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No. EL/3.2.21

Dt. 18.10.2017

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- 3 South Eastern Railway, Garden Reach, Calcutta-700 043
- 4 Central Railway, Mumbai CST-400 001
- 5 Western Railway, Churchgate, Mumbai-400 020
- 6 Southern Railway, Park Town, Chennai-600 003
- 7 South Central Railway, Rail Nilayam, Secunderabad-71
- 8 East Central Railway, Hazipur (Bihar)
- 9 East Coast Railway, BDA Colony, Rly Complex, Bhubaneswar-751016
- 10 South East Central Railway, Bilaspur-495 004
- 11 West Central Railway, Jabalpur-482 001
- 12 North Central Railway, Block 'A', Subedarganj, Allahabad-211 033
- 13 North Eastern Railway, Gorakhpur-273 001
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SPECIAL MAINTENANCE INSTRUCTION NO. RDSO/2017/EL/SMI/0317 **(REV. '0') - dated 18.10.2017**

1.0 Title:

Maintenance practice for improving reliability of Cable Head Termination System with Vertical Receptacle for 25 kV AC LOCO/EMUs and High Voltage Cable with Plug for 3-Phase AC Electric Locomotive.

2.0 Background:

Failures of cable head termination system have been reported by user Railways i.e. CR, SCR, ECoR and SECR, based on which a meeting was convened at RDSO, Lucknow with OEMs of cable head termination system and user Railways on 11.08.2017 to chalk out action plan to improve reliability. Accordingly, this SMI is issued to standardise out maintenance activities on CHTs by Railways. This SMI supersedes earlier issued SMI no. EL/3.2.21 dated 12.01.1998.

2.0 Object:

The purpose of this special maintenance instruction is to prescribe correct method to be undertaken by Railways to carry out maintenance activities of CHTs during major/minor schedules.

3.0 Application:

- a. **Cable Head Termination System with Vertical Receptacle for 25 kV AC LOCO/EMUs:** - The cable head termination system uses XLPE cable; hence there is no oil leakage or fire hazards. The system provides easy connection &

disconnection of Loco termination. The pre-molded accessories used in this system are pre-tested in the factory prior to installation on cable. This provides quality, reliability consistency and excellent performance.

- b. **High Voltage Cable with Plug for 3-Phase AC Locomotive:-** Limited fire hazards electrical installation cable has dual wall insulation, low smoke, halogen free, flame retardant, excellent resistance to high and low temperature, oil, ozone, weathering and abrasion, easily strippable.

4.0 **Brief History:**

- a. **Cable Head Termination System with Vertical Receptacle for 25 kV AC LOCO/EMUs:** The cable head termination system consists of following components and their functions are given below. Each components is listed in the Drawing no. SKEL-4529 for locomotives and Drawing No. SKEL-4526 for AC EMU available in RDSO specification no. ELRS/SPEC/BL/0003 (Rev.1).

- i) **Bushing:**

The purpose of bushing is to connect transformer lead coming inside the turret to outside cables.

- ii) **Straight Receptacle:**

The function of straight receptacle is to provide creep path on bushing and insulate it from live portion. The external surface of straight receptacle is at earth potential.

- iii) **Roof Termination:**

The roof termination consists of one stress cone and fourteen grey modules and crimp lugs. The termination provides path for intake supply onto the cable connector to bus-bar.

- b. **High Voltage Cable with Plug for 3-Phase AC Locomotive:**

High voltage cable with plug assembly is unique inter-connecting system between Loco roof mounted high voltage bushing and bottom mounted traction transformer bushing of Locomotive. This system is fitted inside of the engine room and it is continuously operating at 25 kV OHE high voltage system.

5.0 **Installation of New or Maintenance of existing CHT:**

- i) CHT must be kept duly covered to avoid any dust particle entering to CHT.
- ii) CHT must be disconnected from bushing and removed from roof top plate rubber bush before the engine roof is lifted for other maintenance, to avoid damage to Modules, Self Bonding Tape on outdoor end & Earthing Shunt.
- iii) CHT must be tapped with silicon anti tracking tape only and No PVC tape to be used on crimp connector.
- iv) Bushing must be cleaned properly with CTC (Carbon Tetra Chloride) and silicon grease must be applied regularly. No local grease is to be used.
- v) Venting rod supplied with each CHT set must be preserved for repeated use of Receptacle sliding over bushing converter.
- vi) S.S. clamp of receptacle must be tightened after the CHT is charged.
- vii) Cable support clamps must be tightened after the CHT is connected on both the ends.
- viii) CHT must be connected without any tension on the cable to avoid flashing of CHT in the running condition of the train.
- ix) Modules must be cleaned with CTC, to avoid dust collection on it.
- x) Healthy Lightning Arrester (LA) must be in service, as failed LA on engine leads to burning of earthing shunt of CHT due to heavy fault current passing through it.
- xi) ET-2 air gap must be checked regularly to avoid failure of electrical items against Lightning stroke.
- xii) New CHT must be tested on dummy turret filled with good quality of transformer oil to avoid failure of CHT at the time of initial charging.

6.0 Installation of New or Maintenance of existing High Voltage cable with Plug:

a. Roof Side Connection:

- i) For connecting high voltage with plug assembly on the roof side ensure that the electro beam earthing lead of 250 mm length is at roof.
- ii) Clean the high voltage bushing interface portion with dry cotton and apply sufficient quantity of Silicon grease and also applied Silicon grease on the inner side of Elbow.
- iii) Clean the basic insulating plug with dry cotton cloth and apply sufficient quantity of Silicon grease.
- iv) Insert the bushing interface in Elbow.
- v) Fit the cap on basic insulating plug.
- vi) Connect the electro beam earthing lead to the nearest available earth point within the engine room at roof side.

b. Transformer Side Connection:

- i) For connecting high voltage with plug assembly on transformer side ensure that the electro beam earthing lead of 450 mm length is at transformer side.
- ii) Clean the transformer bushing interface portion with dry cotton and apply sufficient quantity of Silicon grease and also apply Silicon grease on the inner side of Elbow.
- iii) Clean the basic insulating plug with dry cotton cloth and apply sufficient quantity of Silicon grease.
- iv) Insert the transformer bushing interface in Elbow.
- v) Fit the cap on basic insulating plug to insulate the live point.
- vi) Connect the electro beam earthing lead to the nearest available earth point within the engine room at roof side.

7.0 Removal of CHT System:

- i) At outdoor side (on roof top) all the electrical connection must be disconnected and cable support clamp of CHT should be removed before lifting the Locomotive roof top.
- ii) Remove Rubber Bush provided in pipe of S.S. plate at the entrance of roof top.
- iii) At indoor side, remove the earthing connection and cable support clamp.
- iv) Then slide the receptacle upward side by loosening the S.S. clamp provided on receptacle.
- v) Then disconnect the Lug from turret bushing converter and cover the receptacle and bushing converter of turret with plastic cover to avoid dust & moisture.

8.0 Removal of High Voltage Cable with Plug:

- i) First de-energised the Locomotive.
- ii) Remove the earthing at roof side of electro beam earthing lead of high voltage cable with plug assembly.
- iii) Remove the cap on basic insulating plug.
- iv) Loosen the basic insulating plug inserted to Elbow at roof side and remove the same, then slowly take down the Elbow.
- v) At transformer side remove the electro beam earthing lead of high voltage assembly at bottom side.
- vi) Then loosen the basic insulating plug inserted to Elbow at transformer side and remove the same, then slowly remove the Elbow from the transformer bushing.

9.0 Maintenance activities during major/minor schedules of CHT (Loco):

S.No.	Activities	IA	IB	IC	AOH	IOH	POH
1	Check to tightness of nuts & bolts at both of the termination, do tight if required.	✓	✓	✓	✓	✓	✓
2	Check the tightness of earthing shunt, do tight if required.	✓	✓	✓	✓	✓	✓
3	Clean grey modules with wet cotton cloth. Let the modules dry.	✓	✓	✓	✓	✓	✓
4	Check ET2 air gap and earth connection, do tight if required.	✓	✓	✓	✓	✓	✓
5	Check for the condition of rubber bush sealing point at the roof plate, re-seal/ replace if required.	✓	✓	✓	✓	✓	✓
6	Check for the tightness of nuts & bolts of roof top plate, SS cable support device, do tight if required.	✓	✓	✓	✓	✓	✓
7	Check the tightness of earthing lead, do tight if required.	✓	✓	✓	✓	✓	✓
8	Check for the tightness of nuts & bolts of cable support, do tight if required.	✓	✓	✓	✓	✓	✓
9	Check tightness of Al. flange, do tight if required.	✓	✓	✓	✓	✓	✓
10	Check tightness of transformer lead, do tight if required.	-	-	-	✓	✓	✓
11	Check the transformer lead support device fitment, tight it if required.	-	-	-	✓	✓	✓
12	Ensure the turret is full of oil for this, lose the vet to and let the oil come out, release the air trapped in turret oil whenever the turret filled with oil. Tight the vent and remove the oil by cloth.	✓	✓	✓	✓	✓	✓
13	Clean complete cable head termination system with dry cloth inside LOCO	✓	✓	✓	✓	✓	✓
14	Avoid to open CHT from bushing fitted with turret top cover.	✓	✓	✓	✓	✓	✓
15	While opening roof please make sure that no sharp edge towards CHT.	✓	✓	✓	✓	✓	✓
16	Opened CHT (if not avoidable) must be kept in dust free environment.	✓	✓	✓	✓	✓	✓
17*	Must make sure the use of silicon grease recommended by respective OEMs at stress cone area of separable connector at the time of Re-fixing of CHT.	-	-	-	✓	✓	✓
18	Check for tightness of nuts & bolts at both ends of copper plate point.	✓	✓	✓	✓	✓	✓
19	Check for proper earthing of roof top termination.	-	-	✓	✓	✓	✓
20	Check the wear & tear of self bonding tape and Silicon tape at earthing terminals and outdoor crimp connector.	-	-	-	✓	✓	✓

21	Check for the earthing of vertical receptacle point.	-	-	✓	✓	✓	✓
22	Wipe out the old silicon grease of vertical receptacle inside and bushing converter with dry cloth and apply new grease.	-	-	-	✓	✓	✓
23	Check cleaning of cable adaptor with dry cloth and apply silicon grease.	-	-	-	✓	✓	✓
24	Check tightness of SS clamp on vertical receptacle bushing end.	-	-	✓	✓	✓	✓
25	Clean complete CHT with dry cotton cloth.	✓	✓	✓	✓	✓	✓

10.0 Maintenance activities during major/minor schedules of CHT (EMU):

S.No.	Activities	IA	IB	IC	AOH	IOH	POH
1	Check to tightness of nuts & bolts at both of the termination, do tight if required.	✓	✓	✓	✓	✓	✓
2	Check the tightness of earthing shunt, dot tight if required.	✓	✓	✓	✓	✓	✓
3	Clean grey modules with wet cotton cloth. Let the modules dry.	✓	✓	✓	✓	✓	✓
4	Check ET2 air gap and earth connection, do tight if required.	✓	✓	✓	✓	✓	✓
5	Check for the condition of rubber bush sealing point at the roof plate, re-seal/ replace if required.	✓	✓	✓	✓	✓	✓
6	Check for the tightness of nuts & bolts of roof top plate, SS cable support device, do tight if required.	✓	✓	✓	✓	✓	✓
7	Check the tightness of earthing lead, do tight if required.	✓	✓	✓	✓	✓	✓
8	Check for the tightness of nuts & bolts of cable support, do tight if required	✓	✓	✓	✓	✓	✓
9	Check tightness of Al. flange, do tight if required.	✓	✓	✓	✓	✓	✓
10	Check tightness of transformer lead, do tight if required.	-	-	-	✓	✓	✓
11	Ensure the turret is full of oil for this, lose the vet to and let the oil come out, release the air trapped in turret oil whenever the turret filled with oil. Tight the vent and remove the oil by cloth.	✓	✓	✓	✓	✓	✓
12	Clean complete cable head termination system with dry cloth inside EMU.	✓	✓	✓	✓	✓	✓
13	Avoid opening CHT from bushing fitted with turret top cover.	✓	✓	✓	✓	✓	✓
14	While opening roof please make sure that no sharp edge towards CHT.	✓	✓	✓	✓	✓	✓
15	Opened CHT (if not avoidable) must be kept in dust free environment.	✓	✓	✓	✓	✓	✓
16	While opening CHT (if not avoidable), take care for Re-fixing as per manual.	-	-	-	✓	✓	✓

17*	Must make sure the use of silicon grease recommended by respective OEMs at stress cone area of separable connector at the time of Re-fixing of CHT.	-	-	-	✓	✓	✓
18	Check for tightness of nuts & bolts at both ends of copper plate point.	✓	✓	✓	✓	✓	✓
19	Check for proper earthing of roof top termination.	-	-	✓	✓	✓	✓
20	Check the wear & tear of self bonding tape and Silicon tape at earthing terminals and outdoor crimp connector.	-	-	-	✓	✓	✓
21	Check for the earthing of vertical receptacle point.	-	-	✓	✓	✓	✓
22	Check tightness of bushing converter and crimp connector of vertical receptacle.	-	-	-	✓	✓	✓
23	Wipe out the old silicon grease of vertical receptacle inside and bushing converter with dry cloth and apply new grease.	-	-	-	✓	✓	✓
24	Check cleaning of cable adaptor with dry cloth and apply silicon grease.	-	-	-	✓	✓	✓
25	Check tightness of SS clamp on vertical receptacle bushing end.	-	-	✓	✓	✓	✓
26	Clean complete CHT with dry cotton cloth.	✓	✓	✓	✓	✓	✓

* Railways must ensure the use of Silicon grease as recommended by respective OEMs i.e. for M/s SSIPL- Grade SS/PFR/SG-1, HV special grease make "Pifisterer" and for M/s EIPL- Thomas and Betts.

11.0 Maintenance activities during major/minor schedules of High Voltage with Plug:

S.No.	Activities	IA	IB	IC	AOH	IOH	POH
1	Check for tightness of insulating plug by opening of cap tight the same if required and re-fix the cap both side of the cable.	✓	✓	✓	✓	✓	✓
2	Check the tightness of earthing lead, dot tight if required.	✓	✓	✓	✓	✓	✓
3	Clean the high voltage cable and T-connector housing with dry cotton cloth.	✓	✓	✓	✓	✓	✓
4	Remove the oil around the T-connector housing, this place must be clean and dry.	✓	✓	✓	✓	✓	✓
5	Avoid to open CHT from bushing checking of tightness is sufficient subject to there is no any visual defect on T-connector.	✓	✓	✓	✓	✓	✓
6	Ensure that opened high voltage cable with plug must be kept in dust free environment.	-	-	-	✓	✓	✓
7	In any case of re-fixing of T connector, please make sure the all parts of high voltage cable with plug must be dust free, clean the stress cone area , T connector housing and re-grease both of them before fixing.	-	-	-	✓	✓	✓

8	Ensure, when re-fixing the high voltage cable, at first the alloy stud should be tight by hand, then align the cable thimble through T housing with the stud hand fitted in bushing after then insert the insulating plug and push it with revolving with hand palm (Hatheli), tight the same and fix the cap (semiconductor part of the T-connector).	-	-	-	✓	✓	✓
9	Check the tightness of BIP with HV bushing placed on roof.	✓	✓	✓	✓	✓	✓
10	Check the tightness of BIP with transformer bushing.	✓	✓	✓	✓	✓	✓
11	Check the tightness of electro beam earthing lead at roof side and transformer side.	-	-	✓	✓	✓	✓
12	Check the cleaning and greasing of Elbow.	-	-	-	✓	✓	✓
13	Check the cleaning and greasing of transformer bushing.	-	-	-	✓	✓	✓
14	Check the cleaning and greasing of HV bushing.	-	-	-	✓	✓	✓

12.0 Replacement:

CHT assembly should be replaced as per Amendment No. 1 to Technical Circular No. RDSO/2013/EL/TC/0123 (Rev. 0) dated 16.05.2013 circulated vide RDSO letter no. EL/3.6.1 dated 23.09.2014.

13.0 Application:

All AC electric Locomotives/EMUs fitted with Cable Head Termination & High Voltage with Plug arrangement.

14.0 Agency of Implementation:

All Electric Loco/EMU Sheds, shops and production unit.


15.0 Periodicity of Implementation:

Minor schedule inspections/AOH/IOH and POH overhauling schedules/any other unscheduled maintenance.

16.0 Distribution:

As per standard mailing list.

DA: As above.


 18/10/17
 (Suresh Chandra)
 Director/QA(Elect.)
 for Director General/ QA(Elect.)