



**Government of India  
Ministry of Railways**

**STR No.**

**M&C/PCN/043/2020**

**(Revision 2.0)**

***SCHEDULE OF TECHNICAL REQUIREMENTS FOR INFRASTRUCTURE,  
MANUFACTURING, TESTING FACILITIES & QUALITY CONTROL REQUIREMENTS***

**OF**

**EPOXY BASED ANTICORROSION COATING (TWO PACKS)  
FOR PAINTING OF COACHES, BRIDGES, & WAGONS.  
AS PER RDSO SPEC.NO. M&C/PCN/123/2018**

**2020**

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## 1. FOREWORD

This document has been prepared [earlier reference STR No. M&C/PCN/043/2011) (Revision 1)] to lay down the eligibility and capability of suppliers seeking approval for manufacturing & supply Epoxy based anticorrosion coating (Two Packs) for Painting of interior of Coaches, turn under, Bridges situated in corrosion prone areas, & Wagons etc.

Since this product can be manufactured by conventional as well as special technique therefore both the technique has been incorporated.

## 2. SCOPE

2.1 This document covers the infrastructure facilities for manufacturing of Epoxy paints at works, procurement of raw materials, quality control etc. These paints will be used in corrosion prone specific areas for painting of interior of Coaches, Wagons, Bridges and Tracks etc.

2.2 This product can be manufactured by conventional as well as special technique and based on the technique of manufacturing, STR's clause 6.1 & 6.3.1 can be followed keeping other clauses same for both.

## 3. APPLICABLE/REFERENCE DOCUMENTS

(i) IS: 101

(ii) ASTM B-117

(iii) ASTM D-3359

(iv) ASTM G-154

(v) ASTM D 4060

(vi) ASTM G-95-07

Or CAN-CSA-Z245.0 2-98, CI.12.8

(vii) ASTM D 5895

(viii) ASTM D 2794

## 4. TERMINOLOGY

STR – Schedule for Technical Requirements

NTH – National Test House

ISO – International Standards Organization

M&P – Machinery & Plant

NABL – National Accredited Board of Laboratories

NSIC – National Small Industries Corporation Limited

## 5. Requirements

### 5.1 General

Any firm seeking approval of this organization:

- (i) Shall possess valid ISO 9001: 2015 or latest certificate for the products for which approval is sought.
- (ii) Shall have manufacturing and marketing experience of these paints, at least for 2 years.
- (iii) Shall procure these resins from national or international sources and shall produce bill of material.
- (iv) Shall have valid clearance from Pollution Control Board.  
(Proposed for deletion)
- (v) The firm shall install ISO: 14000 Environmental Management System.
- (vi) ~~Shall have the record of supplying the products to the reputed national and international organization like defense, heavy & earthmover industries like BEML, BHEL, railway and major automotive industries.~~ (Proposed for deletion)
- (vii) ~~Shall have minimum turnover of 1.0 crores per annum for last 2 previous years of applying for registration.~~ (Proposed for deletion)  
Proposed for modification as: Shall have balance sheet for last 2 years.
- 13. ~~Firm should have their own R&D facilities approved by Govt. Agency or the firm should have tie up with Govt. R&D Laboratory/Deemed/Govt. University. Valid certificate with clear date of validity on it should be available with the firm and same need to be submitted to RDSO/Lucknow.~~ (Proposed for deletion)
- (ix) The firm should have valid capacity certificate issued by NSIC /Other approved agency for small scale industries.
- (x) In case of medium & large scale industries, if capacity certification is not possible by any approved agency, capacity shall be declared by the firm itself detailing the points to arrive at the capacity and subsequently assessing officer will verify the capacity during the assessment of the firm.

- 5.2 The above information should be furnished by the firm in registration form or by attaching as annexure.
- 5.3 The firm should have covered area with adequate space for the storage of raw material, intermediate and finish products like pigments, extenders, resin, hardeners, oils, varnish, thinners, additives, paints etc. with the firm which is free from dampness and humidity and all manufacturing facilities should be available in same campus of factory. One bond room with lock and key facility for keeping finished products should also be available.
- 5.4 Approval of a firm will be given as per laid down procedure given in ISO apex document only after inspection of the factory premises to assess the capacity/capability of the firm and samples of paints drawn during inspection (comprising of a full system of painting) meets the norms and requirements of the relevant RDSO specifications on testing at RDSO. The initial approval shall be given in "List of RDSO Vendors for developmental orders" and further upgradation to "List of approved vendors" will be given after meeting the requirement given in ISO apex document and supply of minimum 20,000 litres after initial approval.
- 5.5 The firm should submit the Brand Names of the applied products.
- 5.6 The Approval to the firm will be given for full paint system. The list of paint items is furnished at Clause 11.0

## **6. Manufacturing Machines & Plants**

### **6.1 WITH CONVENTIONAL PROCESS.**

Firm should possess the following minimum machines and plants for manufacturing paints based on Epoxy resins.

**Table -I**

<b>Sl. No.</b>	<b>Equipments</b>	<b>Quantity (min.)</b>
1.	High Speed Disburser, min. capacity 500 litres-2 nos. or the total capacity shall be 1000 litres min. may be considered irrespective of no. of machines.	2Nos.
2.	Sand Mill, min. Chamber 25 lts.	2Nos.
3.	Bead Mill, min. capacity 200 lts.	2Nos.
4.	Paint Mixer, min. capacity 2 K ltr.	2 Nos.
5.	High & Slow Speed Premixer/ variable speed premixer.	2Nos.
6.	Attritor, 200 ltr.	2Nos.
7.	Thinning Pump	2Nos.
8.	Automatic Filling Machine	3 Nos.
9.	Weighing Machine, 300 Kg., Least count 0.100 Kg. Weighing Machine, 60 Kg., Least count 0.050 Kg. Weighing Machine, 10 Kg., Least count 25.00 gm	2 Nos. 2 Nos. 2 Nos.
10.	Electronic Balance, 1.00 Kg., Least count 10.00 gm.	3 Nos.
11.	Industrial Vibrator or agitator	2 Nos.
12.	Resin Transfer Pump	2Nos.
13.	Solvent Pump	3 Nos.
14.	Unloading Pump	2Nos.
15.	Hoist 2 ton	2 Nos/suitable plant design to meet the requirements
16.	Filter press with variable mesh size filter	2 Nos
17.	Diesel Generator of adequate capacity	1 Nos.

## **6.2 Quality Control Facilities**

6.2.1 The firm should have proper air conditioned laboratory to maintain lab test conditions at  $27 \pm 2^{\circ}\text{C}$  and  $65 \pm 5\%$  relative humidity, for which suitable indicating/measuring instruments will be available in the lab.

6.2.2 There should be full testing facilities with equipments which are covered as per requirements of IS: 101 latest version or as per ASTM. Other equipments not covered in IS: 101 shall be of reputed make and these should have valid calibration certificate. It is mandatory for a firm seeking approval of RDSO to have following listed equipments at their end.

Table -II

SI No.	Name of the Equipment	Quantity (min.)
1.	Humidity Chamber as per IS : 101	1 No.
2.	Salt Fog Test Cabinet as per ASTM B117 or equivalent to IS: 101	1 No.
3.	Cathodic disbondment tester as per CAN-CSA- Z245.0 2-98, Cl.12.8 or ASTM G-95-07	1 No
4.	Impact resistance tester as per ASTM D- 2794	1 No
5.	Cross cut adhesion tester as per ASTM D 3359	1 No.
6.	Sagging index as per IS : 101	1 No.
7.	Drying time recorder as per ASTM D 5895	1 No
8.	Abel's Flash Point Apparatus as per IS : 101	1 No.
9.	Cryptometer or Black & White Charts as per IS : 101	1 No. or Black and White Charts in adequate quantity
10.	Flexibility & Adhesion Apparatus as per IS : 101	1 No.
11.	Scratch Hardness Tester as per IS : 101	1 No.
12.	Stormer/Brooke Field Viscometer as per IS : 101	1 No.
13.	Weight/10 Litre Cup as per IS : 101	1 No.
14.	Hegdemann Gauge as per IS : 101	1 No.
15.	Centrifuge as per IS : 101	1 No.
16.	Dry Film Thickness Measuring Equipment as per IS : 101t	1 No.
17.	Dean & Stark Apparatus as per IS : 101/ Carl fisher apparatus	1 No.
18.	Hygrometer	1 No.
19.	Distillation Plant	1 No.
20.	Heating Mantles	3 Nos.
21.	Set of Sieves, Thermometers, Glass Wares, Crucibles, Reagents & Chemicals for Testing of Raw Materials, Intermediate and Finished Products as per relevant specifications	In adequate Qty./Nos.
22.	Chemical Balance up to 4 decimal places (in gms.)	1 No.
23.	Physical Balance up to 2 decimal places (in gms.)	1 No.
24.	Hot Air Electric Oven	1 No.
25.	Air & Air less spray gun	1 No each
26.	Water Bath	2No.
27.	Hot Plates	3 Nos.
28.	Mild Steel, Tinned and Glass Panels and Test Racks	In adequate number as per relevant specification.
29.	Pull off adhesion Tester	1 No.
30.	Abrasion Resistance test for 1000 cycles with CS-17 wheels & 1.0 Kg load	1 No.

## 6.3. ALTERNATE METHOD

### 6.3.1 MANUFACTURING WITH SPECIAL TECHNIQUE

#### 6.3.2 Manufacturing Machines & Plants:

Premixing blender, twin screw extruder, chiller drum, rotary crushers, High speed grinding mill, Vibratory screen, Bead Mill.

#### 6.3.3 BRIEF MANUFACTURING PROCESS

Anticorrosion Paint is a kit of Base and Hardener parts. Both Base and Hardener parts are viscous liquid and manufactured separately

##### A. Manufacturing of Base :

Raw Materials used in manufacturing of Base, include solid epoxy resin, pigments, additives and solvent. Following are the steps of manufacturing

##### a. Premixing :

All the solid Raw Materials are charged to a **premixing blender** and homogenized at high speed to a coarse size flake and powder

##### b. Extrusion :

Blended solid material is fed to the hopper of **twin screw extruder** and melt processed as homogenized molten paste. This molten pastes through **chiller drum**, cools to brittle flakes. Flakes will pass through **rotary crushers**.

##### c. Grinding:

Flakes and chips are fed to the high **speed grinding mill**; Grinder is attached with **Vibratory screen**.

##### d. Liquification of Base Material:

Powder of base material is fed to the 500 kg capacity Bead Mill. Requisite quantity of solvents is added to obtain desired volume solids, viscosity and Fineness of the grind. .

#### 6.3.4 Manufacturing of Hardener

Hardener manufacturing is a simple process. It requires High Speed stirring of curative, pigment and solvent.

## 7.0 QUALITY CONTROL SPECIAL TECHNIQUE (Testing facilities)

Manufacturing of Anticorrosion paint requires very stringent Quality Control and Quality assurance discipline.



**A. Raw Material Testing:**

Number of Raw Materials is used in the manufacturing of both part A and part B of Anticorrosive Paint.

Following Laboratory Equipments are used for Testing of Raw Materials and Semi (intermediate) and Finished processed materials:

**Table -III****7.1 Laboratory Equipments for Testing of Raw Materials & Finished Product**

Sl No.	Name of the Equipment	Required for	Quantity (min.)
1.	Gel Plates	Pot Life	1 No.
2.	Micronized sieves	Particle size	1 No.
3.	Brookfield Viscometer	Brook field viscosity	1 No.
4.	Ford Cup	Viscosity in seconds	1 No.
5.	Humidity Chamber	Resistance of cured coating	1 No.
6.	Cross Hatch Tester	Adhesion	1 No.
7.	Cylindrical Mandrel	Flexibility	1 No.
8.	FTIR	Functional groups in the polymer	1 No.
9.	DFT gauge - Elcometer	Dry Film Thickness	1 No.
10.	Electronic Weighing Balance	Fractional weights	1 No.
11.	Film Applicator	Making cured Film	1 No.
12.	Hegman Gauge	Finness of the grind	1 No.
13.	Glossometer	Gloss of cured coating	1 No.
14.	Ring & Ball Apparatus	Softening point of epoxy RM	1 No.
15.	100 X Magnification	To observe defects	1 No.
16.	Pull Off tester	Adhesion to Steel	1 No.
17.	Sag Index Apparatus	Sag Resistance	1 No.
18.	Salt Spray Equipment	Resistance to Salt Spray	1 No.
19.	Scratch Hardness Tester	Scratch Hardness	1 No.
20.	Weatherometer	Long term Weathering Properties	1 No.
21.	Drying time recorder		1 No.
22.	Water Bath	Hot Water Soak Adhesion	1 No.
23.	Impact Tester	Impact Strength	1 No.
24.	Break Down Voltage Tester	Dielectric Strength	1 No.
25.	pH meter	pH value	1 No.
26.	Centrifuge		1 No.
27.	Computerac	Moisture Content in Epoxy Resin (RM)	1 No.
28.	Air & Air less spray gun	For painting of panels	1 No.
29.	Specific Gravity Tester	Specific Gravity	1 No.
30.	Distillation Plant		1 No.
31.	Pensky Martyn Flash Point Apparatus	Flash Point	1 No.
32.	Weighing Machine of 300.60, 10 Kg with least count of .10,.05 &.025		1 No. each

## 8. Quality Control Requirements

- 8.1 There should be a well-designed system for traceability and identification of the materials from raw material, intermediate and finished product stages.
- 8.2 The quality manual of the firm for ISO should clearly indicate at any stage the quality control over procurements of raw materials, manufacturing of intermediate and finished products by computerized process control technique.
- 8.3 The technical supervisors/managers responsible for production & quality control activities related to manufacturing of subject paint item should have the minimum qualification of B.E. / B.Tech (Paint /Polymer Technology/Chemical Engg.) with a minimum of 3 years' experience or M.Sc. (Chemistry) with a minimum of 7 years' experience in relevant fields to look after the production, quality control and testing activities and should have knowledge of paint manufacturing, testing of raw materials etc. They should be able to take corrective steps in case of difficulties in maintaining quality control.
- 8.4 The firm should ensure that proper analysis is being done on monthly basis to study the rejection at various levels and it is well documented. Process capability should also be studied.
- 8.5 The firms should ensure that all the relevant RDSO/BIS/ASTM and other specifications, standards, manuals etc. of latest version are available with them.
- ~~8.6 If the firm tends to obtain approval for paints based on epoxy as well as polyurethane resins they should possess test certificates for paint based on epoxy resins issued by approved test houses viz NTH / MSME / HBTI / Shri Ram Test House / National Laboratories under CSIR. (Proposed for deletion)~~
- 8.7 A periodical/Need basis Quality Audit check may be carried out of the firm to check the quality of paint and other infrastructure and testing facilities mentioned in the STR

8.8 The firm should prepare and submit Quality Assurance Plan for products, which they intend to supply to Indian Railway and Production Units as per Guidelines of ISO Document no. QM-RF-8.1-3 (Latest version) detailing various aspects:

- Organization chart
- Write up on manufacturing process of resins and paints
- Process flow chart for resins and paints
- Traceability of various products.
- Inspection and testing plan for all the products starting from raw materials, in process and final product.
- Details of non-conformity
- Details of customer complaints and warranty failures/In service failures.
- M&P/T&P as per specification/STR/IS.

The paint manufacturer shall introduce ERP/SAP supported by multimodule application software that helps the paint manufacturer to manage the important parts of their business including product planning, purchase of items, maintaining inventories, providing customer service, finance, HRD etc.

8.9 The firm shall have the system of maintaining the Material Safety Data Sheet (MSDS) for each chemical.

## **9. Repair/Service Centre**

The firm should have 24X7 customer complaint registration & redressal mechanism through website

## **10. Major steps involved in getting the firms approval/registration as per latest ISO apex documents:**

10.1 The firm shall apply online for vendor registration on RDSO website.

10.2 The application form and other relevant documents shall be scrutinized at M&C Dte and if any deficiencies are found, the firm shall be asked to comply the deficiencies as per latest ISO apex guidelines.

13.1 After all deficiencies are complied by the firm, the capacity , capability and STR verification of the firm shall be assessed by nominated official. Samples shall also be drawn from the firms premises after satisfactory compliance of STR and shall be tested at RDSO/National Test House (Lab which is accredited by an accrediting agency which meets the criteria laid down in QO-D-8.1-11 {Latest version}) and if test facility for any of parameter is not available either at RDSO/NTH/as specified in QO-D-8.1-11 then it may be referred to Govt lab/University/any other NABL accredited lab, where it exist.

10.4 If all the test results are satisfactory and all other requirements are fulfilled, the firm shall be approved for “List of RDSO Vendors for developmental orders”.

#### **11. LIST OF PAINTS TO BE APPROVED**

RDSO SPECIFICATION NO. M&C/PCN/123/2018 – Epoxy based anticorrosion coating (Two Packs) for Painting of Coaches, Bridges, & Wagons.

Contd.

**ANNEXURE -I**

SN	Description of Machine/Equipment/ Manpower	Capacity requirement/Qualification	Total requirement	No.of Machines available	Operation to be performed by Machine/Equipment	Capacity of available Machine	Year & Make of machine	Present Status Working/Under commencing/ Not working
1	2	3	4	5	6	7	8	9
1	High speed Disbursor	500 lit.	2 Nos.					
2	Dyno Mill/Bead Mill	200 lit./hr	2 No.					
3	Sand Mill/LMZ Sand Mill	100 lit./hr	2 No.					
4	Paint Mixer	2000 lit.	2 Nos.					
5	Variable speed premixer/High speed		2 No.					
6	slow speed premixer		2 No					
7	Thinning Pump		2 No					
8	Automatic Filling Machine		3 No.					
9	Weighing Machine, LC=0.100 kg	300 kg	2 Nos.					
10	Weighing Machine LC=0.050 kg	60 kg	2 Nos.					
11	Weighing Machine LC=25.0 gm	10 kg	2 Nos.					
12	Electronic Balance LC=10.0 gm	1.0 kg	3 Nos.					
13	Industrial Vibrator or agitator		2 Nos.					
14	Resin Transfer Pump		2 Nos.					
15	Solvent Pump		3 Nos.					
16	Unloading Pump		2 Nos.					
17	Hoist	2 ton capacity	2 Nos. /suitable plant design to meet the requirements					
18	Diesel Generator	adequate	1 Nos.					
19	Filter Press	with variable mesh size filter	2 Nos.					

1	2	3	4	5	6	7	8	9
20	Humidity Chamber		1 No.					
21	Salt Fog Test Cabinet as per ASTM B117		1 No.					
22	Cathodic disbondment tester		1 No.					
23	Cross cut adhesion as per ASTM D3359		1 No.					
24	Sagging Index		1 No.					
25	Abel's Flash point Apparatus		1 No.					
26	Crypto meter/Black & White Charts		1 No.					
27	Flexibility & Adhesion Apparatus		1 No.					
28	Scratch Hardness Tester		1 No.					
29	Stormer/Brookefield Viscometer		1 No.					
30	Weight/10 lit Cup		1 No.					
31	Hegdeman Gauge		1 No.					
32	Centrifuge		1 No.					
33	Dry Film Thickness Measuring Apparatus		1 No.					
34	Dean & Stark Apparatus		1 No.					
35	Drying time Recorder		1 No.					
36	Hygrometer		1 No.					
37	Impact resistance tester		1 No.					
38	Chemical Balance, upto 4 decimal place		1 No.					
39	Physical Balance, upto 2 decimal place		1 No.					
40	Hot Air Oven		1 No.					
41	Distillation Plant		1 No.					
42	Hot Plates		3 Nos.					
43	Heating Mantles		3 Nos.					
44	Water Bath		2 Nos.					
45	Mild Steel, Tinned & Glass panels & test Racks		Adequate					

46	Set of Sieves, Thermometers, Glassware, Crucibles, Reagents & Chemicals for testing of Raw materials, Intermediate & finished products as per relevant specifications.		Adequate qty.					
47	Air & Airless Spray Gun		1 No. each					
48	Pull off adhesion tester		1 No.					
49	Abrasion Resistance test for 1000 cycles with CS-17 wheels & 1.0 Kg Load		1 No.					
50	<b>Manpower—</b> The technical supervisors/managers responsible for production & quality control activities related to manufacturing of subject paint item should have the minimum qualification of B.E. / B.Tech (Paint /Polymer Technology/Chemical Engg.) with a minimum of 3 years experience or M.Sc. (Chemistry) with a minimum of 7 years experience in relevant fields to look after the production, quality control and testing activities and should have knowledge of paint manufacturing, testing of raw materials etc.		1 No. each for Production & Quality Control respectively.					

## FOR ALTERNATE METHOD- MANUFACTURING WITH SPECIAL TECHNIQUE

**ANNEXURE -II**

SN	Description of Machine/Equipment/ Manpower	Capacity requirement/Qualification	Total requirement	No. of Machines available	Operation to be performed by Machine/Equipment	Capacity of available Machine	Year & Make of machine	Present Status Working/Under commencing/ Not working
1	2	3	4	5	6	7	8	9
1.	Premixing blender	Suitable Capacity.	1 No.					
2.	twin screw extruder	Suitable Capacity	1 No.					
3.	chiller drum	Suitable Capacity	1 No.					
4.	rotary crushers	Suitable Capacity	1 No.					
5.	High speed grinding mill	Suitable Capacity	1 No.					
6.	Vibratory screen,	Suitable Capacity	1 No.					
7.	Bead Mill	Suitable Capacity	1 No.					
8.	Gel Plates		1 No					
9.	Micronised sieves		1 No.					
10.	Brookfield Viscometer		1 No.					
11.	Ford Cup		1 No.					
12.	Humidity Chamber		1 No.					
13.	Cross Hatch Tester		1 No.					
14.	Cylindrical Mandrel		1 No.					
15.	FTIR		1 No.					
16.	DFT gauge - Elcometer		1 No					
17.	Electronic Weighing Balance		1 No					
18.	Film Applicator		1 No.					
19.	Hegman Gauge		1 No.					



20.	100 X Magnification		1 No.					
21.	Pull Off tester		1 No.					
22.	Sag Index Apparatus		1 No.					
23.	Salt Spray Equipment		1 No					
24.	Scratch Hardness Tester		1 No					
25.	Water Bath		1 No.					
26.	Impact Tester		1 No.					
27.	Break Down Voltage Tester		1 No.					
28.	pH meter		1 No.					
29.	Centrifuge		1 No.					
30.	Computerac		1 No					
31.	Drying time recorder		1 No.					
32.	Specific Gravity Tester		1 No.					
33.	Distillation Plant		1 No.					
34.	Pensky Martyn Flash Point Apparatus		1 No.					
35.	Ring & Ball Apparatus		1 No					
36.	Air&Air less spray gun		1 No.					
37.	Weighing Machine of 300.60, 10 Kg with least count of .10,.05 &.025		1 No. each					
38.	Hot Plates		3 Nos.					
39.	Heating Mantles		3 Nos.					
40.	Water Bath		2 Nos.					
41.	Mild Steel,Tinned & Glass panels & test Racks		Adequate					

42.	Set of Sieves, Thermometers, Glassware, Crucibles, Reagents & Chemicals for testing of Raw materials, Intermediate & finished products as per relevant specifications.		Adequate qty.				
43.	<b>Manpower</b> — The technical supervisors/managers responsible for production & quality control activities related to manufacturing of subject paint item should have the minimum qualification of B.E. / B.Tech (Paint /Polymer Technology/Chemical Engg.) with a minimum of 3 years experience or M.Sc. (Chemistry) with a minimum of 7 years experience in relevant fields to look after the production, quality control and testing activities and should have knowledge of paint manufacturing, testing of raw materials etc.		1 No. each for Production & Quality Control respectively.				

