

## **RDSO SPECIFICATION**

**No. M&C/PCN/111/2018**

# **SPECIFICATION FOR HIGH BUILD EPOXY PAINT (TWO PACK)**

**RESEARCH DESIGNS & STANDARDS ORGANISATION  
MANAKNAGAR, LUCKNOW – 226 011**

March: 2018

Price :

**SPECIFICATION NO. M&C/PCN/111/2018**  
**SPECIFICATION FOR HIGH BUILD EPOXY PAINT (TWO PACK)**

**0. FOREWORD**

0.1 This standard was originally adopted in the year 1988 and was subsequently revised in the year 2000 and 2006. In this revision, resistance to chemicals test, covering capacity at 100 microns DFT/125microns Wet Film Thickness, Drying time for surface dry have been incorporated. Limits of Flash point have been raised to 30 °C as against 20 °C and of Pot life has been raised to 4hrs as against 2 hrs.

**1. SCOPE**

1.1 This standard prescribes the requirements and methods of testing for two packs High Build Epoxy Paint intended to **be used on interior of coaches** where grit blasting is not practicable. The material shall be suitable for application on a metal surface having surface finish equivalent to St2 by hand tool cleaning or St3 by power tool cleaning of IS:9954. It should be suitable for application by airless spray, but by using thinner, it shall be suitable for brush application, for touching-up small areas. The material is compatible with **Acrylic Polysiloxane finish top coat** the use of which will enhance the life of this material.

**2. TERMINOLOGY :**

2.1 For the purpose of this standard apart from the glossary of terms given in IS: 1303-63 and terminology as per clause 2 of IS: 9162-79 and IS: 9954, 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 Build Epoxy Paint.

2.1.2 **Paint** : The mixture of the two packs in the proportion recommended by the manufacturer.

2.1.3 **High Build** : The property of a coating material which permits the application of a coat of greater thickness than usually considered as normal i.e. 80 microns and above.

### 3. REQUIREMENTS :

3.1 The mixing ratio of the pack A and pack B shall be in a simple ratio by volume, 1:1, 1:2 or 1:3 max.

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. No.	Characteristics	Requirements	Method of test
1.	Weight per epoxy equivalent on non-volatile content basis	180-260	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. It shall react with epoxy resin at normal ambient temperature.

### 4. PROPERTIES :

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  $(27 \pm 2)^{\circ}\text{C}$  and a relative humidity at  $(65 \pm 5)\%$ , in a well ventilated chamber free from draughts and dust. The temperature of the surface to be painted must be at least  $3^{\circ}\text{C}$  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 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 the 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 BUILD EPOXY PAINT (TWO PACK)**

S.N.	Characteristics	Requirements	Method of test
1.	<b>Drying time at 27±2°C</b> <b>a) Surface dry, max</b> <b>b) Hard dry/</b> <b>Recoating time, max.</b>	<b>4 hours</b> <b>8 hours</b>	IS:101(Pt.3 /Sec.1)-86
2.	Consistency	Smooth, uniform and suitable for 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.	<b>Colour</b>	<b>Buff to Grey/any RAL colour shade</b>	IS:101(Pt.4/Sec.2)-89
5.	Dry film thickness per coat, By brush or by airless spray	(100-125) microns	By Elcometer / Thickness gauge meter
6.	Volume solids, % min	80	Appendix-I
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 30°C	IS:101( Pt.1/ Sec.6)-87
10.	<b>Resistance to salt spray*</b>	<b>No sign of corrosion &amp; no sign of deterioration up to 3000 hours</b>	ASTM: B-117
11.	<b>Protection* against corrosion under condition of condensation</b>	<b>No sign of corrosion &amp; no sign of deterioration up to 3000 hours</b>	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. (at 125 microns WFT or at 100 microns DFT)	8 sq. m./litre	IS:101(Pt.4 /Sec.1)-88
14.	Wet film thickness, min.	125 microns to ensure 100 microns DFT	By wet film thickness gauge
15.	Resistance to chemicals 1) 25% caustic soda solution (w/v) 11) 30% sulphuric acid solution (v/v) 111) 20% hydrochloric acid (v/v) <b>IV) Resistance to tap Water*</b>	I) Shall not show any sign of blistering, wrinkling & lifting of paint film up to 2000 hrs. (II) -do-  (III) -do-  <b>IV) Shall not show any sign of blistering, wrinkling &amp; lifting of paint film up to 3000 hrs</b>	Appendix -II
16.	Pot life at (27± 2)°C, min.	4 hours	Appendix-III
17.	Mass in kg/10 litres, min.	12.0	IS:101Pt.1 Sec.7- 87
18.	<b>Impact resistance test at height 31 inch and 3.226 pound ) (100 inch-pound load)</b>	<b>Shall be free from cracking in the deformed coating by dropping the indenter on coated side of test panel</b>	ASTM:D 2794-93
19.	<b>Adhesion test</b>	<b>Matches to 5B</b>	<b>ASTM D:3359</b>
20.	<b>Adhesion &amp; compatibility test with Acrylic Polysiloxane</b>	<b>Shall be compatible with Acrylic Polysiloxane and matches to (5A)</b>	<b>ASTM: D-3359 &amp; Appendix-IV</b>

\*In case of approval and / or bulk supply, every 5<sup>th</sup> batch or the last batch if the batches are less than 05, 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.



	<p>ance to chemicals</p> <p>i) 25% (w/v) caustic soda sol.</p> <p>ii) 30% (v/v) sulphuric acid sol.</p> <p>iii) 20% (v/v) hydrochloric acid sol.</p> <p>iv) <b>Resistance to tap Water</b></p>							
10	<b>Impact resistance test</b>	-do-	-do-	-do-	-do-	-do-	-do-	<b>Apply two coats on one side of test panel</b>
11.	<b>Adhesion test</b>	<b>MS</b>	<b>150 x 100 x1.25</b>	<b>One coat of H.B. Epoxy Paint</b>	<b>125-150 microns</b>	<b>-do-</b>	<b>-do-</b>	<b>-</b>

## 5. MARKING AND PACKING

- 5.1 Each container shall be marked with the following :
- Name of the material
  - Indication of the source of manufacture
  - Volume of the material
  - Batch No. or Lot No. in code or otherwise and
  - Month & year of manufacture
- 5.2 For touch up/patch painting, the material shall be supplied in one litre container.

## 6. INSPECTION

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

- 6.1 At the time of initial approval, full testing shall be done.
- 6.2 Inspecting Authority shall draw the sample from each batch and test shall be done as per Table II, except for long duration test as per S. No.10,11 &15 (IV).
- 6.3 For bulk supply, every fifth batch or last batch if the batch is less than 5 batches shall be subjected for full testing.

### **6. (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

### PROCEDURE FOR DETERMINING VOLUME SOLIDS PERCENTAGE

#### 1. SCOPE

This method is applicable to the determination of the volume of non volatile matter of paint coatings.

#### 2. SIGNIFICANCE

This method is intended to provide a measure of the volume of dry coating obtainable from a given volume of liquid coating. This volume is considered to be the most equitable means of comparing the coverage (sq.meter of surface covered at a specific film thickness per unit volume) and also for calculating the wet film thickness of the given paint.

#### 3. APPARATUS

- i) Analytical balance
- ii) Steel disc – Preferably stainless steel, 60 mm dia and 0.70 mm thickness with a small hole 2 to 3 mm from the edge. A fine wire such as chromel is attached through the hole and made of the appropriate length for suspending the disc in a liquid.
- iii) Weight box
- iv) Beaker 1 litre , for weighing the disc in liquid.
- v) Weight per litre cup for determining the specific gravity of the paint material and of the suspending liquid if not known.
- vi) Oven.

#### 4. PROCEDURE :

- i) Dry the disc in an oven at 105°C for 10 minutes and cool.
- ii) Weigh the disc in air. Let it be W1 grams.
- iii) Suspend the disc in water and weight again. Let it be W2 grams.
- iv) Calculate the volume of the disc V as follows :

$$V = \frac{W1 - W2}{d} \text{ where } d \text{ is the density of the water at room temperature.}$$

- v) Determine the weight of non-volatile content of the liquid coating material by drying a known amount of paint at 105° C for 3 hours. Let it be W grams.
- vi) Determine the specific gravity of the paint to the nearest 0.001 g/ml by using weight per gallon cup. Let it be P.
- vii) Dip the disc in the paint sample for 10 minutes and take out the disc and allow the excess coating material to drain off. Blot the coating material off the bottom edge of the disc so that heads or drops do not dry on the bottom edge of the disc.

- viii) Dry the disc. in an oven for 3 hours at 105°C and cool.
- ix) Weigh the coated disc in air. Let it be W3 grams.
- x) Suspend the coated disc in water and weigh again. Let it be W4 grams.
- xi) Calculate the volume of the coated disc as follows :

$$V1 = \frac{W3 - W4}{d}$$

where d is the density of the water at room temperature.

- xii) Calculate the volume of the dried coating as follows :-

$$\text{Volume of dried coating} = V1 - V(Vd)$$

- xiii) Calculate the volume of wet coating as follows :

$$V1 = \frac{W3 - W1}{W \times P}$$

where W = grams of nonvolatile matter.  
P = specific gravity of the paint.

- xiv) Calculate the percentage volume solids of the paints as follows :

$$\frac{V1 - V}{Vw} \times 100 \quad \text{OR} \quad \frac{Vd}{Vw} \times 100$$

The volume of non-volatile matter or the percentage volume solids of a paint is related to the covering capacity and thickness in the following manner :

a)  $\frac{\% \text{ Volume solids}}{\text{Dry film thickness (microns)}} \times 10 = \text{Covering Capacity}$

$\frac{\text{Dry film thickness (microns)}}{\% \text{ Volume solids}} \times 100 = \text{wet film thickness}$

## APPENDIX-II

### Accelerated Tests: (Resistance to Chemicals ) :

The following short - term tests of chemical resistance, do not categorize the type of service for which High build 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 9 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 3/4<sup>th</sup> of the panel in 25% (w/v) caustic soda solution for 2000 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 3/4<sup>th</sup> of the panel in 30% (v/v) sulphuric acid solution for 2000 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 3/4<sup>th</sup> of the panel in 20% (v/v) hydrochloric acid for 2000 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 3/4<sup>th</sup> 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-III

### PROCEDURE FOR DETERMINING THE POT LIFE

(AS PER U.S. DEPT. OF TRANSPORT/FED. RAIL, ROAD ADMN. OFFICE OF SAFETY TEST METHOD 2.7.1)

Take the usable time as the pot life of paint. Condition the components of the coating for one hour at 27± 2<sup>o</sup>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 hour thereafter. However, the interval may be shortened, if desired.
2. Near the end of the paint's working life, the viscosity builds-up rapidly. During this period, when it appears the paint may be too viscous to spray, remove a small portion and add the appropriate thinner. 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-IV****DETERMINATION OF ADHESION AND COMPATIBILITY****1. Outline of method:**

The material is tested in a painting system comprising of high build epoxy and Acrylic Polysiloxane 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 build epoxy and Acrylic Polysiloxane paint 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 build epoxy (two pack), 100-125 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 Polysiloxane (two pack), 45 microns, minimum DFT, as per the specification. Allow to air dry for 5 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 build epoxy and Acrylic Polysiloxane.

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.