दक्षिण मध्य रेलवे, रेल निलायम, सिकंदराबाद-500 371
11. दक्षिण पूर्व मध्य रेलवे, बिलासपुर - 495 004
12. दक्षिण पूर्व रेलवे, गार्डनरीच, कोलकाता-700 043
13. दक्षिण रेलवे, पार्क टाउन, चेन्नई-600 003
14. दक्षिण पश्चिम रेलवे हुबली-580020
15. पश्चिम मध्य रेलवे, जबलपुर-482 001
16. पश्चिम रेलवे, चर्चगेट, मुम्बई- 400 020
17. चित्तरंजन रेल इंजन कारखाना, चित्तरंजन - 713331
18. डीजल रेल इंजन कारखाना, वाराणसी-221004

SPECIAL MAINTENANCE INSTRUCTION No. RDSO/2007/EL/SMI/0246, Rev. '2'

1.0 **Title:** Maintenance of Axle Box Bearings for WAP7 & WAG9/WAG9H Locos.

2.0 **Brief history with existing instructions:**

- 2.1 Schedule maintenance instruction No. 246 Rev. 0 and Technical circular No. 129 Rev. 0 were issued on maintenance practices, mounting, dismounting and inspection of Axle Box Bearing Unit for WAG 9/WAP7 Locomotive in respect to failure and problem in maintenance of Axle Box Bearing Unit reported from Zonal Railways since long time. But the problem of axle box bearing failure was continuing for which the above SMI and TC was reviewed with OEMs and revision '1' of the SMI & TC was issued including instruction related to storage of bearings, fitment of bearings, greasing procedure, Do's and DON'TS for better maintenance practices and reliability improvement of axle box bearing.
- 2.1 Considering the failure of axle box bearings reported from Railways even after maintenance instruction for axle box bearing issued vide SMI 246 Rev. '1' and TC 129 Rev. '1', a meeting on failure of axle box bearings was held at ELS/GZB with Zonal Railways and OEMs of axle box bearing. During the meeting,

Railways suggested use of step size inner racers having bore diameter of $148+.068/+.043$ in line with conventional locos to address the problem of scoring of axle journal as well as increase life of axle.

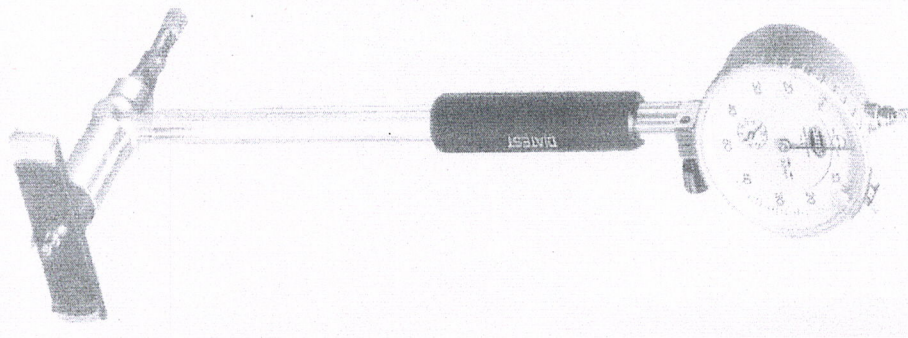
- 2.2 In this regard OEMs of axle box bearing were consulted and their view was taken in this concern. Accordingly the matter was studied in detail and decided to use step size axle box bearing in WAP7 & WAG9/WAG9H Locos.
- 2.3 Axle box bearings which are mounted on axle journal have bore diameter designed a way to provide optimum interference between the bearing inner racer and axle journal. Diameter of axle journal used for WAP7 & WAG9/WAG9H Locos is $150+.068/+.043$ mm. Presently inner racers of CRU-150 axle box bearings having bore diameter of $150 +0/-0.025$ mm are used for WAP7 & WAG9/WAG9H Locos to maintain interference between axle journal and inner racers in the range of .043mm to .093mm.
- 2.4 It has been experienced that frequent mounting/dismounting as well as corrosion, wear & tear causes axle surfaces to deteriorate which result in rejection of axles. Zonal Railways have also been reported problem of scoring of axle journal when the inner racers are pulled out hydraulically.
- 2.5 To avoid rejection of axles, diameter of such axle journal can be reduced up to $148+.068/+.043$ by machining. In order to match bearings to this reduced journal size, step size inner racers can be used to provide identical interference as is done for normal axle journal and inner racers of axle box bearing.

3 Storage of Bearing:

- 3.1 The storage area should be air conditioned.
- 3.2 Bearing should be stored in horizontal position in their original, unopened packages until needed.
- 3.3 Open bearings should be stored in their original packing.
- 3.4 The storage area should be free from vibrations, sub sonic vibrations as such the bearing should be stored on semi soft rubber mat of appropriate thickness.
- 3.5 First in first out (FIFO) use of bearing is recommended. Sealed bearings should be used within 3 years from the date of manufacture.

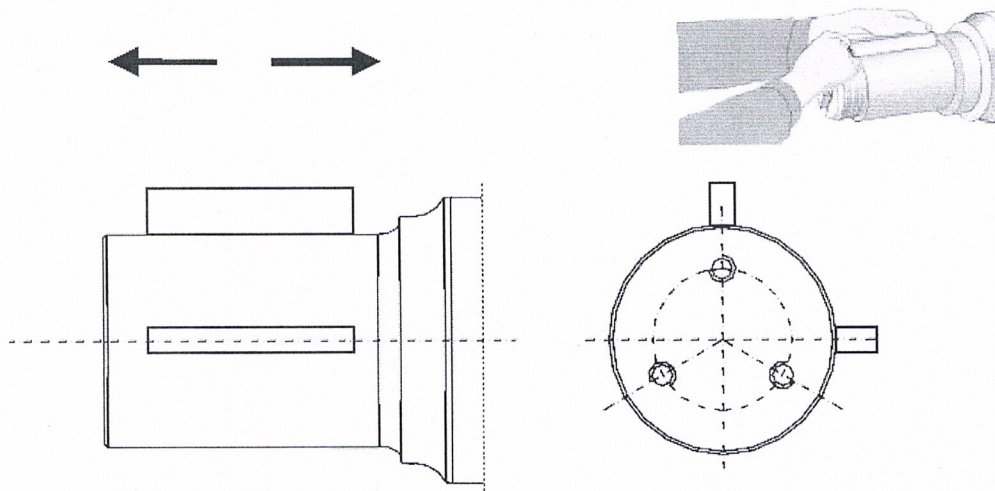
4 General inspection & mounting/dismounting process for Bearing:

- 4.1 Clean the rust and dirt from axle box housing for rust with the help of Emery Paper.
- 4.2 Visually check for defects like ridges, protrusions, high spots or steps are not removed before mounting axle box housing.
- 4.3 Measure Bore Diameter, Taper and ovality with the help of cylindrical bore gauge at minimum 4 places.



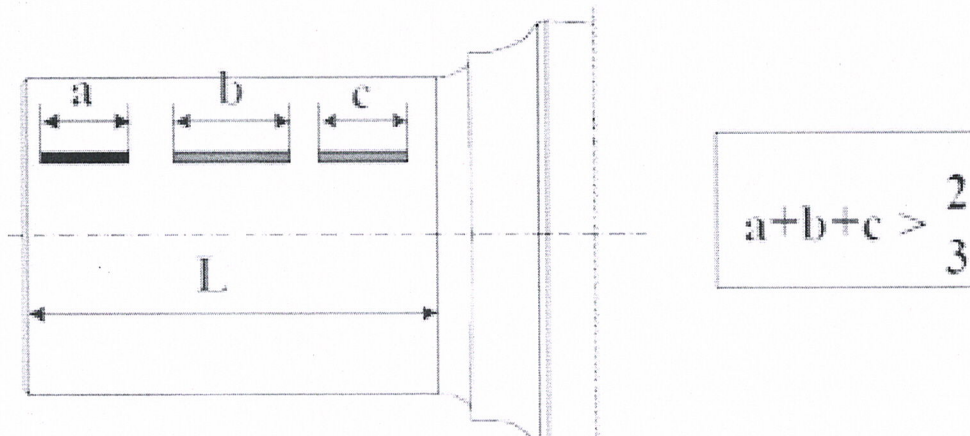
Cylindrical Bore Gauge

- 4.4 Inspect the journal surface for waviness on its surface by means of a metal ruler smeared with marking blue and moving it forwards & backwards on the journal in the axial direction several times in at least two planes at 90°.



p

If the surface plate leaves an unbroken line, the journal is good and suitable for use. If the line left on the journal is a broken line and total length of its parts is less or equal to 2/3 of the total length, the journal must be scrapped or repaired within specified tolerances.



- 4.5 Measure the diameter of journal as at bearing seating positions and at thrower seat.

Parameters	Max.	Min.
Axle Journal Dia	150.068mm	150.043mm
Cylindricity	0.01mm	0.0mm
Surface finish	Rz 6.3 (grind)	-

- 4.6 Measure the inner racer bore diameter.

Max – 150.00mm

Min – 149.975mm

- 4.7 Select the inner racer so that interface between the bearing seat on axle and inner racer is between .043mm to .093 mm. Also measure the outer diameter of selected racer.

- 4.8 Measure axle box bore diameter.

Max. – 250.046mm

Min. – 250.00mm

- 4.9 Fits and tolerances as well as boundary dimensions of roller bearings used in axle boxes:

(a) Boundary dimensions of bearing racer and loose lip:

SN	Parts description	Size & Tolerances (mm)	Max. Dia (mm)	Min. Dia (mm)
1	Outer racer	Outer Dia		
		SKF	250.00	249.970
		NEI	250.00	249.970
		FAG	250.00	249.970
2	Lipped / Plain inner ring	Bore		
		SKF	150.00	149.975
		NEI	150.00	149.975
		FAG	150.00	149.975
3	Loose lip	Bore		
		SKF	150.075	150.035
		NEI	150.125	150.085
		FAG	150.100	150.060

(b) Fits with respect to journal dia and housing bore:

Journal Dia(mm)	Inner ring bore(mm)	Theoretical interference fit	Class of fit
150.068Max. 150.043 Min.	150.00Max. 149.975 Min.	0.043mm to 0.093mm (interference fit)	p6
Outer race outer dia(mm)	Housing bore dia (mm)	Fit	Class of fit
250.00Max. 249.970 Min.	250.046 Max. 250.00 Min.	0.0mm to 0.076 mm(slide fit)	H7

4.10 Axle Box Assembly Procedure:

4.10.1 Axle box assembly area should be a *dedicated area* in locosheds/workshops free from dust and dirt.

4.10.2 Apply a thin coating of lead-free corrosion inhibitor like *Anabond Nabakem Long 2-Heavy duty rust preventer* or any other corrosion preventer of similar properties (taking all the precautions as given in manufacturer's manual) on journal fillet and shoulder. Heat up the thrower upto 150 °C & slide it on to the shaft. The thrower must be demagnetized to less than 5 gauss.

4.10.3 Apply *coating of grease (preferably calcium based)* on the labyrinth of thrower & Place the end cover against the thrower. Wipe out excess grease from labyrinth.

4.10.4 During cold pressing apply thin layer of *SAE 30/40 heavy mineral oil* on journal as well as inner side surface of inner racers before mounting.

4.10.5 During assembly of new wheel set the CRU 150 bearing complete unit to be mounted as a set over journal with min. 450 KN force with the help of *hydraulic press*, equipped with control valve.

4.10.6 **Radial clearance:** Radial clearance of bearing should be checked using suitable size feeler gauge. Recommended value of Radial clearance is 0.165 to 0.215 mm.

4.10.7 **Axial clearance:** Axial clearance of bearing should be checked with the help of Magnetic base dial indicator. Recommended value of axial

clearance is 0.400 to 0.700 mm for SKF & NEI make bearings while 0.2 to 0.4 for FAG make bearing).

4.10.8 After mounting the bearing on journal apply end cover & tighten the end cover screws with a torque of 340 Nm using suitable type of torque wrench.

4.10.9 All the fasteners should be tightened as per recommended torque in assembly drawing.

4.11 Axle Box dismounting Procedure:

4.11.1 Remove the front cover & untighten the rear cover bolts and pull out the axle box housing while suspending it with crane.

4.11.2 Remove axle end cap & Withdraw bearing outer ring & roller set, Bearing outer ring to be suspended with crane to avoid any damage due to falling.

4.11.3 Inner racer of bearing should be removed by pulling with *hydraulic press* through thrower.

4.12 List of M&P/Tools required during handling/maintenance of WAG9/WAP7 Axle box:

- i. Internal Micrometer (Bore Gauge is preferable)
- ii. External Micrometer (Snap gauge is preferable)
- iii. Comparator (for checking surface roughness)
- iv. Hydraulic Press
- v. Gauss meter (or magneto meter)
- vi. Fillet gauge
- vii. Feeler Gauge
- viii. Dial Indicator along with magnetic stand
- ix. Grease Gun

5 Quantity and Schedule of Greasing of Axle Box Bearing:

5.1 Re lubrication to be done after a running interval of 150000 KMs or 9 Months whichever is earlier.

5.2 Re lubrication to be only with the grease initially filled into the bearing (*Refer RDSO TC no. 0034 latest revision*).

5.3 Quantity of grease for re-lubrication of axle box bearing will be as below:

Quantity of Grease	M/s SKF	M/s NEI	M/s FAG
Initial Quantity (grams)	470	650	390-430
Top up Quantity(grams) in every IC (9 months) for WAG-9 locos	80-100		
Top up Quantity(grams) in every 6 months for WAP-7 locos (Coinciding with UST schedule)	60 -70		

6 Greasing Procedure:

- 6.1 Angles ring without the provision of threaded hole should be replaced immediately with modified angle rings having threaded hole.
- 6.2 Threaded hole on the angle ring should be used to pull out the angle ring with the help of M6 bolt. After taking out the ring, the condition of the bearing, its roller and inner racer can also be examined to some extent. If the condition of grease, bearing shows sign of heat, metal content etc, the axle box should be overhauled and re greased.
- 6.3 If the condition of bearing is satisfactory then grease quantity as per para 5.0 should be pumped in from sideways where angle ring is installed with the help of small tube 5mm diameter and long enough to penetrate the area between the rollers.
- 6.4 During the process care should be taken so that even smallest ferrous particle should not come in close vicinity of the Axle Box.
- 6.5 Proper record should be maintained.

7.0 Precautions:

- 7.1 Use Grease gun to re-grease the bearing.
- 7.2 Do not use hands to re-grease the bearings.
- 7.3 Do not re-grease the bearing through Grease Nipple provided on the Axle Box as this would increase the possibility of ingress of contamination into the bearing.

8.0 Other Precautions:

- 8.1 While carrying out welding on the locomotive proper precautions should be taken to avoid flow of electrical current through axle box bearing.

- 8.2 Electric Loco shed shall ensure the discipline of provision of earth brushes on the locos.
- 8.3 Zonal Railways to monitor/measure axle box temperature with the help of Temperature Gun on arrival of train at destination, when worked with WAP7 locos. Record for these measurements should be maintained. This is to be done immediately after the train reaches station and action to be taken as under:
- (i) If the temperature rise is noticed more than 20°C above ambient but less than 25 °C above ambient at axle box cover level, loco should be got checked for bearing condition at the earliest opportunity.
 - (ii) If the temperature rise is noticed more than 25°C above ambient at axle box cover level, following action should be initiated:
 - (a) Loco should be withdrawn from service immediately.
 - (b) Axle box should be opened and the condition of the bearing should be checked for investigation

9.0 Instructions for using step size bearing:

- 9.1 In order to use step size bearing, following components have been modified.

Component	Bore diameter (mm) for step size bearing		
	SKF	NEI	FAG
Lipped/plain inner racer	148+0/-0.025	148+0/-0.025	148+0/-0.025
Angle ring (loose lip)	148+0.075/+0.035	148+0.125/+0.085	148.06+0.04/0
End cap	148+0.106/-0.043	148+0.106/-0.043	148+0.106/-0.043 (F8)

- 9.2 **Procurement of modified components:** Procurement of these modified components will be done by the Zonal Railways as a kit from bearing manufacturers.

9.3 Precautions for using step size bearing :

Step size racers with reduced bore diameter look identical to regular racers, although their bore diameter is different (approx. 2mm). To avoid confusion and mixing of step size racers with regular racers, following precautions should be taken:

- 9.3.1 Assembly of CRU150 with step size inner racers (flanged & plain) should be made in pairs. The pairing should be of the same make as the dimensional tolerances of different make can be varied.
- 9.3.2 Both lipped inner racers & plain inner racers should be replaced altogether.
- 9.3.3 Do not rub or mark on bearing for any reason. If any additional marking is required, it may be done without deteriorating the original marking on bearing.
- 9.3.4 Measure journal diameter and bearing inner racer bore before mounting on journal (as per procedure mentioned in bearing OEM maintenance manual)
- 9.3.5 After fitment of complete bearing outer racer of bearing should be rotated by hand to check smooth rotation, if any sluggish movement of outer racer is observed, it may indicate damage on raceway during mounting process or bearing handling.
- 9.3.6 In case where inner racers are heated through induction heater prior to mounting, necessary adjustments may be done in induction coil size to match step size bore diameter. *The increased cross section of step size racers effects the time required to reach desired temperature.* The size of the induction coil should be adjusted to facilitate mounting/dismounting of inner racer on induction heater coil without application of force.
- 9.3.7 Necessary adjustments may be done in tooling/mandrels/fixtures (where applicable) which are used to align/mount inner racer on axles.
- 9.3.8 In addition to the above points (9.3.1 to 9.3.7), adherence to bearing OEM maintenance manual is strongly recommended for storage, handling, transportation, and inspection, preparation for mounting and other related activities.
- 9.3.9 In the event of any observed discrepancy or requirement of further clarity, bearing OEMs may be contacted.

10.0 DO'S and DON'TS:

DO'S and DON'TS of axle box bearing maintenance

10.1 DO'S

10.1.1 Keep your hands clean while handling bearings.

10.1.2 During assembly operations, ensure that absolute cleanliness is maintained.

- 10.1.3 If thrower and inner racers are not being immediately mounted on journal that are ready in all respects, then bearing seat on journals should be protected at all times against possible damage from moisture, dust/dirt or other substances.
- 10.1.4 If wheel and axle assembly is not being immediately fitted in the bogie, turn each axle box a few times every few days to prevent the parts from remaining in the same position for any appreciable length of time.
- 10.1.5 While assembling the axle box after overhauling in major schedules, always inspect for fretting corrosion between inner racer and axle journal. Fretting reduces the solid contact between the inner racer and the journal, causing the inner racer to become loose.
- 10.1.6 While overhauling the axle box in major schedule, always check the axle box bore to ensure it is within prescribed limit.
- 10.1.7 Keep a complete inspection record at the shed at all times using axle box and axle serial no. and axle box location along with make of axle box and bearing on all locos for future reference.
- 10.1.8 Always protect the axle box and its accessories from dirt and dust until reassembly.
- 10.1.9 Ensure periodic calibration of measuring instruments and gauges.

10.2 ***DON'TS***

- 10.2.1 Bearings should not preferably be stored in assembled condition.
- 10.2.2 Do not remove bearing parts from original packings until immediately before assembly.
- 10.2.3 Do not over grease the axle box.
- 10.2.4 Never allow the axle box to run warm continuously without thorough examination.
- 10.2.5 Do not heat the grease to facilitate application.
- 10.2.6 Avoid mixing up of the components of different bearings of make.
- 10.2.7 Never use flame heating or welding torches for extracting the racers/throwers which are to be reused or once again to be put into service.
- 10.2.8 Never compromise with critical dimensions/ tolerances on axle box or bearing.

10.2.9 Avoid use of cotton waste or dirty clothes to wipe the bearings.

10.2.10 Never scratch or nick the bearing critical surface.

10.2.11 In case of improper finish on the bearing seat, it should not be manually polished either in the sheds or workshops as it is likely to cause the ovality on the bearing seat.

11.0 Procurement of Bearing and its Spares:

11.1 Spare bearings are to be procured by Railways from OEMs only.

11.2 The procurement of following bearing components should be done by the Zonal Railways as a kit from bearing manufacturers as per the drawings of CLW:

- (i) Lipped and plain inner racers
- (ii) Abutment ring (thrower) (1 No.)
- (iii) End cap (1 No.)
- (iv) Axle box cover (Earth contact type)
- (v) Axle Box cover (Speedometer type)

11.3 Balance components to be purchased as another kit from bearing manufacturers since consumption pattern of the following is much higher and will be required during every overhauling of the axle boxes.

- (i) 'O' Ring FREUDENBERG 250.0x3.0x72 NBR 1872 (2 Nos)
- (ii) Gasket (1 No.)
- (iii) Socket HD Cap screw M20x50, 10.9E (4 Nos.)
- (iv) Screw Hex.HD.M16x45, 8.8-A3P (12 Nos.)
- (v) Washer VS16 FSt-A3P (12 Nos.)
- (vi) Washer Helical spring VS20 FSt-A3P (4 Nos.)

11.4 Reference Drawings-

- (1) ABB Drawing for Axle Box – complete Bill of Materials Drg. No. IB011-00183-BOM
- (2) ABB Drawing for Axle Box – complete Bill of Materials Drg. No. IB016-00464

12.0 Application to:

Axle Box Bearings of WAP7 & WAG9/9H Electric locomotives.

13.0 Agency of Implementation:

13.1 Electric Loco sheds housing WAP7/WAG9 locomotives, Workshops and CLW.

13.2 Step size axle box bearing will be implemented by electric loco sheds housing WAP7 & WAG9/9H locos and workshops as per the need.

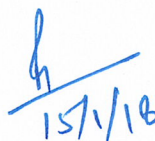
14.0 Periodicity of Implementation:

As mentioned in Clause 5.0, 8.0 & 13.2 above.

15.0 Supersedes:

Technical Circular No. RDSO/2014/EL/TC/0129, Rev '1' issued vide RDSO letter no. EL/3.2.108 (3 - phase) dated 04.12.2015.

Encl: Nil


(Pratibha Gupta)
for Director General/Electrical

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