सत्यमेव जयते

भारत सरकार – रेल मंत्रालय
अनुसंधान अभिकल्प और मानक संगठन
लखनऊ – 226011
Tele/Fax : 2465754
e-mail : dse4cs@gmail.com

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

No. EL/3.1.10/1

Date: 15.02.2016

Chief Electrical Engineer,

1. Central Railway, Mumbai, CST-400 001.
2. East Central Railway, Hazipur-844101.
3. East Coast Railway, Chandrashekharpur, Bhubaneshwar-751016.
4. Eastern Railway, Fairlie Place, Calcutta-700001.
5. North Central Railway, Block-A, Subedarganj, Allahabad- 211033.
6. Northern Railway, Baroda House, New Delhi-110001.
7. South Central Railway, Secunderabad-500 071.
8. South East Central Railway, Bilaspur-495004.
9. South Eastern Railway, Garden Reach, Calcutta-700 043.
10. Southern Railway, Park Town, Chennai-600 003.
11. West Central Railway, Jabalpur-482001.
12. Western Railway, Churchgate, Mumbai-400 020

MODIFICATION SHEET No. RDSO/2016/EL/MS/0448 Rev. '0', Date 15.02.2016

Title: Modification to the cabs of 25 kV conventional Electric Locomotive (WAP-4 & WAG-7) for noise reduction.

Object:

1.1 The noise environment in the locomotive cab has been in the focus of Indian Railways recently. Long exposure to high level of noise not only affects the efficiency of the loco pilot but also accelerates the time taken to reach the fatigue level.

1.2 The noise environment of a locomotive cab is the result of the contributions from many sources. Sound is transmitted to an operator's ears via an air-borne path and vibration is transmitted through the structure. A sealed window and door will break the sound path from airborne noise generated outside the cab, resulting in significant noise reduction. The noise generated through vibration is controlled using sound dampening methods and the noise in the cab is reduced by acoustic absorbent material.

1.3 Use of different noise reduction methods (air sealing, sound absorption, damping and deadening) were tried out in the cabs of loco no. 22622 (WAP-4) locomotive at POH workshop Charbagh/Lucknow. After modification, noise level was reduced to acceptable limit under normal operating conditions.

1.4 This modification will bring down the noise level in cabs of conventional electric locomotives (WAP-4 & WAG-7) to international standard.

2.0 Existing data/condition: The measurement of noise level has been carried out inside the cab electric locomotives during run with all doors and window closed and it was found that the noise level in the cab of conventional electric locomotives is 4 to 5 dB above, the specified limit 85 dB as per Code of Federal Regulation (CFR-49) Pt. 229.121(a).

3.0 Modification: The following work is required to be carried out:-

(a) Air sealing of cab:-

(i) Sealing of all panels/partition door/cab entry doors by Nitrile rubber foam of thickness 3mm or 6mm as required.

(ii) Plugging of all holes in the cab for pipes/cable using self-expandable Polyurethane foam.

(iii) Sealing of welding gaps in partition wall between machine room and cab as well as cab floor and cab walls using polyurethane adhesives.

(b) Dampening of vibration of metal sheet:-

(i) Painting 2.0 mm thick coating of sound dampening paint should be provided on the rear side of all panel doors i.e BD panel, SB panel etc.

(ii) Painting 2.0 mm thick coating of sound dampening paint on partition wall between cab and machine room on the machine room side.

(iii) Provision of three layered anti-slip flooring to be provided in locomotive cab floor for reducing sound and vibration.

(c) Absorption of Noise:-

(i) Filling of roof cavity with three layer acoustic insulation. The polyester non-woven layer shall be towards the roof, sound barrier vinyl polymer shall form the middle layer and polypropylene with polyester non-woven layer shall form the inner most layer.

(ii) Fixing of Aluminum perforated sheet below the acoustic insulation.

Note: All material being used should be fire retardant as per EN-45545 (Fire protection on railway vehicles).

4. **Application to class of Locomotives:** WAP-4/WAG-7 locomotives.

5. **Material Required:** As per Annexure-A.

6. **Material Rendered Surplus:** Nil

7. **Reference:** Railway Board letter no.2011/M(L)/466/2(18) dated 02.02.2015.

8. **Modification Drawing :** Nil

9. **Agency of Implementation:** POH workshop during POH of conventional locomotives.

(Mohit Sonakiya)
for Director General/Electrical

Annexure-A

Material shall comply with the following standard:-

SN	Material	Specification
1.	Sound dampening paint	(i) Transmission Loss- 44 STC (sound transmission coefficient) or higher (ASTM E90-04) (ii) Damping Loss Factor (30-400 Hz)-0.033 STC (sound transmission coefficient) or higher (ASTM E756-98).
2.	Acoustic insulation consisting of 3-layers	-
	(i) Polyester non-woven (25mm thick)	Noise reduction coefficient (NRC)-0.65 or higher (ISO-354-2006)
	(ii) Sound barrier vinyl Polymer (2mm thick)	Sound transmission coefficient (STC)- 26 or higher (ISO-15186-1/ISO-10140-4)
	(iii) Polypropylene+ polyester non-woven (25mm thick)	Absorption coefficient at 1000 Hz-0.2 or higher Absorption coefficient at 4000 Hz-0.8 or higher (ASTM-E1050)
3.	Nitrile rubber foam	Compression Set (40°C/22h/50%) ≤ 40% (DIN EN ISO-1865
4.	Sealing (Polyurethane adhesive)	Elongation at break >600% (ASTM D412) Should have good bonding with metal sheet.
5.	Self-expandable foam	Yield-1000 ml yield ca 35-40 L cured foam
6.	Cab floor	As per DLW specification-MISC 101 R4

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