



भारत सरकार — रेल मंत्रालय  
अनुसंधान अभिकल्प और मानक संगठन

लखनऊ — 226011  
Fax : 91-0522-2465716 & 2452581  
e-mail : dsetmrds@gmail.com

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

Telephone : 2465716 & 2451200 ext.42225



No.EL/2.2.13

Date: 24.12.2013

Chief Electrical Engineer,

1. Northern Railway, Baroda House, New Delhi 110001
2. North Central Railway, Subedarganj, Allahabad (U.P.) - 210033
3. Central Railway, Mumbai CST 400 001
4. Eastern Railway, Fairlie Place, Kolkata 700 001
5. East Central Railway, Hajipur-844001
6. East Coast Railway, Bhubaneswar-751016
7. Southern Railway, Park Town, Chennai-600 003
8. Southern Central Railway, Rail Neelayam, Secunderabad 500 371
9. South Eastern Railway, Garden Reach, Kolkata 700 043
10. South West Railway, Hubli (Karnataka)
11. South East Central Railway, Bilaspur-495004
12. Western Railway, Churchgate, Mumbai 400 020
13. West Central Railway, Jabalpur (M.P.) - 482 001
14. Chittaranjan Locomotive Works, Chittaranjan (W.B.)-713 331

**SPECIAL MAINTENANCE INSTRUCTION NO. RDSO/2013/EL/SMI/0278 (Rev '0')**

**1. Objective:**

Instructions for fitment of traction motor Drive End bearings NU2236 used in 3 Phase traction motors type 6FRA 6068

**2. Brief History:**

- 2.1. Recently, there has been large no. of DE bearing seizures in traction motors fitted in WAP7/WAG9 locomotives on line disrupting the traffic. In addition to this, a large number of failures could be avoided by detection of bearing defects during schedule inspections. Sheds have reported crack in cage, increased cage to roller clearance, rollers coming out during dismantling, etc. RDSO collected the data from sheds and observed around 25% DE bearings are having installed radial clearances (RC), less than 70 micron against a minimum value of 110 micron. Further, this RC reduces during operation due to temperature rise and difference in temperature between inner race and outer races.
- 2.2. Measurement of RC in bearings in mounted condition is cumbersome and therefore Bombardier has recommended an indirect method of measurement of radial play of bearings and recommended limits. For given manufacturing tolerances for the bore of bearing bracket and bearing seating of the shaft, it is not possible to achieve the lower limit with lower value of uninstalled RC of DE bearing (170 micron).

- 2.3. Even at CLW/BHEL/CGL, in some of the cases, measured value of radial play of DE side bearings have been observed out of limits.
- 2.4. Hence, during assembly of DE bearings of traction motors, matching of components are required so that minimum recommended RC can be maintained in installed condition.

### **3. Scope:**

- 3.1. Proper procedure of fitment of bearings (DE & NDE) of traction motors, which includes measurement of radial and axial play of DE bearings and their maintenance. Before providing a traction motor in locomotive, radial and axial play must be measured. During overhauling if traction motors are taken out, their radial and axial play of DE bearings shall be measured and recorded. Further, in order to weed out motors in service with less radial play, temperature measurement shall be carried out.

## **4. Mounting of Bearings :**

### **4.1. Matching of Components :**

- 4.1.1. Measure the un-mounted RC of DE bearing which shall 170 to 220 micron.
- 4.1.2. Measure the outer diameter of the outer racer of the bearing. Measure the bore diameter of the bearing bracket. Interference in the range of 10-25 micron shall be ensured. This can be achieved by ensuring appropriate combinations of bearing and bearing bracket. Record these measurements.
- 4.1.3. Ensure dummy pinion is inserted in the shaft before mounting of inner racer. Measure the bore diameter of inner racer and bearing seat diameter and ensure there shall be interference between 50-65 micron. This can be done by selecting right match of inner racer for a given shaft. Record these measurements.

### **4.2. Fitment of Inner and Outer Racers:**

#### **4.2.1. Inner racer :**

- After following necessary precautions, heat the inner racer upto 120°C and mount the inner racer and hold it in the position till it cools down. Measure the swell of inner racer and record it.

#### **4.2.2. Outer racer :**

- Clean the end frame and all its tapped holes with compressed air/sand paper,
- Fix the expanding Dowel on the hole above the greasing ripple hole by driving the ball of expanding dowel with the help of metallic rod and hammer.
- Insert the grease with grease gun in the re-greasing bore such that the grease just fills the entire bore. Remove the first grease which comes out of the bore, the regreasing hole.
- Clean the inner labyrinth and apply grease on half of the circumference with grease gun.
- Insert the inner labyrinth by matching its slot with the regreasing hole with the help of copper hammer.
- Take the cylindrical roller bearing. Apply grease with grease gun inside the cylindrical rollers. Make it uniform by hand.
- Heat the bearing bracket upto 120°C and insert the outer racer in it
- Clean the bearing cap and apply grease on half of the circumference with grease gun. Assemble the sealing ring.
- Apply the anti-rust compound on the bearing cap and the end frame surface.
- Apply the anti-rust compound all bolts.
- Mount the bearing cap by matching its slot with the re-greasing bore hole.
- Tighten all bolts by torque wrench.

### **4.3. Dismounting of Dummy pinion and mounting of Pinion**

Cordon the area near the traction motor for the safety of men and machine.



#### 4.3.1. Removal of Dummy Pinion

- a. Assemble the oil pressing connections to the Dummy pinion with flexible tubes for oil pressure injection.
- b. Apply a pressure of 1500 bar for about 10 minutes. Apply a pressure of 2000 bars and see if Dummy pinion moves slightly. Insert a wedge in the gap created because of movement of dummy pinion.
- c. Again apply a pressure of 1000 bars, this time the dummy pinion comes out.
- d. Remove the oil injection arrangement and remove the Dummy pinion.

#### 4.3.2. Preparation for Mounting of Pinion

- a. Check the tapered fit for any damages and correct it if necessary. Clean the tapered fit by cloth, paper and thinner. Dry it.
- b. Clean the pinion with paper and cloth and all its holes by compressed air. Pinion must be free of any grease/rust.
- c. Place the pinion in vertical position on a flat horizontal leveled surface. Slide ring gauge on the pinion. Ring gauge shall be as per RDSO's drawing no. SKEL 4991.
- d. Measure the distance between gauge face & pinion teeth face. It should be  $15 \pm 0.3$  mm. If the distance is less than 14.7 mm, pinion is rejected.

#### 4.3.3. Dye Transfer Test (Colour Matching)

- a. The pinion must be in horizontal position on a flat surface. Three lines (2-5 mm thick) along the axis of the pinion at 2, 6 & 10 O' clock position over the complete length of the cone shall be made with blue colour touching up paste.
- b. The Ring gauge has to be put on the cone sliding along 2 O' clock and 10 O' clock lines. DO not move the ring gauge up during the procedure. The 6 O' clock line must not be touched.
- c. When the ring gauge is in the end position, turn it a little bit to the left and right.
- d. Take the ring gauge off, sliding along the 2 O' clock and 10 O' clock lines.
- e. Measure the lengths of the 2 O' clock, 10 O' clock and 6 O' lines of blue print on the ring gauge no. SKEL 4991.
- f. Blue transfer of the 2 O' clock and 10 O' clock positions should be 100% on the pinion gauge along the length. The sum of the lengths of the blue transfer of 6 O' clock position on the ring gauge should be longer than 110 mm.
- g. If both the above conditions are satisfied, the pinion is accepted, otherwise the pinion is rejected.

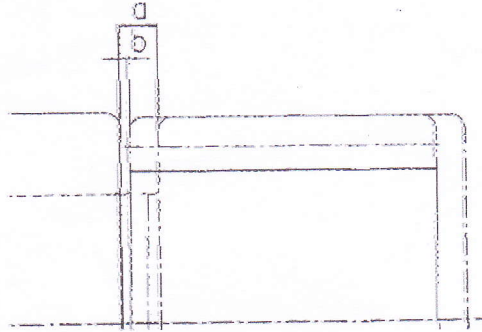
#### 4.4. Colour matching of pinion with shaft taper:

Apply blue colour of thin paste on complete surface of the cone of the pinion shaft and insert the pinion in the shaft, putting together the tally mark on the shaft and pinion. Force the pinion lightly in the shaft. Rotate it little left and right. Take out the pinion carefully and check the status of contact between the pinion and the shaft. Contact area shall be more than 90% of the entire contact area to be actually in contact.

#### 4.5. Mounting of Pinion

- a. Clean the tapered fit by cloth and paper and thinner. Dry it. Clean the pinion with paper and cloth and all its holes by compressed air. Pinion and the shaft bore must be free of any grease/rust/colour.
- b. Mount the pinion on the shaft as per the procedure given in the maintenance manual.
- c. Measure the distance between gauge face & pinion teeth face. It should be  $15 \pm 0.3$  mm (say a). The pinion shall travel 12 mm inside the shaft and after mounting of pinion, it shall be

$$a - b = 12 \pm 0.1 \text{ mm}$$



There shall be a travel of  $12 \pm 0.1$  mm of pinion during application of pressure.

**4.6. Method of measurement of Radial Play in assembled conditioned of traction motor bearing NU2236**

- After following procedures recommended in the maintenance manual, the assembled motor shall be put at plane surface.
- Fix the dial gauge at End frame and position the dial gauge sensor at 40mm away from outer labyrinth as shown in **photograph-1 (as per BT's Doc. No. 3EHM 311886 )**
- Put the jack below the pinion as shown in **photograph-1**.
- Put plain wooden piece between pinion and jack
- Lift the jack till reading become constant and set the needle to zero
- Release the jack to lower the pinion and deflection in the gauge is measured value of radial play and record the value in Table A.

**4.7. Measurement of axial play :**

Axial play shall be measured with the help of dial gauge.

Measure the displacement in dial gauge and noted down in following format:-

Table A						
TM serial no.	Rotor serial no.	No. of teeth of pinion	Pinion Insertion ( a-b)	Measured value of Radial Play	Radial clearance (RC): measured value $\times 0.86$	Axial Play
			$12 \pm 0.1$ mm	Range: 130 to 220 micron	Range: 110 to 190 micron	Range: 180 to 300 micron

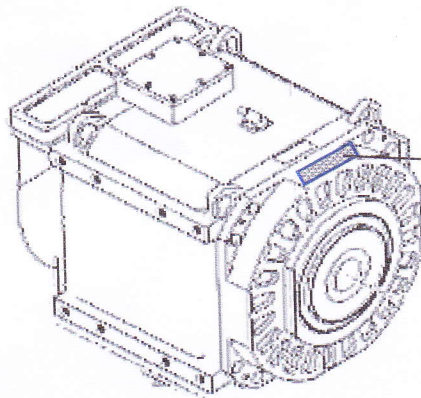
**Note:-** Final value of RC = measured value (dial gauge reading)  $\times 0.86$  (as per BT's doc. No. 3EHM 311886)



**Range of Radial play of DE side bearing , RC of DE/NDE ( both mounted and un-mounted) , axial play bearing and pinion insertion of 6FRA 6068 TM as per BT's Doc. No. 3EHM311886**

- 4.8. **Weeding out Traction Motors with less RC:** In order to weed out traction motors having less RC , following actions are recommended :

- 4.8.1.If traction motors are taken out for overhauling, their radial play shall be measured as recommended in para 4.6 and RC shall be calculated, values shall be within the limits as given in Table A. If RC is below the limit, the traction motor shall be dismantled, matching of components shall be done as recommended in para 4.1.
- 4.8.2.For in situ measurement of temperature, irreversible temperature strips of ranges 40-70°C and 60-100°C are to be pasted on DE of bearing as displayed below :



Location for pasting of  
temperature strip

- 4.8.3.Abnormal temperature rise in any traction motor with respect to other motors shall be investigated. Measure Radial Play on DE bearing. If radial play is found less, the motor is to be dismantled and assembled as mentioned above.

**Caution:** Clean the surface of TM with to make it oil & dust free and dry it .Simply remove the adhesive backing and press the label firmly onto a clean, dry surface. The dots/strips in the middle will darken irreversibly indicating that the maximum temperature has been reached.

**4.9. Checking of Insulation Resistance of NDE Bearings ( NJ320) :**

Rolling bearings in traction motors are at risk from the passage of electric current, which can damage the surfaces of rolling elements and raceways in the bearing and degrade the grease rapidly. The risk of damage increases greatly with frequency converter controlled the motors as in these motors, an additional risk for high frequency bearing currents occurs due to the inherent stray capacitances within the motor.

Outer layer of NDE bearings is provided with a ceramic layer which provides required current insulation and therefore these bearings are sensitive to jerks and blows. Therefore, checking of insulation resistance (IR) of NDE bearing during overhauling schedules and unscheduled repair is mandatory. These bearings are designed to withstand voltage upto 3000VDC. This will help in preventing passage of current from DE bearings and hence fluting phenomenon.

Apply 1000V DC with 1KV Meggar on the bearing insulated coating with respect to the earth and insulation resistance shall not be less than 50 mega- ohm (MΩ).

**5. Application to class of Locomotives:**

WAG9/WAP7 locomotive for traction motors type 6FRA6068

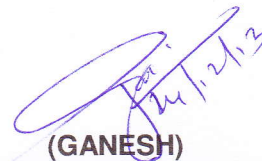
**6. Agency of Implementation:-**

- a. All Electric Loco Sheds, CLW and POH shop.
- b. All approved sources of traction motors type 6FRA6068

**7. Periodicity of Implementation:**

During overhauling/assembly and manufacturing of traction motors

**8. Distribution: As per standard mailing list**

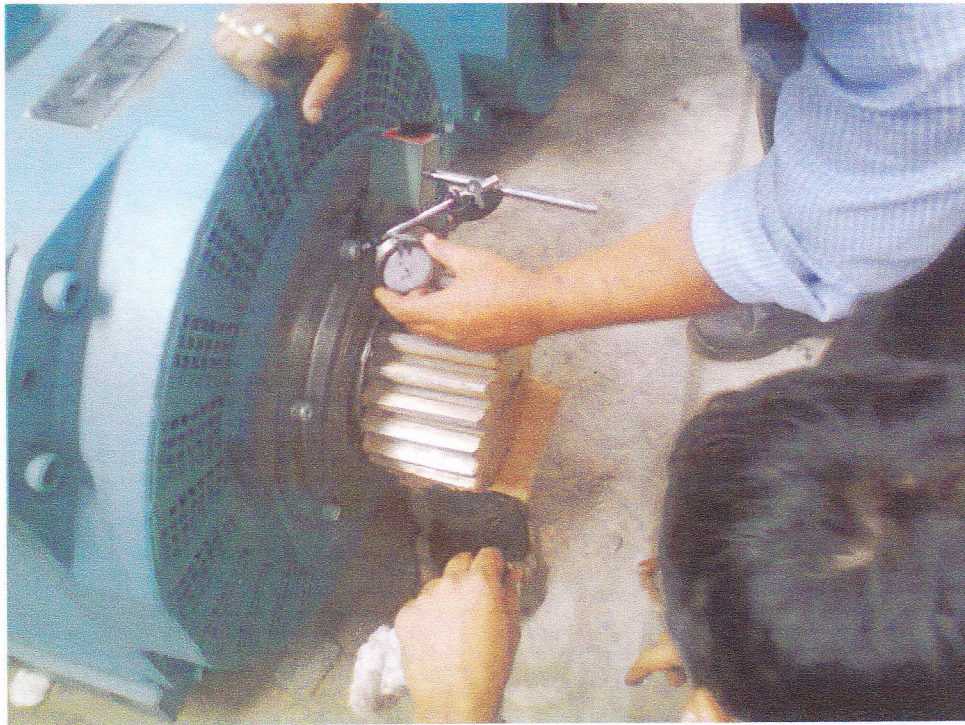


(GANESH)

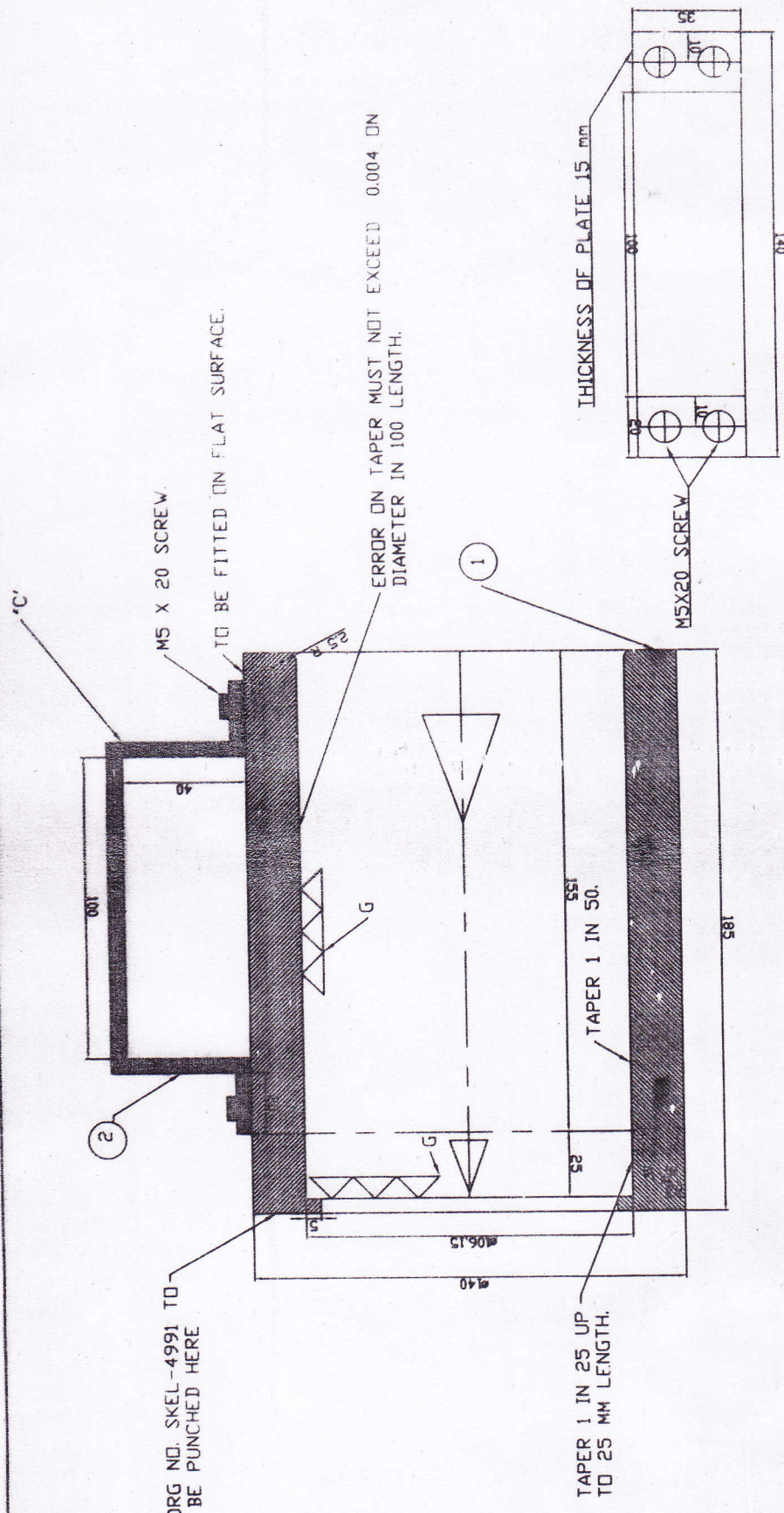
for Director General/Electrical



**Photograph-1: Measurement of DE side radial clearance of traction motor type 6FRA 6068**







- NOTE:
1. THE DIMENSIONS AND TOLERANCE ARE WORKED OUT ON THE BASIS OF MEASUREMENTS TAKEN ON SOME OF THE ORIGINAL PINION SHAFTS USED IN T.M. OF VAG9/WAP7 LOCOMOTIVES.
  2. PLUG GAUGE TO BE FINISHED BY COLOUR MATCHING WITH THE EXISTING ONE OR MORE PINION SAMPLES MAY BE USED FOR THIS PURPOSE.
  3. PLUG GAUGE TO BE FINISHED WITH BEDDING OVER NOT LESS THEN 95-98% OF THE FITTING SURFACE OF THE SAMPLE PINION SHAFT FACE OF THE PINION SHAFT SHALL LIE WITHIN THE DIMENSIONS SPECIFIED.
  4. WHERE NO TOLERANCES ARE SPECIFIED FOLLOW DEVIATION MEDIUM IS2002.
  5. CARBON TOOL STEEL HAVING CARBON PERCENTAGE FROM 0.60 TO 0.90 SHALL BE USED. THIS SHALL BE SUITABLY HARDENED & TEMPERED.
  6. MACHINE ALL OVER IF NOT OTHERWISE SHOWN.
  7. ALL SHARP EDGES TO BE ROUNDED OFF.
  8. SUITABLE WOODEN CASE TO BE USED FOR KEEPING PLUG GAUGE TO AVOID ANY DAMAGE TO BORE TAPER.

# DETAIL OF "C"

2	HANDLE	1	STEEL 13-226
1	PLUG GAUGE BODY	1	STEEL IS1570
REF. NO.	PART NO.	DETAIL DRG. NO.	NO. OF PART
REF. 1	---	SCALE: 1:1	APPROD BY
RING GAUGE FOR PINION OF VAG9/WAP7 LOCOMOTIVES			
RDSO ELECT.DTE			SKEL-4991
FIRST ISSUE			SUPERSEDS
SUPERSEDED BY			