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**DRAFT RDSO SPECIFICATION**

**No. M&C/PCN/123-11**

**SPECIFICATION FOR HIGH PERFORMANCE  
ANTICORROSION EPOXY COATING (TWO PACK)**

**RESEARCH DESIGNS & STANDARDS ORGANISATION**

**Manaknagar , LUCKNOW – 226 011**

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## **DRAFT SPECIFICATION NO. M&C/PCN/123/2011**

### SPECIFICATION FOR HIGH PERFORMANCE EPOXY PAINT (Two Pack)

#### **1. SCOPE :**

This standard prescribes the technical requirements and methods of testing for two pack 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 Sa 2.5 preferably or St<sub>3</sub> of ISO Specification No.:8501-1-88. It should be suitable for application by air / air-less spray with 10% (max.) 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.

#### **2. 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 Epoxy Paint.

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

#### **3. REQUIREMENTS :**

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

3.2 **Composition :** The paint shall consist essentially of two packs namely Pack A and Pack B

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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 vehicle content basis	250-450	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. 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. The minimum temperature for satisfactory cure is  $10^{\circ}\text{C}$ .

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.

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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.

**4.2.6 TABLE-II : REQUIREMENTS FOR HIGH PERFORMANCE EPOXY PAINT (Two Pack)**

S.No.	Characteristics	Requirements	Method of test
1.	Drying time at 27±2°C a) Surface dry, max b) Recoating time, min. c) Hard dry, max. d) Curing time,max.	2 hours 4 hours 16 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, min., by brush /air / airless spray	(75-125) microns	IS: 101(Pt.3/Sec.2)-89 By Elcometer/Thickness gauge meter
6.	Volume solids, % min	65±10	See 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	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 2000 hours	ASTM: B-117
11.	Protection* against corrosion under condition of condensation	No sign of corrosion & no sign of deterioration up to 2000 hours	IS: 101(Pt.6 /Sec.1)-88

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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 * I) 25% caustic soda solution (w/v)  II) 30% sulphuric acid solution (v/v)  III) 20% hydrochloric acid (v/v)	Shall not show any sign of blistering, wrinkling & lifting of paint film up to 2000 hrs. -do-  -do-	Appendix -II
15.	Pot life at 27± 2°C min.	3hours	Appendix-III
16.	Mass in kg/10 litres, min.	12.0	IS:101Pt.1 Sec.7- 87
17.	Impact resistance test, height 100 inch, load 3.464 pound, painted side should face indenter	Shall be free from cracking in the deformed coating	ASTM:D 2794-93
18.	Resistance to distilled Water	Shall not show any sign of blistering, wrinkling & lifting of paint film up to 500 hours	IS:101 Part 7/Sec.1-
19.	Cathodic disbondment test, max	8.0 mm. at 3.5v ,24 hr., and 65°C	CAN-CSA- Z245.0 2-98, Cl.12.8

**\*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 may be tested. The duration of the test shall be 2000 hrs. Edges of the test panels may be resealed with wax if it gets damaged/thinned down during testing period.**



7.	Resistance to Salt Spray	M.S.	150 x 100 x 1.25	Two coats of High Performance Epoxy Paint	150-250 microns	-do-	-do-	Paint both sides of panels and seal the edges with wax.
8.	Protection against corrosion under conditions of condensation	-do-	-do-	-do-	-do-	-do-	-do-	-do-
9.	Resistance to chemicals i)25% (w/v) caustic soda sol. ii)30% (v/v) sulphuric acid sol. iii) 20% (v/v) hydrochloric acid sol.	-do-	-do-	-do-	-do-	-do-	-do-	-do-
10.	Resistance to distt. water	-do-	-do-	-do-	-do-	-do-	-do-	-do-

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**5. 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. 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. No. 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 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.



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**APPENDIX- I**

**PROCEDURE FOR DETERMINING VOLUME SOLIDS PERCENTAGE**

**1. SCOPE**

This method is applicable for 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 :

$$W1 - W2$$

V = ----- where d is the density of the water at room temperature.

$$d$$

- 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.

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- 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 :  

$$W3 - W4$$

$V1 = \frac{W3 - W4}{d}$  where d is the density of the water at room temperature.

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

Volume of dried coating =  $V1 - V$   
 $(Vd)$

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

$W3 - W1$

$V1 = \frac{W3 - W1}{P}$  where W = grams of non-volatile matter.

W X P

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 :-

% Volume solids

a) ----- X 10 = Covering Capacity

Dry film thickness (microns)

Dry film thickness (microns)

b) ----- X 100 = wet film thickness

% Volume solids

## **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 performance 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.

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### **APPENDIX-III**

#### **PROCEDURE FOR DETERMINING POT LIFE**

(AS PER U.S.DEPPT.OF TRANSPORTATION/FED.RAIL ROAD ADMN.OFFICE OF SAFETY, 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<sup>0</sup> C and mix immediately in proper ratio to get approx. 200 ml. of paint in 250ml.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 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.