INDIAN RAILWAYS

FUNCTIONAL REQUIREMENT OF SPECIFICATION FOR IMPROVED COACH INSULATING MATERIAL FOR AC COACHES

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Functional Requirement of Specification for Improved Coach insulating material for AC coaches

1. FOREWORD

Indian Railway is intended to improve the thermal insulation and heat load of Air Conditioned coaches to save energy. Provision of better and proven coach insulating materials for ceiling, sidewall and flooring is one of the energy efficiency measures for AC Coaches. The following specifications/STRs are in vogue for coach insulating material for AC Coaches:

i) ICF's STR No. ICF/M/D/spec.172 for Bonded slag wool/resin bonded fibre glass wool insulation cladded on one side with double side laminated heat resistant Aluminum Foil.

ii) RCF's STR No.MDTS 207 (Rev.2) for resin bonded fibre glass wool insulation laminated on one side with single side laminated heat resistant aluminum foil.

iii) IS specification No.8183 for Bonded mineral wool.

iv) RCF's STR No. MDTS 088 Rev.04 for thermal insulation for under frame and side wall of Railway coaches.

v) RCF's STR No. MDTS 223 Rev.02 for thermal insulation with fibre glass cloth for stainless steel AC double decker coaches.

vi) RDSO's STR No.C-K304 (Rev.1) for Thermal bonded polyester waddings for use in Railway Coaches.

2. SCOPE

This specification covers the functional requirement related to improved coach insulating material for AC coaches under the operating conditions as given in Para 4 of this specification.

3. FUNCTIONAL REQUIREMENT

The improved coach insulating material is intended for the following functional requirements:

a) The material should have a quality to improve the coach insulation (Min 25%) from existing one.

b) The material should have lower thermal conductivity (k) value w.r.t. to existing material being used in IR AC Coaches.

c) The material should have high thermal resistance (R) value w.r.t. to existing material being used in IR AC Coaches.

d) The material should have improved thermal insulation and heat load to facilitate energy saving.

e) The material should not sag during service under dynamic condition of coaches.

f) The material should not absorb moisture during service.

g) The material should reduce noise and vibration in side coach.

h) The material should have long lasting performance.

i) The material should have following fire retardancy characteristics:

S. No.	Name of Test	Method of test	Specified Value
1	Resistance to spread of flame	Appendix 8 of UIC 564-2 OR	Class A
2	Limiting oxygen index	IS 13501	Min 35
3	Deterioration of visibility due to smoke	Appendix-15 of UIC 564-2 OR	Class A
4	Toxicity	NCD- 1409	<1
5	Heat Release rate	EN- 45545-2	R1 HL-3

4. OPERATING CONDITION

4.1 Ambient Conditions

(i) Ambient temperature : - 4° C to 50° C
Altitude : Sea level to 2500m
Max. Temperature under Sun: 70° C
Relative humidity : 40% to 95%

(ii) The rainfall is fairly heavy.

(iii) During dry weather, the atmosphere is likely to be dusty.

(iv) Temperature variations can be quite high in the same journey or short period of time.

(v) Coaches operate in coastal areas with continued exposure to salt laden air.

(vi) The coach length over buffer is approximately 22.3 meters for ICF type coaches & for LHB type coach length over coupler is approximately 24 meters.

4.2 Coach Inside Conditions

Air conditioned Coaches are equipped with roof mounted air conditioning system with central ducting system and side distribution branch lines. The coaches are conditioned to a nominal temperature of 23°C to 25°C, RH 55% to 60% & air flow @ 4000 cubic meter /hour. The specified speed of the coaches is 110 kmph and 160 kmph which may vary as per IR requirements.

4.3 Coach Dynamics

Equipment shall withstand satisfactorily the vibrations and shocks normally encountered in service as indicated below:

i) Maximum vertical acceleration 1.0g
ii) Maximum longitudinal acceleration 3.0g
iii) Maximum transverse acceleration 2.0g

The vibrations are of sine wave form and the frequency vibration is between 1 Hz to 50 Hz.

The amplitude ‘a’ expressed in millimeters is given as a function of f, by equations

$a = 25/f$ for values of f from 1 Hz to 10 Hz.

$a = 250/f^2$ for values of f exceeding 10Hz and up to 50 Hz.

In the direction corresponding to the longitudinal movement of the vehicle, the equipment is subjected for 2 min. to 50 Hz. Vibrations of such a value that the maximum acceleration is equal to 3g.

4.4 **Coach-body displacement encountered under dynamic conditions.**

i)	Vertically-	±100 mm
ii)	laterally -	±55 mm
iii)	longitudinally-	±10 mm
iv)	bogie rotation about center pivot -	$\pm 4^0$

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