भारतीय रेलवे मानक

उच्च प्रदर्शन जंग रोधी एपॉक्सी पेंट (दो पैक)- विशिष्ट

(भारतीय रेलवे परिवहन में उपयोग हेतु)

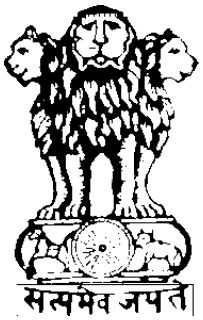
(प्रथम संस्करण)

INDIAN RAILWAY STANDARD

HIGH PERFORMANCE ANTI-CORROSION EPOXY PAINT (TWO PACK) - SPECIFICATION

(FOR USE IN INDIAN RAILWAYS)

(First issue)



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(STANDARDS DEVELOPING ORGANISATION)

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FOREWORD:

This first issue of standard for high performance anti-corrosion epoxy paint (two pack) has been framed by Standard Developing Organizations (SDO) of Research Designs & Standards Organization (RDSO) after the finalization of draft standard by committee: M&C Directorate-RDSO/Paints, comprising of members for different field and domain of knowledge like R&D, testing, consumer, industry etc following RDSO ISO document No.QO-D-8.1.1, version 2.1 (Creation of the new RDSO standard) for adoption and use by BIS, Railways & its vendors.

The composition of committee responsible for formulation of this standard is given in Annex A.

1.0 SCOPE:

This standard prescribes the technical requirements and methods of testing for two pack High Performance Anti-Corrosion Epoxy Paint system intended to be used at areas where improved corrosion resistance is needed under severe corrosive condition. The material shall be suitable for application on interior of coaches like lavatory area, turn under etc. The material may be used on surfaces having surface finish equivalent to St_3 of ISO Specification No.:8501-1-88 done by mechanical cleaning. It should be suitable for application by air / air-less spray with 10% (max.) compatible thinner / without using thinner depending upon prevailing condition, and shall also be suitable for brush application, for touching-up small areas. The material should be compatible with aliphatic type polyurethane finish coat and Fluoro polymer/FEVE coating system.

2.0 TERMINOLOGY:

2.1 For the purpose of this standard apart from the glossary of terms given in IS: 1303-83 and terminology as per clause 2 of IS: 9162-79 and IS:9954-81, the following shall also apply. Rounding off, of observed values on different tests shall be in accordance with IS: 2-1960.

2.1.1 **Pack:**

The term used to describe each of the two packs of the paint which when mixed together, form High Performance Anti-Corrosion Epoxy Paint.

2.1.2 **Paint:**

The mixture of the two packs in the proportion recommended by the manufacturer.

3.0 REQUIREMENTS:

3.1 The mixing ratio of the Pack A and Pack B shall be in a simple ratio by volume 1:1or as recommended by manufacturer

3.2 **Composition:**

The paint shall consist essentially of two packs namely Pack A and Pack B.

3.2.1 **Pack A:**

Normally referred to as Base, shall consist of epoxy resin with or without diluents. In the formulation of paint, epoxy resin of the following grade shall be used.

Table – I
Requirements for epoxy resin

S.N.	Characteristics	Requirements	Method of test
1.	Weight per epoxy equivalent on non-volatile vehicle content basis	180-450	Cl.4 of IS:9162-79

3.2.2 **Pack B :**

Normally referred to as Hardener shall consist of any liquid hardener.

3.2.3 **Liquid Hardener:**

This shall be liquid type such as an aliphatic amine, an aliphatic or aromatic amine adduct, a polyamide or amido polyamine or any other suitable hardener with or without accelerators depending upon manufacturer. It shall react with epoxy resin at normal ambient temperature.

4.0 **PROPERTIES:**

Unless specified otherwise, pure chemical (A.R. i.e., Analytical Reagent) & distilled water shall be employed in the tests.

4.1 **General:**

The paint shall comply with the requirements specified in Table-II of this Specification.

4.2 Unless otherwise specified the following testing conditions shall apply.

4.2.1 The preparation of steel, tinned and glass panels shall be in accordance with Cl. 2, Cl.3 and Cl.5 respectively of IS: 101(Pt.1/ Sec.3)-87.

4.2.2 All the tests shall be conducted at room temperature $(27\pm2)^0$C and a relative humidity at (65 ± 5)%, in a well ventilated chamber free from draughts and dust. The temperature of the surface to be painted must be at least 3^0C above the dew point to prevent moisture condensation.

4.2.3 The two components i.e., base and hardener shall be mixed in the ratio recommended by the manufacturer before conducting the test or tests. Where the paint is required to be applied on panels, it shall be done so by using suitable air/airless spray/brush application.

4.2.4 For touch-up/patch painting, the material shall be supplied in one litre containers.

4.2.5 For preparation of painted panels for conducting different tests mentioned in **Table-II**, the details given in **Table-III** shall be followed.

TABLE-II

REQUIREMENTS FOR HIGH PERFORMANCEANTI-CORROSIONEPOXY PAINT (TWO PACK)

S.N.	Characteristics	Requirements	Method of test
1.	Drying time at 27±2°C **a)**Surface dry, Max **b)**Recoating time, Max. **c**)Hard dry, Max **d)**Curing time, max	 2 hours 8 hours 8 hrs. 07 days	IS: 101(Pt.3 /Sec.1)-86
2.	Consistency	Smooth, uniform and suitable for air/air-less spray/brush application	IS: 101 (Pt.1/ Sec.5)-89
3.	Finish	Smooth, matt/semi-glossy, free from sagging & wrinkling	IS: 101 (Pt.3/Sec.4)-87
4.	Colour	As desired	IS: 101(Pt.4/Sec.2)-89
5.	Dry film thickness per coat, by brush /air / airless spray	(75-125) microns	IS:101(Pt.3/Sec.2)-89 By Elcometer/Thickness gauge meter
6.	Volume solids, %	70±5	IS: 101(Pt.8/Sec.6)-93
7.	Scratch hardness (at 1.5 Kg. load)	No such scratch as to show bare metal	IS: 101(Pt.5/Sec.2)-88
8.	Flexibility & Adhesion (6.25 mm Mandrel)	No visible damage or detachment of film	IS: 101(Pt.5/ Sec.2)-88
9.	Flash Point for both the packs	Above 25°C	IS: 101(Pt.1/ Sec.6)-87
10.	Resistance to salt spray*	No sign of corrosion & no sign of deterioration up to 3000 hours	ASTM: B-117
11.	Protection* against corrosion under condition of condensation	No sign of corrosion & no sign of deterioration up to 3000 hours	IS: 101(Pt.6 /Sec.1)-88

12.	Keeping Properties for both the packs	Not less than 12 months	IS: 101(Pt.6/ Sec.2)-89
13.	Covering Capacity, min. I) 100microns DFT II) 75 microns DFT	 5.5 sq. m./litre 7.0 sq.m /litre	IS:101(Pt.4 /Sec.1)-88
14.	Resistance to chemicals at ambient temperature i) 25% caustic soda solution (w/v) ii) 30% sulphuric acid solution(v/v) iii) 20% hydrochloric acid (v/v) iv) Resistance to tap Water*	 Shall not show any sign of blistering, wrinkling & lifting of paint film up to 1800 hrs --do-- --do-- Shall not show any sign of blistering, wrinkling & lifting of paint film up to 3000 hours	Appendix –I
15.	Pot life at (27± 2)ºC, min.	3hours	Appendix-II
16.	Mass in kg/10 litres, min.	12.0	IS:101Pt.1 Sec.7- 87
17.	Impact resistance test at height 31 inch and weight 3.226 pound) (100 inch-pound load) indenter diameter of 0.500 inch (12.7mm)	Shall be free from cracking in the deformed coating by dropping the indenter on coated side of test panel	ASTM:D 2794-93
18.	Cathodic disbondment test, max.	8.0 mm. at 3.5V, 24 hr. and 65^{o}C	CAN-CSA- Z245.0 2-98, Cl.12.8
19.	Abrasion Resistance test for 1000 cycles with CS-17 wheels & 1.0 Kg load	Maximum loss=0.170gm	ASTM D-4060
20.	Adhesion test	Matches to 5B	ASTM D-3359

21.	Adhesion & compatibility test with Acrylic Polyurethane Paint & FEVE coating	Shall be compatible with Acrylic Polyurethane Paintand & FEVE coating matches to (5A)	ASTM: D-3359 & Appendix-III
22.	Pull off Adhesion test, Min.	400 PSI	ASTM D-4541

*In case of approval and / or bulk supply, every 5th batch or the last batch if the batches are less than 05 may be tested. The duration of the test shall be 3000 hrs. Edges of the test panels may be resealed with wax if it gets damaged/thinned down during testing period.

TABLE-III

DETAILS OF PREPARING PAINTED PANELS FOR TESTING OF HIGH-PERFORMANCEANTI-CORROSION EPOXY PAINT (TWO PACK).

S. N.	**Test**	**Type of Metal Panel**	**Size in mm.**	**Painting Details**	**DFT**	**Method of Application**	**Duration of Air Drying before commencement of test**	**Special Instruction**
1.	Drying Time	M.S.	150 x 100 x1.25	One coat of H.P.A.C. Epoxy Paint	(75-125)µ	Brush/ Spray	-	-
2.	Finish	-do-	-do-	-do-	-do-	-do-	48 Hours	-
3.	Colour	-do-	-do-	-do-	-do-	-do-	24 Hours	-
4.	Dry Film thickness							
	a) By brush	-do-	-do-	-do-	-do-	Brush	-do-	-
	b) By air/airless spray	-do-	-do-	-do-	-do-	Spray	-do-	-
5.	Scratch Hardness	Tin	150 x50 x .315	-do-	-do-	Brush/ Spray	7 days*	-
6.	Flexibility & Adhesion	-do-	-do-	-do-	-do-	-do-	-do-	-
7.	Adhesion test	MS	150 x 100 x1.25	One coat of H.P.A.C. Epoxy paint	(75-125)µ	-do-	-do-	-
8.	Resistance to Salt Spray	M.S.	150 x100 x1.25	Two coats of H.P.A.C. Epoxy Paint	(150-250)µ	-do-	-do-	Paint both sides of panels and seal the edges with wax.
9.	Protection against corrosion under conditions of condensation	-do-	-do-	-do-	-do-	-do-	-do-	-do-

10.	Resistance to chemicals	-do-	-do-	-do-	-do-	-do-	-do-	-do-
	i) 25% (w/v) caustic soda sol.							
	ii) 30% (v/v) sulphuric acid soln							
	iii) 20% (v/v) hydrochloric acid sol.							
	iv) Resistance to tap Water							
11.	Impact resistance	-do-	-do-	-do-	-do-	-do-	-do-	Apply two coats on one side of test panel
12.	Pull off Adhesion test	-do-	-do-	One coat of H.P.A.C. Epoxy Paint	(75-125)µ	-do-	-do-	Apply one coat on both sides of panels.

5.0 **MARKING AND PACKING**

5.1 Each container shall be marked with the following:

a) Name of the material

b) Source of manufacture

c) Volume of the material

d) Batch No. or Lot No. in code or otherwise and

e) Month & year of manufacture

5.2 For touch up/patch painting, the material shall be supplied in one litre container

6.0 **INSPECTION**

6.1 At the time of initial approval, full testing shall be done.

6.2 In case of acceptance testing, Inspecting Authority shall draw the sample from the batch under consideration and tests shall be done as per Table-II, except for long duration tests as per S.N.10, 11&14.By way of purchase Inspection, OEM's original work Test Certificate specific to each batch can be accepted by Inspection Authority.

6.3 **(a) Paint procured through Indian Railway store contract**

For bulk supply, frequency of full testing of the material as per table-II may be decided by the purchaser. Purchaser reserves the right to conduct tests for any parameter at any time.

(b) Paint procured through Supply-Apply and Maintenance contract:

The paint procured by Indian Railway through Supply–Apply and maintenance contract, the contractor shall take responsibility of mechanical damages due to peel off, flaking off, cracking, Chalking and delamination i.e., all types of adhesion related premature failure for the entire warrantee period of 03 years during service from the date of application under maintenance contract as per laid down terms & conditions of P.O. The defect arises during warranty period shall be repaired by the contractor on their own cost. However, Production units (PU), Zonal Railway workshops and other consignee shall frame their own terms and conditions of supply-apply and maintenance contract for procurement of this paint and the same shall be introduced in P.O.

APPENDIX-I

Accelerated Tests (Resistance to Chemicals):

The following short - term tests of chemical resistance, do not categorize the type of service for which High performance anti-corrosion epoxy paint coatings are intended but are included to assure the customer that the coating contains a sufficiently cured resin to exhibit the long-term requirements.

Prepare the panels as per clause 10 of Table-III. Allow the panels to air dry for 7 days and seal the edges with wax.

a) Resistance to 25% caustic soda solution:
Immerse 3/4th of the panel in 25% (w/v) caustic soda solution for 1800 hours. Remove the panel, wash in running water and allow it to air dry for an hour and record the observations.

b) Resistance to 30% sulphuric acid solution:
Immerse 3/4th of the panel in 30% (v/v) sulphuric acid solution for 1800 hours. Remove the panel, wash in running water and allow it to air dry for an hour and record the observations.

c) Resistance to 20% hydrochloric acid solution:

Immerse 3/4th of the panel in 20% (v/v) hydrochloric acid for 1800 hours. Remove the panel, wash in running water and allow it to air dry for an hour and record the observations.

d) Resistance to tap water:

Immerse 3/4th of the panel in tap water for 3000 hours. Remove the panel, wash in running water and allow it to air dry for an hour and record the observations.

APPENDIX-II

PROCEDURE FOR DETERMINING POT LIFE

(AS PER U.S.DEPT.OF TRANSPORTATION/FED.RAIL ROAD ADMN.OFFICEOFSAFETY, FED. TEST NO.2.7.1)

Take the usable time as the pot life of paint. Condition the components of the coating for one hour at 27^0 C and mix immediately in proper ratio to get approx. 200 ml. of paint in 250 ml. of container. The lid should be loosely placed on the container.

1. Measure the viscosity initially and every half an hour thereafter. However, the interval may be shortened, if desired.

2. Near the end of the coating's working life, the viscosity builds-up rapidly. During this period, when the paint may be too viscous to spray, remove a small portion and add the appropriate compatible thinner recommended by the manufacturer. If the paint can still be thinned, the end of the working life has not been reached. The end of the working life is reached when the paint gels, becomes stringy or cannot be thinned for application.

APPENDIX-III

DETERMINATION OF ADHESION AND COMPATIBILITY

1. Outline of method:

The material is tested in a painting system comprising of high performance anti-corrosive epoxy paint (Two Pack) with Acrylic Polyurethane (Two Pack) and Fluoro polymer/FEVE coating system and schedule simulating actual use. Satisfactory adhesion and compatibility between the coats is taken as criteria for having passed the test.

2. Procedure:

A panel 300x150x0.9 mm, mild steel, with high performance anti-corrosive epoxy paint (Two Pack) and Acrylic Polyurethane paint (Two Pack) system shall be prepared as described below:

a) Clean the surface either by shot or grit blast and wipe this with petroleum hydrocarbon solvent, 145/205 (low aromatic) (see IS: 1745- 1978) and allow to dry.

b) Apply one coat of high performance anti-corrosive epoxy paint (Two Pack), (75-125) microns, DFT as per the specification and allow to air dry for at least 8 hours, minimum. Dry rub with emery paper no. 400 and wipe clean with a dry soft cloth.

c) Spray/apply one coat of Acrylic Polyurethane (two pack), 45 microns, minimum DFT, as per the specification. Allow to air dry for 8 hours, minimum. Allow to air dry for at least 7 days before assessing the performance.

The material shall be deemed to have passed the test, if the material shows good adhesion and compatibility over substrate and between high performance anti-corrosive epoxy paint (Two Pack) and Acrylic Polyurethane Paint & FEVE coating (two pack).

This is assessed as per Test Method A-Cross Cut Tape Test of ASTM D 3359-97 by making grid and placing 25 mm wide adhesive tape, semi-transparent, pressure sensitive, Parmacel 99 make or equivalent. The adhesive tape is then pulled away with a jerk. The material shall be deemed to have passed the test, if the edges of the cuts are completely smooth i e. it matches to 5A class of the above-mentioned specification.

ANNEX A

COMMITTEE COMPOSITION

M&C DIRECTORATE-RDSO/PAINTS

Organization	:	Representatives
Research Designs & Standards Organization, Annexe-II, Manak Nagar, Lucknow-226011	:	Shri B.L. Bairwa, ED/M&C Chairperson (Ex officio)
Research Designs & Standards Organization, Annexe-II, Manak Nagar, Lucknow-226011	:	Shri Rajesh Srivastava, Director/M&C (Member Secretary)
Rolling Stock Workshop (Loco & Carriage), Charbagh, N.Rly., Lucknow-226004	:	Shri Rashid Akhater DYCCMT/Northern Railway (Member consumer)
Carriage Workshop, Alambagh, N.Rly., Lucknow-226005	:	Shri Anurag Mishra (Alternate) DYCME/Northern Railway (Member consumer)
Ministry of MSME, Office of Development Commissioner (MSME),A-wing, 7th Floor, Nirman Bhawan, New Delhi-110011	:	Shri Pramod Bharti Asst. Director/Chemical (Member industry)
Ministry of MSME, Office of Development Commissioner (MSME),A-wing, 7th Floor, Nirman Bhawan, New Delhi-110011	:	Shri Kamal Bansal(Alternate) Asst. Director/Chemical (Member industry)
University Institute of Chemical Technology, KBC North Maharashtra University, Jalgaon, Maharastra-425001	:	Dr. Ravindra G. Puri Asst. Professor (Member R&D institutions)
Head, Deptt. Of Paint Technology, Harcourt Butler Technical University(HBTU), Kanpur-208002	:	Prof. Arum Maithani Professor (Member R&D institutions)
Visiting Professor, Deptt. Of Paint Technology, Harcourt Butler Technical University(HBTU), Kanpur-208002	:	Prof. Pramod Kumar(Alternate) Professor (Member R&D insttutions)
National Test House(WR), Plot No.F-10, MIDC, MAROL, Andheri (East), Mumbai-400093	:	Shri Anath Bandhu Mondal Scientist-C (Chemical) (Member testing labs)
National Test House(WR), Plot No.F-10, MIDC, MAROL, Andheri (East), Mumbai-	:	Shri Mangesh Pandhrinath Gharpure (Alternate)

400093		Scientist-C (Chemical) (Member testing labs)
Research Designs & Standards Organization, Annexe-II, Manak Nagar, Lucknow-226011	:	Shri Kishan Kumar Talreja ARO/QA (Member inspection)
Research Designs & Standards Organization, Annexe-II, Manak Nagar, Lucknow-226011	:	Shri Sandeep Tigga (Alternate) ARO/QA (Member inspection)

Standard Developing Organizations (SDO):

SDO of Research Designs & Standards Organization (RDSO) is to promote harmonious development of the activities of the standardization for Indian Railways items.

Copyright:

Review of Standards:

Standard can be reviewed as per the requirement of Railways as and when the need arises. The process of Review/Authentication of the Standard shall be ensured in every five years cycle.

Record of the RDSO Standard:

Metallurgical and Chemical Directorate will retain all the records for at least 10 years from the date of publication of Standard or for two review cycles whichever is earlier.

This Standard has been developed from Doc No.: RDSO-MC/Paints/01