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SPECIAL MAINTENANCE INSTRUCTION NO. RDSO/2018/EL/SMI/0323 (Rev '0') Dated 20.8.2018

1. **Title:** Procedure of measurement of axial clearance and limit of axial clearance for Traction motor type 6FRA6068.

2. **Brief History:**

2.1 Bearing internal clearance is defined as the total distance through which one bearing ring can be moved relative to the other in the radial direction (Radial internal clearance) or in the axial direction (Axial internal clearance).

2.2 Bearing which has axial force taking capability with limited axial movement is defined as locating bearing. Bearing which has capability to slide freely as shaft expands is defined as non-locating bearing.

2.3 Axial Play of traction motor (axial movement of shaft relative to frame) is dependent upon limited axial movement/ axial clearance of locating bearing. In case of 6FRA6068 traction motor Non Drive End (NDE) bearing i.e. NJ320 along with angle ring HJ320 is used as a locating bearing. Drive End (DE) bearing NU2236 is non-locating bearing in which inner race is free to slide axially under rollers and has no roll in defining axial play of traction motor. Axial Play of traction motor type 6FRA6068 is governed by total axial clearance of locating bearing type NH320 only.

2.4 Axial clearance of 180µ -300µ is specified in ABB's Document No. 3EHM 311886 (Motor Assembly) & 3EHM 211758 (Bearing assembly) for traction motor type 6FRA6068. SMI-0278 dated 24.12.2013 also prescribes same limits of axial clearance for TM type 6FRA6068.

2.5 M/s BHEL had informed that limit of 180µ -300µ is axial clearance at inner race only and they are getting axial clearance higher than 300µ in most of the traction motors manufactured.

2.6 To discuss the issue in detail, a meeting was held at RDSO on 27.07.2018 with traction motor and bearing manufacturers.

2.7 During the meeting it was found that the various manufacturers are following different methods for measurement of axial clearance.

2.8 During the meeting, both bearing manufacturers M/s Schaeffler and M/s SKF had informed that the specified limit of 180µ -300µ is axial clearance on the inner ring only as per DIN 43283 and total value of axial clearance of bearing will be sum of the axial clearance of rollers with outer ring and axial clearance of rollers with inner ring.

2.9 As per M/s SKF for their design, total axial clearance of complete bearing assembly including inner ring as well as outer ring will be between 210µ - 400µ.

2.10 As per M/s Schaeffler for their design, total axial clearance of complete bearing assembly including inner ring as well as outer ring will be between 200µ -395µ.

2.11 Limit of axial clearance of bearing as declared by M/s SKF and M/s Schaeffler are as follows:

Sl. No.	**Make**	**Designation**	**Total axial clearance of NDE bearing (microns)**
1	SKF	NJ320E-CM/P64VA3091+ HJ320EC.VA301	210 to 410
2	FAG	NJ320-E-XL-M1-F1-J20A-C4+HJ320-E-F1	200 to 395

2.12 It was also informed by bearing manufacturers that during measurement if motor is completely lifted from ground (i.e.) inclined at 50-55 degree, then rollers of bearing may tilt and net axial play will be much higher as indicated below:

Sl. No.	Make	Designation	Total axial clearance of NDE bearing (microns)
1	SKF	NJ320E-CM/P64VA3091+ HJ320EC.VA301	550
2	FAG	NJ320-E-XL-M1-F1-J20A-C4+HJ320-E-F1	650

2.13 Thus, proper procedure for measurement of axial clearance is very important.

3. **Object:**
To define the procedure of measurement of axial clearance and limit of axial clearance for Traction motor type 6FRA6068.

4. Modified Instructions:

4.1 Dial gauge to be placed on the outer face of the pinion and following procedure recommended by bearing manufacturers to be adopted for proper measurement of axial clearance:

Chronology	Activities	Observation	Position
Shift rotor to one extreme position **(Step-1)**	Lift horizontally placed motor from DE side by 20^0 to 30^0 and put it back to horizontal position & than set dial to '0' position.	At this stage, Rotor will shift towards NDE side completely	
Re-confirming the rotor extreme position. **(Step-2)**	Again lift the motor from DE side by 20^0 to 30^0 and slowly put it back to horizontal position.	Dial shows deflection when TM is lifted but returns to zero when TM is brought back to horizontal position.	
Moving the rotor to other extreme position. **(Step-3)**	Lift the motor from NDE side by 20^0 to 30^0.	Dial gauge deflection indicates 'Total axial movement of rotor' i.e. axial clearance of bearings including effect of tilting of rollers, radial clearance and elastic deformation of components	

Chronology	Activities	Observation	Position
Final measurement of axial clearance **(Step-4)**	Lower the motor gradually back to horizontal position.	Dial gauge will retract partially. Dial gauge reading when motor is again back to horizontal position is actual axial clearance of the motor. It minimizes the impact arising from tilting of rollers, radial clearance and elastic deformation of components.	

4.2 Overhead Crane is presently used for lifting of traction motor for measurement of axial clearance. As lifting by crane may cause jerk on the motor, it is recommended to develop and use a fixture with hydraulic lifting/lowering arrangement to gradually lift traction motor by 20^0 to 30^0 and then lowering it gradually back to horizontal position both from drive end and non-drive end.

4.3 **As per recommendations of M/s Schaeffler and M/s SKF**, **the range of axial clearance for traction motor type 6FRA6068 is revised from existing 180µ - 300µ** (specified in ABB's Document No. 3EHM 311886 & 3EHM 211758 and Special Maintenance Instruction (SMI) number RDSO/2013/EL/SMI/0278 (Rev. '0') dated 24.12.2013) **to 200µ - 400µ**.

5. **Application class:**
Applicable to Traction motor type 6FRA6068 used in WAG-9/WAG-9H/WAP-7 class of locomotives.

6. **Agency of Implementation:**
All Electric Locomotive sheds/Workshops/Traction Motor manufacturers.

7. **Periodicity of Implementation:**
During measurement of axial clearance of traction motor type 6FRA6068 after assembly.

Encl: nil

20.8.18

(P. K. Saraswat)
for Director General/Electrical

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