

**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
RESEARCH DESIGNS & STANDARDS ORGANISATION
Manak Nagar, Lucknow-226011
Fax 0522-2452581**

No.EL3.2.172

Dated 28.10.2004

**SPECIAL MAINTENANCE INSTRUCTION
No. ELRS/SMI/ 0220-2000 (Rev '1')**

1. **TITLE** : Preventive measures to arrest the failures due to breakage of M16 X 40L Hexagonal head bolts of CE outer bearing stopper on HS 15250 A Traction motors.

2. **BRIEF HISTORY** :

In the year 2000, Railways had reported cases of failures of commutator end armature bearing type NH-324 of traction motors type HS-15250A due to the shear-off/breakage of Hex. Head bolts size M16x35L. After investigation and discussion with traction motors manufacturers, RDSO issued SMI 0220-2000 (Rev'0') which mainly covered increase in bolt length from 35 mm to 40 mm.

3. **OBJECTIVE AND ANALYSIS** :

Recently ER, NCR and SR have reported cases of breakage of the bolts M 16x 40 L of CE outer bearing stopper. Detailed discussions and investigations have been carried out with sheds. The incidence of failures have been found to vary from shed to shed. The pattern of failures near head portion of the bolts points out to loosening of bolts and subsequent breakage due to bolt getting stuck with the CE bearing cover which has a clearance of 3 mm from the top of bolt head. Various possible causes of the failures have been examined and the following actions are advised:

- i) The hexagonal head bolts size M 16x40 L are locked using triangular locking plate to Hitachi drawing no. 10S778-664 Alt D. The material specified as per JIS G3141(Grade SPCC -1T) should be having hardness value 85 and over H_RB. Since hardness grade of the alternate material (IS- 513 'O' grade) is not specified in the drawing , there is possibility of soft material being used for the plate. This will make locking arrangement ineffective and can cause excessive pressing of the plate during tightening. The margin on edges of the locking plate is also found insufficient to properly bend and lock the bolts. A new RDSO drawing No. SKEL 4686 has therefore been prepared showing the increase in the margins of the locking plate and also specifying the hardness Grade "H" to IS : 513, 'O' grade with minimum hardness value of 85 H_RB as alternate material.

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- ii) Sometimes the bolts procured are not as per IS 1364 -1992, Part-2, Grade A-8.8 P. The bolts should be procured strictly to the above specification and 8.8 P property class.
- iii) It was suggested by some of the Railways that the torque of 10-12 kgf.m is not sufficient and the torque may be increased to 21 kgf.m as suggested by M/s Unbrako. This aspect has been studied. The torque of 21 kgf.m is the maximum value reachable for class 8.8 P fasteners. For the present application, the torque of 10-12 kgf.m specified by the OEM should suffice. However the torque is being slightly increased to 15-16 kgf.m in place of 10-12 kgf.m.
- iii) The seat dimension of outer bearing stopper (CE end) of (100.118+ 0/0.054 mm) is critical from fitment point of view and needs to be strictly maintained by ensuring the quality of this component.
- v) Some Railways have reported that the depth of the holes in armature shaft sometimes is not sufficient to accommodate the complete length of the bolt. This may lead to over tightening and subsequent breakage of the bolt. The depth of the holes in shaft may, therefore, be increased by 5 mm.

4. **MODIFIED INSTRUCTIONS:**

- i) Procure Lock Washer (triangular locking plate) as per new RDSO drawing no. SKEL 4686. Ensure proper hardness as specified in above RDSO drawing .
- ii) CLW to increase depth of holes in armature shaft drawing by 5 mm and circulate the modified drawing to Railways.
- iii) Ensure that proper property class of bolts of 8.8 P to IS 1364-Part 2 is procured.
- iv) Ensure proper dimensions of outer bearing stopper, specially 100.118+ 0/0.054 mm.
- v) Apply a coat of thread locking compound – Loctite 222/ANR-124 on the thread portion of bolts.
- vi) Refit the Hex Hd. Bolts in their position along with the triangular locking plate and tighten all three bolts at the specified torque of 15-16 Kgf.m by torque wrench.
- vii) Relock the Hex. Hd. Bolts head face by bending the three edges of triangular locking plate against the flat edges of Hex. Head bolts size M16x 40L.
- viii) Refit the 'CE' bearing cover as per usual process. A clearance of minimum 3 mm must be maintained between the top face of CE bearing cover and Hex. Head face of the bolts.

5. **APPLICATION** : Traction motor type HS 15250A/HS 1050Er fitted on WAG5, WAG7, WAP4 and WCAM3 class of Electric Locomotives.

6. **MATERIAL REQUIRED** :

- Thread locking compound Loctite 222/ANR124.
- Hex. Head bolts size M16x40L as per IS 1364 of 1992 Part 2 Grade A-8.8P.
- Triangular locking plate as per new RDSO Drg. No. SKEL 4686 (**copy enclosed**).
- Torque wrench 0-30 Kgf.m

7. **MATERIAL RENDRED SURPLUS** :

- Existing Lock washer to Hitachi drawing no. 10S774-664 Alt. D.

8. **REFERENCE** :

- Detailed discussions carried out with Electric loco sheds and also discussion with traction motors manufacturers.

9. **MODIFIED OR NEW DRAWING** :

New RDSO Drawing no. SKEL 4686 for Lock washer (Triangular Locking plate) in place of existing Hitachi drawing no. 10S774-664 Alt.D.

10. **AGENCY OF IMPLEMENTATION** :

- All Electric Loco Sheds.
- All traction motor manufacturers & CLW.
- All POH/Repair Workshops.

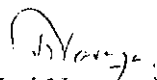
11. **PERIODICITY OF IMPLEMENTATION** :

- During AOH/IOH/POH

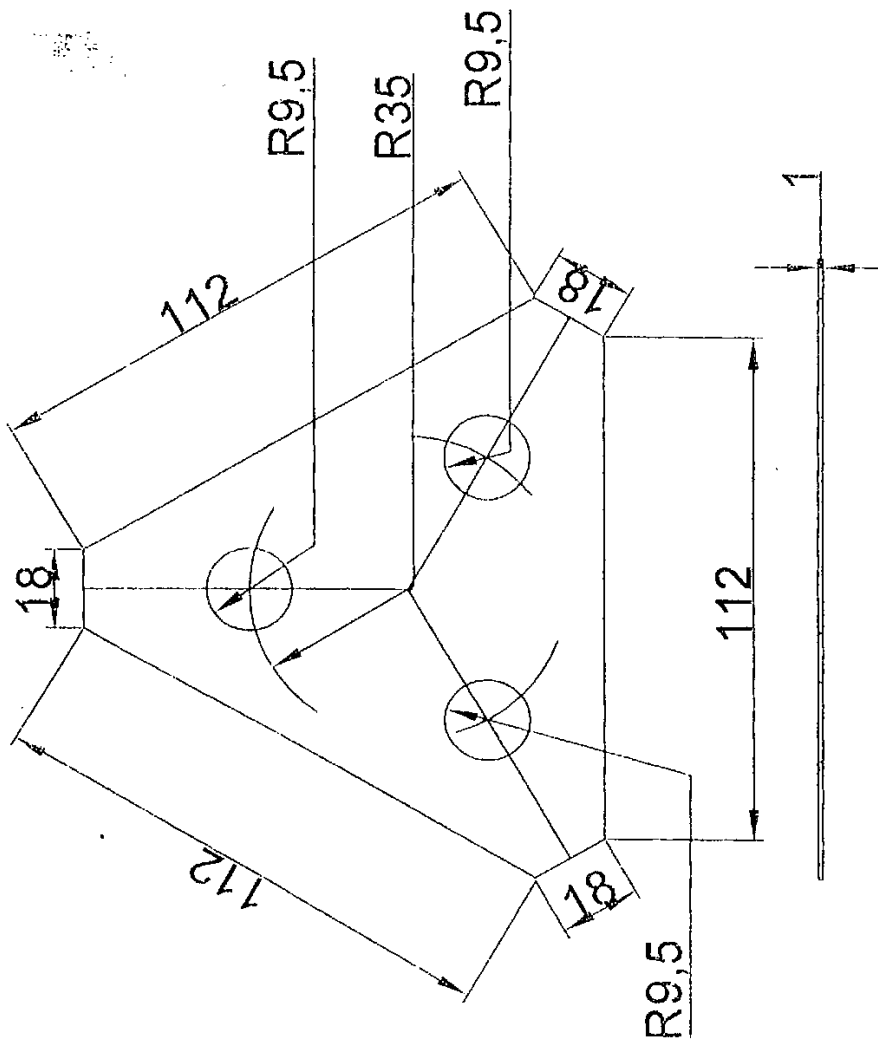
OR

Wherever the failure of M16X40 L bolts of CE end outer bearing stopper occurred due to the shear-off/ breakage of its locking Hex. Head Bolts in service.

Encl.: RDSO Drg. No.SKEL 4686


(Hari Narayan)
for Director General (Elec)

Copy to: As per Standard Mailing List No. EL/M/0019



NOTE:-

1. ALL DIMENSIONS ARE IN M.M.
2. ALTERNATE MATERIAL TO IS:513-1994,"O" GRADE, HARDNESS "H" (85HRB Min.).
3. COMPONENT TO BE ZINC PLATED(GALVANISED).

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STATUS	ALT	REF.NO.	DESCRIPTION	APPD.BY	DATE

LOCK WASHER	6	SPEC-1T	JISG3147
REF.NO. PART NO.	DESCRIPTION	DETAIL DRG. NO	NO/LOC MATL. SPEC.
Hitachi drawing REF. no. 10S778-664	SCALE: NTS.	APPD. BY	(FOR DGI)
LOCK WASHER COMMUTATOR END	FIRST ISSUED -		
FOR HS-15250 TRACTION MOTOR	SUPERSEDES -		
RDSO. ELECT.DTE	SKEL-4-686	SUPERSEDED BY -	