

Page 1 of 9	Specification No. M&C/ PCN/ 104 /2020	Effective from :Sep-2020	Rev. 1.0
RDSO Specification for Epoxy based Chemical Resistant Finishing Paint (Two pack)			

**RDSO SPECIFICATION NO.  
M&C/PCN/104/2020  
(Rev 1.0)**



**SPECIFICATION FOR EPOXY BASED  
CHEMICAL RESISTANT FINISHING  
PAINT (TWO PACK)**

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Page 2 of 9	Specification No. M&C/ PCN/ 104 /2020	Effective from :Sep-2020	Rev. 1.0
RDSO Specification for Epoxy based Chemical Resistant Finishing Paint (Two pack)			

## **RDSO SPECIFICATION NO. M&C/PCN/104/2020**

### **SPECIFICATION FOR EPOXY BASED CHEMICAL RESISTANT FINISHING PAINT (TWO PACK)**

#### **0.0 FOREWORD**

This standard was initially adopted in 1986 and subsequently revised in the year 2000. In this revision requirement limits for Epoxy equivalent, Drying time, %Volume solids, Pot life, Keeping property has been revised in the light of technological advancement and experience gathered. The minimum temperature of the surface to be painted has been incorporated. The procedure for determining pot life has also been revised. Under scope, the suitability of the material by airless spray has also been incorporated. Methods of test have been specified as per revised IS: 101.

#### **1. SCOPE**

- 1.1 This standard specifies requirements and methods of testing of Epoxy Based Chemical Resistant Finishing Paint supplied in Dual Packs, intended to be used for the protection of Interior of Railway Coaches and Bridge Girders against aggressive conditions of corrosion. It is suitable for application by Brush/Spray/Airless Spray.

**NOTE:** “Firm should comply Make in India Policy and Public Procurement (Preference to Make in India) Order-2017 under this specification” and subsequent Amendment done time to time.

#### **2. TERMINOLOGY**

- 2.1 For the purpose of this standard apart from the Glossary of Terms given in IS 1303 - 1983, Reaffirmed 2017 or its latest version and Cl.2 of IS: 9162-79, Reaffirmed 2016 or its latest version the following shall also apply.
- 2.1.1 **PACK:** This term used to describe each of the Two Packs of the paint, which when mixed together, form an Epoxy Based chemical resistant finishing paint.
- 2.1.2 **PAINT:** The mixture of the two components in the proportion recommended by Manufacturer/Supplier.

#### **3. REQUIREMENTS**

- 3.1.1 The mixing ratio of the Pack A and Pack B shall either be a simple ratio such as 1:1, 1:2, 1:3 etc. by volume or as recommended by Manufacturer/Supplier.
- 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 and Pigment.
- 3.2.1.1 In the formulation of paint, Epoxy Resin of the following grade shall be used

**TABLE I : Requirements for Epoxy Resin**

SN	Characteristic	Requirement	Method of Test
1.	Weight per Epoxy equivalent on Non-volatile vehicle content basis, g/mole	150-600	CI 2.2 & 4 of IS:9162-79 Reaffirmed 2016 or its latest version

### 3.2.1.2 PIGMENT CONTENT

The material shall consist of a minimum of 30.0 % by mass of pigment, when both the components mixed in the ratio, as given by manufacturer and tested as per IS: 101, Part 8/ Sec 2-1990, Reaffirmed 2017 or its latest version by using the following extraction mixture:

- i) Methyl Iso-Butyl Ketone(MIBK) or 25 parts by volume  
Methyl Ethyl Ketone(MEK) or  
a Mixture of both in the ratio 1:1 by volume)
- ii) Xylene 50 parts by volume
- iii) Acetone 25 parts by volume

b) The pigment shall contain not less than 80% by mass of Titanium Dioxide (Rutile Grade) pigment, conforming to IS: 411. The balance of the pigment composition shall consist of Extenders and other suitable colouring matters to have desired colour finish.

### 3.2.2 PACK B : (Normally referred to as Hardener )

This shall be liquid type such as an Aliphatic Amine, and Aliphatic or Aromatic Amine adduct, a Polyamide or Amido Aolyamine or any other suitable Hardener. It shall react Epoxy Resin at normal ambient temp.

## 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 metal panels shall be in accordance with IS: 101 (Part1/Sec.3)-86, Reaffirmed 2012 or its latest version.

4.2.2

4.2.3 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.

4.2.4 The two packs i.e. Base and Hardener shall be mixed in the ratio recommended by the Manufacturer/Supplier before conducting the test or tests. Where the paint is required to be applied on panels, it shall be done so by using suitable Brush/Spray.

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 :

Page 5 of 9	Specification No. M&C/ PCN/ 104 /2020	Effective from :Sep-2020	Rev. 1.0
RDSO Specification for Epoxy based Chemical Resistant Finishing Paint (Two pack)			

**TABLE-II: REQUIREMENTS FOR EPOXY BASED CHEMICAL RESISTANT FINISHING PAINT (TWO PACK)**

SN	Characteristics	Requirements	Test Method
1.	Drying time a) Surface Dry, Max. b) Hard Dry, Max c) Hard Dry at 70 °C, Max. d) Curing time, Max	3 Hours 8 Hours 30 Minutes, with 15 Minutes flash of time 7 days	IS:101-86 (Part3/Sec.1) Reaffirmed 2017 or its latest version -do- -do- -do-
2.	Consistency	Smooth & uniform, and suitable for brush/spray application	IS:101-89 (Part1/Sec.5), Reaffirmed 2019 or its latest version
3.	Finish	Smooth and semi glossy	IS : 101-87 (Part3/Sec.4), Reaffirmed 2019 or its latest version
4.	Colour	Black or to an agreed colour where IS/RAL colour is not specified	IS : 101-89 (Part4/Sec.2), Reaffirmed 2019 or its latest version
5.	Dry Film Thickness per coat, Min a) By Brush b) By Airless Spray	100 microns 125 microns	IS: 101-89 (Part3/Sec.2), Reaffirmed 2019 or its latest version By Elcometer
6.	Volume Solids, %, Min.	65.0	APPENDIX -I
7.	Scratch Hardness (1.5 Kg. Load)	No such scratch so as to show base metal	IS : 101-88(Part5/Sec.2), Reaffirmed 2019 or its latest version
8.	Flexibility & Adhesion (6.25 mm Mandrel)	No visible damage or detachment of film	IS : 101-88(Part5/Sec2), Reaffirmed 2019 or its latest version
9.	Flash Point for both Packs	Above 20°C	IS : 101-87(Part1/Sec.6), Reaffirmed 2019 or its latest version
10.	Resistance to Salt Spray	No sign of corrosion and no sign of deterioration of paint film up to 1000 hours	IS : 101-88(Part6/Sec1), Reaffirmed 2015 or its latest version
11	Protection against corrosion under condition of condensation	-do-	IS : 101-88(Part6/Sec1), Reaffirmed 2015 or its latest version
12.	Keeping Properties (for both Packs), Min.	09 months	APPENDIX-III
13.	Mass in Kg./10 liters, Min	12.0	IS:101-87(Part1/Sec.7), Reaffirmed 2019 or its latest version
14.	Pot life (After 15 minutes of induction time), at i) 27±2°C, Min ii) 40±2°C, Min	3 Hours 30 Minutes 2 Hours	APPENDIX- II

**RDSO Specification for Epoxy based Chemical Resistant Finishing Paint (Two pack)**

15.	Resistance to Chemicals a) 10% Caustic Soda Solution,(w/v) b) 10% Ammonia Solution,(v/v) c) 10% Hydrochloric Acid Solution .(v/v) d) 10% Sulphuric Acid Solution(v/v)	Shall not show any sign of blistering, wrinkling lifting of paint film upto 500 hours for Bases(a & b) and 250 hours for Acids( c & d).	APPENDIX- IV
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**TABLE-III: DETAILS OF PREPARING PAINTED PANELS FOR TESTING OF EPOXY BASED CHEMICAL RESISTANT FINISHING PAINT (TWO PACK)**

S N	Test	Type of metal panel	Size in mm	Painting Detail	D.F.T. in micron , Min	Method of Application	Duration of air drying before commencement of test	Special Instructions
1.	Drying time	M.S.	150x100x1.25	One coat of Epoxy Chemical Resistant Paint	100	Brush/ spray	-	-
2.	Finish	-do-	-do-	-do-	-do-	-do-	48 hrs.	
3.	Colour	-do-	-do-	-do-	-do-	-do-	24 hrs.	
4.	Dry film Thickness	-do-	-do-	-do-	-do-	-do-	-do-	
5.	Scratch Hardness	Tinned M.S.	150x150x.315	-do-	-do-	Brush spray	7 days	Apply a load 1.5 Kgs. instead of 1 Kg
6.	Flexibility & Adhesion	-do-	-do-	-do-	-do-	-do-	-do-	
7.	Resistance to Salt Spray	M.S.	150x100x1.25	One coat of *Epoxy Zinc Phosphate primer & one coat of Epoxy chemical resistant paint	60 micron + 100 micron	-do-	24 hours + 7 days	Test duration shall be 1000 hrs.
8.	Protection against corrosion under conditions of condensation	-do-	-do-	-do-	-do-	-do-	-do-	-do-
9.	Resistance to chemicals a) 10% Caustic Soda solution.(w/v) b) 10% Ammonia Soln. (v/v) c) 10% Hydrochloric acid Soln. (v/v) d)10% Sulphuric acid Soln. (v/v)	-do-	-do-	Two coats of epoxy chemical resistant paint	200 microns	-do-	-do-	Prepare & paint both sides of panels & seal the edges with wax

\* As per RDSO Specification No M&C/PCN/102/2020 or its latest version, Specification for Epoxy Based Zinc Phosphate Primer (Two Pack).

Page 7 of 9	Specification No. M&C/ PCN/ 104 /2020	Effective from :Sep-2020	Rev. 1.0
RDSO Specification for Epoxy based Chemical Resistant Finishing Paint (Two pack)			

## APPENDIX – I

### PROCEDURE FOR DETERMINING VOLUME SOLIDS PERCENTAGE

#### 1. SCOPE :

This method is applicable for determination of the volume solids percentage 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. metre 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) Weight the disc in air. Let it be W1 grams.
- (iii) Suspend the disc in water and weigh 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:-  
 Volume of dried coating (Vd) = V1 - V
- xiii) Calculate the volume of wet coating as follows:  

$$V_w = \frac{W3 - W1}{W \times P}$$
 where W = grams of non volatile matter in 1.0 gm paint.  
 P = specific gravity of the paint.
- xiv) Calculate the percentage volume solids of the paints as follows:

$$\frac{V1 - V}{V_w} \times 100 \quad (\text{OR}) \quad \frac{V_d}{V_w} \times 100$$

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)  $\frac{\% \text{ Volume solids}}{\text{Dry film thickness (microns)}} \times 10 = \text{Covering Capacity}$
- (b)  $\frac{\text{Dry film thickness (microns)}}{\% \text{ Volume solid}} \times 100 = \text{wet film thickness (microns)}$

Page 9 of 9	Specification No. M&C/ PCN/ 104 /2020	Effective from :Sep-2020	Rev. 1.0
RDSO Specification for Epoxy based Chemical Resistant Finishing Paint (Two pack)			

## **APPENDIX – II**

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

(AS PER U.S. DEPTT. 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  $27 \pm 2^{\circ}\text{C}$  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. Measure the viscosity initially and every hour thereafter. However, the interval may be shortened, if desired. 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 compatible 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- III**

### **KEEPING PROPERTIES**

When stored under cover in a dry place in the original sealed containers under normal temperature conditions, the material shall retained the properties prescribed in the specification for the stipulated keeping period from the date of manufacture which shall be subsequent to the date of placement of contract(P.O.).



Page 10 of 9	Specification No. M&C/ PCN/ 104 /2020	Effective from :Sep-2020	Rev. 1.0
RDSO Specification for Epoxy based Chemical Resistant Finishing Paint (Two pack)			

## APPENDIX-IV

### RESISTANCE TO CHEMICALS TEST

The following short term tests of chemical resistance do not categorize the type of service for which Epoxy based chemical resistant finishing paint are intended but are included to assure the customer that the coating contain a sufficiency of cured resin to exhibit the long term requirements.

- a) **Resistance to 10% Caustic Soda solution (w/v):** Immerse 3/4<sup>th</sup> of the panel in 10% (w/v) caustic soda solution for 500 hours. Remove the panel, wash in running fresh water and allow it to dry for an hour and record the observations.
- b) **Resistance to 10% Ammonia solution (v/v):** Immerse 3/4<sup>th</sup> of the panel in 10% (v/v) ammonia solution (prepared by diluting liquor ammonia in distilled water) for 500 hours. Remove the panel, wash in running fresh water and allow it to dry for an hour and record the observations.
- c) **Resistance to 10% Sulphuric Acid solution (v/v):** Immerse 3/4<sup>th</sup> of the panel in 10% (v/v) sulphuric acid solution (prepared by diluting con. sulphuric acid in distilled water) for 250 hours. Remove the panel, wash in running fresh water and allow it to dry for an hour and record the observations.
- d) **Resistance to 10% Hydrochloric Acid solution (v/v):** Immerse 3/4<sup>th</sup> of the panel in 10% (v/v) hydrochloric acid solution (prepared by diluting con. hydrochloric acid in distilled water) for 250 hours. Remove the panel, wash in running fresh water and allow it to dry for an hour and record the observations.