SPECIFICATION OF THERMAL CUM SOUND INSULATION MATERIAL FOR DRIVER'S CAB TO BE USED ON WAG-9HC & MODIFIED WAP-5 THREE-PHASE ELECTRIC LOCOMOTIVE OF INDIAN RAILWAYS.

SPECIFICATION No. CLW/MS/3/160 ALT.NIL

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ALTERATION RECORD SHEET

ALT. NO.	DATE	DESCRIPTION	REASON	SIGNATURE

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TECHNICAL SPECIFICATION OF THERMAL CUM SOUND INSULATION MATERIAL FOR DRIVER'S CAB TO BE USED ON WAG-9HC, MODIFIED WAP-5 THREE-PHASE ELECTRIC LOCOMOTIVE OF INDIAN RAILWAYS.

1. SCOPE:

This specification covers the general, technical and test requirements of the Thermal cum Sound Insulation material to be used in the Driver's Cab of the WAG-9HC, Modified WAP-5 3-Phase Electric locomotive. The insulation material is designed to provide thermal insulation and reduce noise levels in the driver's cab, ensuring the safe operation of equipment and the comfort of the driver.

2. SCOPE OF SUPPLY:

A complete Thermal cum Sound Insulation material, consisting of thickness 50mm & 75mm as per drawing to be supplied as a set.

2.1. One set per loco, to be supplied for WAG-9HC loco as per Drg. No. 1209-08.130-145 ALT.2 or latest alteration.

2.2. One set per loco to be supplied for Aerodynamic Cab of modified WAP-5 Loco as per Drg. No. 1211-01.130-221 with latest alteration.

2.3. One set per loco to be supplied for Flattened Cab of modified WAP-5 Loco as per Drg. No. 1211-02.030-150 with latest alteration.

3. GENERAL:

3.1. **Material Composition**: The insulation material should be a composite of multiple layers, including a layer of glass fiber woven cloth, a fire-resistant polymeric sound barrier, an acoustical foam layer, and a thermal insulation blanket.

3.2. **Dimensions**: The material shall be supplied as per drawing

3.3. **Weight**: The material should be lightweight and easy to handle.

3.4. **Corrosion Resistance**: The material should be corrosion-proof.

3.5. **Acoustic and Thermal Properties**: The material should have excellent sound and thermal insulation properties.

3.6. **Hygiene**: The material should have an anti-bacterial surface and be resistant to fungal growth. It should be physiologically safe with no formaldehyde emissions.

3.7. **Installation**: The insulation material shall be easily cut to size on site with an ordinary knife or scissor. It should be fixed using a suitable pressure-sensitive adhesive that maintains its adhesive properties at temperatures up to 50°C.

3.8. **Environmental Compliance**: The material should not contain any substances classified as Class I or Class II ozone-depleting substances according to the Montreal Protocol.

4. CLIMATIC AND ENVIRONMENTAL CONDITIONS:

While manufacturing Thermal cum Sound Insulation material following climatic and environmental conditions to be considered:

a) Ambient Temperature : 0˚C to 60˚C
b) Maximum Temperature : 75˚C
c) Humidity : 100% saturation during rainy season.
d) Rainfall : Very heavy in the continent.
e) Costal Area : High humidity, salt laden atmosphere.
f) Vibration : Shocks up to $50 m/s^2$.

5. MANUFACTURE:

The insulating material shall be manufactured according the following table:

Sl. No.	Material Composition	Material Details
1	Layer of Glass Fiber Woven Cloth	200(± 15 %) GSM
2	Layer of Fire Resistant Polymeric Sound Barrier (Thickness)	2(± 15 %)mm
3	Layer of Acoustical Foam made of Fire Resistant Poly Urethane Foam (Thickness)	50(± 15 %)mm or 75(± 15 %)mm
4	Layer of Thermal lnsulation Blanket (Thickness)	1.75(± 15 %)mm
5	Layer of Glass Fiber Woven Cloth	200(± 15%)GSM

6. TEST REQUIREMENT/PROPERTIES:

Sl No.	Properties		Requirement	Specification
1	Thermal Insulation Coefficient		Max 0.040W/mK at 23^0 C	ASTM C -518 / IS: 3346 /ASTM C 177
2	Sound absorption (Noise reduction Coefficient-NRC)		>0.80 (for 50 mm) >0.90 (for 75 mm)	AS 1045 / ISO 354 / EN ISO 11654
3	Sound lnsulation (Sound Transmission Class) insulation measure (STC)		41 dB minimum	DIN 5221 part 1/ISO 10140-2/ASTM E90
4	Fire & Smoke characteristics (EN 45545-2 R1 HL3)			
	a) Lateral spread flame CFE (Min)		$20kW/m^2$	ISO:5658-2
	b) Heat release rate (Cone calorimeter Method) MARHE(Max.)		$60kW/m^2$	ISO : 5660-1:50kW/m2
	c) Smoke generation Ds(4) (Max.)		150 Dimensionless	EN ISO: 5659-2:50 kW/m2
	d) Smoke generation VOF4(Max.)		300 minutes	EN ISO: 5659-2:50 kW/m2
	e) Gas analysis in smoke chamber using FTIR technique $CIT_G(4)$ (Max.)		0.75 Dimensionless	EN ISO: 5659-2:50 kW/m2
5	Melting behavior		No Drip	IS 15061:2002 Annex C
6	Acoustical Foam made of Fire Resistant Poly Urethane Foam		25 ± 5 (kg/m^3)	IS 7888:1976
7	Glass Fiber Woven Cloth (GSM)		200 $\pm$ 15 % GSM	IS 1964:2001 (Method)
8	Water Vapour Transmission rate(Max) per 24 hrs for	50 mm	0.07 g/m^2	ASTM E 96 (Foil face towards desiccant)
		75mm	0.047 g/m^2	
9	Resistance to Fungi		Zero Growth	ASTM G 21
10	Fire test		Class- A	Appendix-8 of UIC-564-2OR
11	Water absorption (%) (Max) (for composite material with PU foam, edqes shall be properlv sealed)		1.0	JIS K6767

6.1. Nominated representative of purchaser will carry out the inspection of the prototype sample. All the necessary tests conducted during inspection shall be arranged and borne by the supplier.

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6.2. Compressive strength shall be tested and recorded. It should stand resilience and recovers to its nominal thickness after compression. Deformation under compressive loading shall be limited.

6.3. Prior to prototype inspection CLW's representative will be deputed to seal the sample piece of the material specified for test in the Government approved/RDSO approved on test Lab. The Lab test report should be produced at the time of prototype inspection.

7 CLASSIFICATION OF TESTS:

7.1. Testing of following parameters as mentioned in this specification shall be treated as type tests and shall be repeated every 24 months:

a) Fire & Smoke characteristics

However, if the consignee or inspecting agency desires to do the type tests, before 24 months; the supplier should not deny the same. There are various circumstances when type tests may be needed on next supply before one year of last supply / last type tests e.g.:

- ln case of doubt in type test certificate(previous)
- Complaint regarding type test certificates
- Failure of material attributable to any of the parameters covered in type tests, etc.

7.2. Testing of following parameters as mentioned in this specification shall be treated as type tests and shall be repeated every 12 months:

a) Thermal lnsulation Coefficient

b) Sound absorption / Noise reduction Coefficient

c) Water vapour transmission rate (Max)

d) Resistance to Fungi

However, if the consignee or inspecting agency desires to do the type tests, before 12 months, the supplier should not deny the same. There are various circumstances when type tests may be needed on next supply before one year of last supply/ last type tests e.g.:

- ln case of doubt in type test certificate (previous)
- Complaint regarding type test certificates
- Failure of material attributable to any of the parameters covered in type tests, etc.

7.3. Testing of density Parameters Acoustical Foam made of Fire Resistant Poly Urethane Foam, GSM, Melting behaviour, Sound lnsulation / Sound Transmission class measure (STC) & Fire test shall be acceptance test.

8. SUPPLY OF DOCUMENTS:

8.1 Material Certificate indicating the specification.
8.2 All Test Certificates as mentioned in Para 6.

9. QUALITY ASSURANCE:

As per ISO: 9000:2015 or latest standard

10. LABELING/MARKING:

Each pack shall be legibly marked with indelible marking in ink/paint showing the following details:

10.1. Name of the Product.
10.2. Month & Year of Manufacture.
10.3. Name of the manufacturer with Trade mark, Code No. & Batch No.
10.4. Respective Drawing Number in each packet.

11. PACKAGING AND DELIVERY:

11.1. Protective packaging to be done which is suitable for the transport and storage under the climatic and environmental conditions mentioned in Para 4 and which will prevent any damage to the material during handling, transit and storage.

11.2. Defective material will not be accepted.

12. WARRANTY/GUARANTEE:

All aspects of design, workmanship and material quality will be covered by the warranty/guarantee of satisfactory performances of the product for 30 months from the date of supply or 24 months from the date of commissioning as per Para 3202 of latest IRS contract conditions September 2022 version 1.0 or latest.

13. NOTE:

13.1. For any further clarification tenderers may contact Dy.CEE/D-III at CLW/CRJ. Only successful tenderers should collect the detailed drawings from CLW.

13.2. The firm has to also install fibre glass insulation in the Locomotive. The programme for availability of the locomotive will be intimated by Dy.CME/ELA, two months in advance. The firm has to complete installation of fibre glass insulation as per Dy. CME/ELA's programme. The maximum time allotted for installation of fibre glass insulation will be 25 days from taking over of locomotive. If the installation is not done as per Dy. CME/ELA's programme or within 25 days of taking over of locomotive, the same will be treated as breach of contract and Risk Purchase action will be taken against the firm.

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