

**RDSO SPECIFICATION
No. M&C/PCN/129/2018**

**SPECIFICATION FOR FULL GLOSS POLYSILOXANE
BASED PAINTING SYSTEM FOR THE BRIDGES,
EXTERIOR OF RAILWAY COACHES, DIESEL, ELECTRIC
LOCOMOTIVES AND OTHER INDUSTRIAL
APPLICATIONS**

PAINTING SYSTEM

Epoxy Zinc Rich Primer
Unsaturated Polyester Putty
Epoxy MIO Intermediate coating
Acrylic Full Gloss Polysiloxane finish coat

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Price:

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1. INTRODUCTION:

Indian Railway has adopted Full Gloss Polysiloxane based painting system for Bridges, exterior of railway coaches, diesel, electric locomotives and other applications. This specification consists of technical and physico-chemical requirements of Acrylic Full Gloss Polysiloxane based painting system.

2. STRUCTURE: This specification has been divided into 05 chapters designated as under:

i) General : Chapter-I

ii) Epoxy Zinc Rich Primer : Chapter-II

iii) Unsaturated Polyester Putty : Chapter-III

iv) Epoxy MIO Intermediate coating : Chapter-IV

v) Full Gloss Polysiloxane finish coat : Chapter-V

CHAPTER-I

1. GENERAL:

This Chapter provides information with regard to Surface preparation, Details of various components of painting system, aspects to be adhered to by the Manufacturers, procurement details to be followed by the users and other important aspects.

2. Surface Preparation:

The substrate shall be degreased by using suitable Petroleum Hydrocarbon solvents to IS: 1745-78. After degreasing, the surface shall be prepared by garnet/grit blasting to white metal and the prepared surface shall match to minimum Sa 2.5 of ISO Specn. No. 8501-1.

3. Components of the Painting system:

The painting system has the following components

Sl. No.	Painting operation	Description of paint	Method of Application	Chapter of Specification No. M&C/PCN/129/2018
1	Priming	Epoxy Zinc Rich Primer	Airless spray	Chapter-II
2	Putty	Unsaturated Polyester Putty	By Knife/ Spatula	Chapter-III
3	Intermediate coat	Epoxy MIO Intermediate coat	Airless spray	Chapter-IV
4	Finishing	Full Gloss Polysiloxane finish coat	Airless Spray	Chapter-V

4. Important Instructions For-

A. manufacturers:

- i) Manufacturers shall certify that the paint material is free from health hazardous material like Cr, Pb, Hg, Asbestos etc. and also that the material is free from carcinogenic and Estrogen mimimic solvents.
- ii) For touch up painting, during POH, the paint supplier shall supply the material in one litre packing. However, bulk supply of paint shall be in 20 liters packing.
- iii) Manufacturers shall submit internal test certificate for each product for all the parameters specified, at the time of supplying the material.
- iv) Manufacturers shall submit material safety data sheet along with the supplies.

v) **Warranty:**(a) Paint system procured through Indian Railway store contract:

Indian Railways may use cleaning compound for cleaning of exterior of coaches to RDSO Specification No. M&C/ PCN / 101/ 2007, taking into this and other aspects such as prevailing operating / service conditions, the Manufacturers will take warranty of their material regarding gloss retention, colour retention and adherence property at the time of supplying the painting system to be used for painting of railway assets. The minimum acceptable limits for the above properties, after various duration, are as per the following Table:

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

The paint system procured by Indian Railways through Supply-Apply and Maintenance contract, the contractor may use other cleaning /washing/polishing agent of their own choice and on their own expenses during the entire warrantee period for color and gloss retention as per the following Table. Mechanical damage and any other painting defect arise during service and warranty period shall be repaired by the contractor on their own cost. Production units and other consignee shall frame their own terms and conditions of Supply-Apply and Maintenance contract for procurement of the paint system and the same shall be introduced in P.O.

S N	Time Period	% age Gloss Retention	Colour Retention Rating on 0-10 scale (Initial rating of painted panels/coach or ISC/RAL Shade Card shall be taken as 10)	Adherence of Paints (with each other and with substrate) Cross-Cut Tape Adhesion test as per ASTM D:3359/97 (or latest)
1.	After 1 Year	No loss of gloss	10	5B
2.	After 2 Year	90% retention of initial gloss	9	5B
3.	After 3 Year	85% retention of initial gloss	8.5	5B
4.	After 4 Year	80% retention of initial gloss	8.0	5B
5.	After 5 Year	75% retention of initial gloss	7.5	5B
6.	After 6 Year	Gloss after completion of six years shall not be less than 70 units at 60 degree angle of incidence.	7.0	5B

- vi) **Marking and Packing:** 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
 - f) Shelf life of paint /material on container and temperature to be stored at.
- vii) For touch up/patch up painting, the material shall be supplied in one litre container.

B. Procurement Authorities :

All paints including thinner for the above painting systems must be procured from the same source to ensure compatibility.

C. Testing Authorities :

All the paint shall be tested in as supply condition after mixing pack A&B in recommended ratio. No thinner shall be employed until recommended by the manufacturer. All the characteristics specified shall be tested in this mixture as per specification at the time of initial approval and / or bulk every batch by which supply will cross 2500 lts or last batch in case of supply lies between more than 1500 lts & less than 2500 lts (2500 lts > supply Qty >1500lts) may be tested. In case of supply less than 1500 lts, all the tests except long duration test like salt spray, protection against corrosion under condition of condensation and accelerated test for durability will be carried out wherever it comes in picture.

Normally addition of thinner in prepared paint (obtained after mixing Pack A & Pack B in recommended mixing ratio) shall not be required. If environmental fluctuations (e.g. fall in temperature) take place, then small amount of thinner as recommended by the manufacturer, subject to a maximum of 10% (v/v), may be added to adjust the spray viscosity.

CHAPTER-II

SPECIFICATION FOR EPOXY BASED ZINC RICH PRIMER (TWO PACK)

1. SCOPE

This standard specifies requirements and methods of testing of Epoxy based Zinc Rich Priming paint supplied in two packs, intended to be used for bridges, coaches and other industrial applications. Two components epoxy zinc Rich primer is intended to be used as an anti corrosive primer over bare steel surface garnet/ grit blasted to Sa2½ of ISO: 8501-I to impart sacrificial and barrier protection against severe corrosive environments. The material shall have good adhesion on the substrate and shall have good compatibility with subsequent coats of painting system. The primer should be suitable for spray application (as per Chapter-I, Para3). It may also be suitable for application by brush for touching up smaller areas. The paint obtained by mixing the material in two packs is used as a highly protective anti-corrosive primer on steel surfaces for providing a much higher degree of protection than conventional primers. The material is suitable for over coating with epoxy and/or Polysiloxane based coatings.

1.1 The material as per this specification is not suitable for over coating with any alkyd based coating.

2. TERMINOLOGY

2.1 For the purpose of this standard apart from the glossary of terms given in IS: 1303-83 and CI2 of IS: 9162-79, 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 an epoxy based zinc Rich priming paint.

2.1.2 **Paint** : The mixture of the 2 packs, along with thinner, in the proportion recommended by the manufacturer. The mixing of the two packs shall be done with the heavy duty stirrer for 15 minutes max. (The rise in temp. shall not be more than 5°C).

2.1.3 **Barrier protection**: Corrosion protection due to formation of an impervious layer of film of corrosion resistant products and resins on the substrate surface.

2.1.4 **Sacrificial protection**: Protection from corrosion of steel substrate due to dissolution of zinc and supplying electrons to the steel substrate.

3. REQUIREMENTS:

- 3.1 The mixing ratio of the pack A and pack B shall be in simple ratio and same as supplied in dual containers.
- 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 (a) Epoxy resin (b) zinc Pigment. The material shall consist of 80.0 % by mass, minimum of zinc dust.
- 3.3.2 The purity of zinc dust to be used in the formulation of the material shall be of 95.00 %, min.
- 3.2.1.1 In the formulation of the paint, epoxy resin of the following grade shall be used.

TABLE I : REQUIREMENTS FOR EPOXY RESIN

S. No.	Characteristics	Requirement	Method of test
1.	Weight per epoxy equivalent on non-volatile vehicle content basis, g/mole	300-600	CL. 4 of IS:9162-79

- 3.2.2 **Pack B:** (Normally referred to as Hardener or catalyst solution)

This shall be liquid type, such as an aliphatic amine, an aliphatic or aromatic amine adducts a polyamide or amido polyamine or any other suitable hardeners. 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. The latest specification should be taken into consideration wherever applicable.
- 4.2 Unless otherwise specified, the following testing conditions shall apply.
- 4.2.1 The preparation of metal panels shall be in accordance with CL.5.2.1.1 of IS: 101-86.
- 4.2.2 All the tests shall be conducted at room temperature (27±2) °C and a relative humidity at (65 ± 5) % in a well-ventilated chamber free from draughts and dust.
- 4.2.3 **Condition in Containers:** Each component as delivered shall be free of gel, coarse particles, skins, foreign matter and sediments. Any sediment that does form must be easy to stir up with a high speed stirrer for 15 minutes maximum, in order to give a homogenous paint.
- 4.2.4 The two packs i.e. base and hardener shall be mixed in the ratio as 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 suitable spray (as per Chapter I, Para3). After mixing the two components thoroughly, an induction time of 10 to 15 minutes shall be allowed before use.

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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 EPOXY BASED ZINC RICH PRIMER (TWO PACK)

S.N.	Characteristics	Requirements	Test Method
1.	Drying time a) Surface Dry, max b) Hard Dry, max c) Hard Dry at 70°C, max	1/2 hours 1 hours 30 minutes with 15 minutes flash off time	IS : 101-86 (Part 3/ Sec. 1)
2.	Consistency	Smooth, uniform and suitable for brush/spray application	IS : 101-89 (Part 1/ Sec.5)
3.	Finish	Smooth and matt to egg shell flat	IS : 101-87 (Part 3/ Sec. 4)
4.	Colour	Self standard Red Oxide or Grey	IS: 101-89 (Part 4/ Sec. 2)
5.	Dry film thickness/Per coat	(40-60) microns	IS: 101-89 (Part 3/ Sec. 2) By Elcometer
6.	Volume solids, %, min	50.0	Appendix-I
7.	Scratch hardness (1.0 Kg Load)	No such scratch so as to show base metal	IS: 101-88 (Part 5/ Sec. 2)
8.	Flexibility & Adhesion (6.25mm mandrel)	No visible damage or detachment of film	IS: 101-88 (Part 5/ Sec. 2)
9.	Flash Point (a) Component A (b) Component B	Above 35°C Above 35°C	IS: 101-87 (Part 1/ Sec. 6)
10.	Resistance to salt spray	No sign of corrosion & no sign of deterioration viz. blistering, detachment of film up to 1000 hrs.	ASTM B – 117/90
11.	Protection against corrosion under condition of condensation	-do-	IS: 101-88 (Part 6 /Sec. 1)
12.	Keeping Properties for both the packs	Min. 18 months	See Appendix-III
13.	Mass in Kg/10 liters	(23-25)	IS : 101-87 (Part 1/ Sec. 7)
14.	Pot life(After induction time) at i) 27 ± 2°C, min ii) 40 ± 2°C, min	(with 10% Thinner) (without Thinner) 20 hours 4 hrs 15 hours 2 hrs	Appendix-II
15.	Theoretical Spreading Capacity, min(with 10% Thinner)	8.0 Sq. m/ lt., at 50 microns DFT	Appendix-I
16.	Fineness of grind	25-30 microns	IS : 101-87 (Part 1/Sec 7)
17.	Viscosity (Efflux time by Ford cup No. 4 of paint i.e. mixture of two components at (27±2)° C (with 10% Thinner)	30 sec. min.	IS : 101-89 (Part 1/Sec5)

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CHAPTER – III

SPECIFICATION FOR UNSATURATED POLYESTER BASE KNIFING PUTTY (TWO PACK)

1. SCOPE

This standard specifies requirements and methods of testing a two-pack unsaturated Polyester base Knifing Putty intended to be used for leveling up the surface imperfections of the exteriors of Railway Coaches, Diesel and Electric Locomotives and other industrial applications. It is suitable for application by knife of about 30 cm width or more.

1.1 USES

Material complying with this standard is intended to be used for levelling up effectively the surface imperfections viz., dents and depressions less than 2 mm of the exterior of Railway Coaches, Diesel and Electric Locomotives and other industrial applications. Dents more than 2 mm may be filled in, with the help of fillers based on unsaturated polyester resin filled with glass bubbles or any other suitable material. The material shall have good compatibility with Epoxy Zinc Rich Primer on which it is to be applied and with Epoxy based MIO Intermediate coat, which is to be used as a subsequent coat.

1.2 DEFINITION

For the purpose of this standard, the glossary of terms given in IS: 1303-83, shall apply. Rounding off, of observed values on different tests shall be in accordance with IS: 2-1960

2. MATERIAL REQUIREMENTS AND PROPERTIES

2.1 COMPOSITION

The knifing Putty shall consist essentially of two components, namely COMPONENT 'A' & COMPONENT 'B'.

COMPONENT 'A' (normally referred to as knifing Putty) shall consist of:

- (i) An appropriate unsaturated polyester resin,
- (ii) Appropriate pigments, extenders, solvents and additives.

COMPONENT 'B' (normally referred to as HARDENER or catalyst solution) shall consist of:

- (i) An organic peroxide,
- (ii) Appropriate additives.

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The material shall be of such a composition as to satisfy the requirements of this standard. In order to obtain satisfactory rubbing properties, use of slate powder along with suitable extenders and pigments, as may be necessary, is recommended.

MIXING RATIO: The mixing ratio shall be according to the recommendation of the supplier.

3.0 PROPERTIES

3.1 GENERAL

The paint shall comply with the requirements specified in TABLE-1 of the specification.

Unless otherwise specified, the following testing conditions shall apply:

The preparation of metal panels shall be in accordance with Clause 5.2 to 5.2.1.2 of IS: 101-1986.

All tests shall be conducted at room temperature ($27 \pm 2^{\circ}\text{C}$) and a relative humidity of $(65 \pm 5) \%$ in a well-ventilated chamber free from draughts and dust.

The two-component knifing Putty (Component 'A' & 'B') shall be mixed in the ratio recommended by the manufacturer (before conducting the test).

3.2 PREPARATION OF PANELS FOR TESTING

For the preparation of painted panels for conducting different tests mentioned in Table-1, the details given in Table-2 shall be followed.

3.3 CONDITION IN CONTAINER

Each component, as delivered, shall be free of gel, coarse particles, skins, foreign matter and sediments. Any sediment, that does form, must be easy to stir up with a high speed stirrer for 15 minutes maximum, in order to give a homogeneous paste.

**TABLE-1 REQUIREMENTS FOR UNSATURATED POLYESTER BASE
KNIFING PUTTY (TWO PACK)**

Sl. No.	Characteristics	Requirements	Test Method
1.	Drying time a) Surface dry, max. b) Hard dry, max. c) Hard dry time at 70°C, max.	2 hours 8 hours 2 hours, with 30 minutes flash off time	IS : 101-86 (Part 3/Sec.1)
2.	Consistency	Smooth, uniform and suitable for knife application	IS : 101-87 (Part 1/Sec.5)
3.	Stopping properties	Shall show no sagging, cracking or shrinkage	Appendix-IX
4.	Rubbing properties	Shall dry rub with 150 grade paper and wet rub with 280 grade water proof paper without clogging of the paper and shall not show defects like roughness, scratches, cracks and pinholes after rubbing.	Appendix-X
5.	Hold out Property	Finish with uniform gloss and colour	Appendix-XI
6.	Adhesion & Compatibility of Paint System	Good adhesion and compatibility of the paint system	Appendix-VII and ASTM D 3359-09
7.	Pot life, at $(27 \pm 2)^{\circ}\text{C}$, min.	30 minutes	See Note
8	% Solids, , min	85	IS: 101-87 (Part 8/ Sec 2
9.	Keeping properties	Not less than twelve months	Appendix-III

Note: Pot life is taken as the duration up to which the mixed material is still in a usable condition, starting from the time of mixing.

TABLE –2 DETAILS OF PREPARING PAINTED PANELS FOR UNSATURATED POLYESTER BASE KNIFING PUTTY (TWO-PACK)

Sl. N.	Test	Type of metal panel	Size in mm	Painting detail	D.F.T., minimum	Method of application	Duration of Air Drying before commencement of test (Applicable for panels either air dried or dried at elevated temperature)
1.	Drying time	M.S.	150 X 150 X 1.25	One coat of knifing putty	300 microns	By knife/spatula	-
2.	Stopping properties	-do-	300 X150 X 0.9	One coat of Epoxy Zinc Rich Primer (allow it to air dry for 2 hrs.) followed by three coats of U.S. polyester based knifing putty(giving interval of not less than 8hrs. and not more than 24 hrs. between successive applications)	50 microns Total DFT 1000 microns	By suitable Spray technique By knife/spatula	- 02 Hours after application of each coat.
3.	Rubbing properties	-do-	-do-	One Coat of Epoxy Zinc Rich Primer (allow it to air dry for 2 hrs.) followed by One coat of U.S. polyester based knifing putty.	50 microns 300 microns	By suitable Spray technique By knife/spatula	- 08 Hrs. after application of putty.
4.	Hold out property	-do-	300 X 150 X 0.9	One coat of Epoxy Zinc Rich Primer (allow it to air dry for 2 hrs.), followed by three coats of U.S. polyester based knifing putty (giving interval of not less than 8hrs. and not more than 24 hrs. between successive applications) Allow final coat of putty to air dry for 08 hrs., followed by One coat of Epoxy based MIO intermediate (allow it to air dry for 05 hrs.) followed by Two coats of Polysiloxane full Gloss Enamel (apply 2 nd coat after 6 hrs of air drying of 1 st coat)	50 microns Total DFT 900 microns 100 microns 45 + 45=90 microns	By suitable Spray technique Knife/Spatula By suitable Spray technique -do-	- - 48 hours
5.	Adhesion and compatibility in Paint System	-do-	300x150 x 0.9	-do- (same as at S.No.4)	-do- (same as at S.No.4)	-do- (same as at S.No.4)	07days

CHAPTER-IV

SPECIFICATION FOR EPOXY BASED MICACEOUS IRON OXIDE (TWO-PACK)

1. Scope:

1.1. This standard prescribes requirements and methods of testing of epoxy based Micaceous Iron Oxide paint supplied in dual pack, intended to be used as intermediate coat for the protection of bridges, railway coaches and other industrial applications. It should be suitable for application by airless/air spray and touch painting by brush.

1.2 The paint obtained by mixing the material in two packs is used as an intermediate coat on bridges and other industrial application.

2. TERMINOLOGY

2.1 For the purpose of this standard apart from the glossary of terms given in IS: 1303-83 and Cl.2 of IS: 9162-79, 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 an epoxy Micaceous Iron Oxide paint.

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

3. REQUIREMENT:

3.1 The mixing ratio of the Pack 'A' and Pack 'B' shall be in simple ratio by volume.

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

3.3 **PACK 'A':** Normally referred to as base, shall consist of (a) Epoxy resin and (b) Pigment.

3.4 In the formulation of the paint, epoxy resin of the following grade shall be used:

Table-I Requirements for Epoxy Resin

S.No.	Characteristics	Requirement	Method of Test
1.	Weight per Epoxy equivalent on Non-volatile vehicle content basis	150-600	IS: 9162-79

3.5 **Pigment content:** a) The material shall consist of a minimum of 30% 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)-90 by using the following extraction mixture

- | | | |
|------|--|---------------------|
| i) | Methyl iso-butyl ketone or | 25 parts by volume |
| | Methyl ethyl ketone 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 micaceous iron oxide pigment, conforming to designation Grey with metallic sheen as per ISO-10601-93 or BS: 3981-76. The balance of the pigment composition shall consist of extenders, thixotrope etc. as may be considered necessary.
- 3.6 **Pack B:** Normally referred to as Hardener, shall be liquid type, such as an aliphatic amine, an aliphatic or aromatic amine adduct, a polyamide or amido-polyamine or any other suitable hardeners. 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 metal panels shall be in accordance with IS: 101(Part1/Sec.3)-86.
- 4.2.2 All the tests shall be conducted at room temperature (27 ± 2) °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° C above the dew point to prevent moisture condensation.
- 4.2.3 The two packs 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 suitable brush / airless spray.
- 4.2.4 For the preparation of painted panels for conducting different tests mentioned in Table II, the details given in Table-III, shall be followed.
- 4.3 **Condition in container:** Each pack as delivered shall be free of gel, coarse particles, skins, foreign matter and sediments. Any sediment, that does form, must be easy to stir up with a power driven stirrer again in order to give a homogeneous paint.

**TABLE NO. II - REQUIREMENT FOR EPOXY BASED MICACEOUS IRON OXIDE
(TWO-PACK)**

S N.	Characteristics	Requirements	Test Methods.
1.	Drying time a) Surface dry max. b) Hard Dry Max. c) Hard dry at 70°. C	2 hours 4 hours 30 minutes with 15 minutes flash off time	IS:101(Part 3/Sec.1)-86
2.	Consistency	Smooth, uniform and suitable for brush/spray application	IS:101(Part 1/Sec.5)-89
3.	Finish	Smooth and matt to egg shell	IS:101(Part 3/Sec.4)-87
4.	Colour	Light grey with metallic sheen	IS:101(Part4/Sec2)-89
5.	Dry Film Thickness per coat, min. a) By Brush b) By airless spray	75 Microns 100 microns	IS:101(Part 3/Sec.2)-89
6.	Volume solid % min.	65	Appendix-I
7.	Scratch hardness (1.5 kg load)	No such scratch as to show bare metal	IS:101(Part5/Sec.2)-88
8.	Flexibility & Adhesion	No visible damage or detachment of film	IS:101(Part 5/Sec.2)-88
9.	Flash point for both packs	Above 35°C	IS:101(Part 1/Sec.6)-87
10.	Resistance to salt spray	No sign of corrosion & no sign of deterioration upto 1000 hrs.	IS:101(Part 6/Sec.1)-88
11.	Protection against corrosion under condition of condensation	-do-	IS:101(Part 6/Sec.1)-88
12.	Keeping Properties for both the packs	Not less than 18 months	IS:101(Part 6/Sec.2)-89
13.	Pot life a) at 27±2 °C , min b) at 40±2 °C , min	10 hours 2 hours	Appendix-II
14.	Mass in kg/10 liters, min	17.0	IS:101(Part 1/Sec.7)-87
15.	Theoretical coverage, min	7.0 m sq. per lt.	Appendix-I
16.	Adhesion and compatibility with primer and finish coat	5A	ASTM D-3359-97& Appendix-VII
17.	Fineness of grind, min.	30 micron	IS:101(Part 1/Sec.7)-87

CHAPTER-V

SPECIFICATION FOR FULL GLOSS POLYSILOXANE BASED ENAMEL (TWO PACK)

1.1 SCOPE

This standard specifies requirements and methods of testing a two-pack full gloss Polysiloxane Enamel, intended to be used for long life protection and decoration of bridges , exteriors of Railway Coaches, Diesel and Electric Locomotives and other industrial applications, against atmospheric corrosion. It is primarily suitable for application by spraying. It may also be applied by brush for touching up small areas.

1.2 USES

Material complying with this standard is intended to be used as top coat in paint system for the protection of bridges, exteriors of Railway coaches, Diesel and Electric Locomotives and other industrial applications, against corrosion, involving wet and damp areas, high humidity, coastal/marine and industrial fallout. Polysiloxane paints are suitable for use in those exterior applications where it is desirable to retain colour and gloss for long periods of time in addition to providing excellent chemical, abrasion and corrosion resistance. Polysiloxane top coat is also compatible with a suitable Tie-coat for application over any Alkyd/PU based coating.

1.1 DEFINITION

For the purpose of this standard, the glossary of terms given in IS: 1303-83, shall apply.

1.4 COMPONENT

The term used to describe each of the two parts of the paint which, when mixed together, form a pigmented Polysiloxane paint.

2.1 PAINT

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

2.1.1 COMPOSITION

The paint shall consist essentially of two components, namely COMPONENT 'A' and COMPONENT 'B'

COMPONENT 'A' (Normally referred to as Enamel) shall consist of:

- (i) An appropriate acrylic Polysiloxane resin
- (ii) Appropriate pigments, solvents and additives

COMPONENT 'B' – (Normally referred to as HARDENER or catalyst solution) shall consist of suitable Amino functional alkoxy silane based curing agent, catalyst and solvents. Acrylic Polysiloxane paint should be formed after mixing the two components.

2.1.2 MIXING RATIO

The mixing ratio of the Component 'A' and Component 'B' shall be in recommended ratio by volume.

3.1 PROPERTIES

3.2 GENERAL

The paint shall comply with the requirements specified in TABLE 1 of the specification.

3.2.1 Unless otherwise specified, the following testing conditions shall apply:

3.2.2 The preparation of metal panels shall be in accordance with Clause 5.2 to 5.2.1.2 of IS: 101-1986.

3.2.3 All tests shall be conducted at room temperature $(27 \pm 2)^\circ \text{C}$ and a relative humidity of $(65 \pm 5)\%$ in a well-ventilated chamber free from draughts and dust.

3.2.1 The two components P.S Finish Enamel (component 'A' & 'B'), along with thinner, shall be mixed in recommended ratio before conducting the test or tests. However, during mixing of the two components in large quantities for painting, the mixing may be done by using a high speed stirrer for 5 minutes max. (Rise in temp. shall not be more than 5°C). After thorough mixing of the two components, an induction time of 10 to 15 minutes shall be allowed before use. Where the enamel is required to be applied on panels, it shall be done so by using suitable spraying apparatus (as per Chapter-I, Para3).

3.2.5 The spray gun shall be thoroughly cleaned before use. It shall be fitted with the correct size of nozzle and air-cap. In case of airless spray, the pressure ratio of air cylinder to hydraulic cylinder shall be adjusted in accordance with the viscosity of the material to be sprayed. The pressure ratio shall be adjusted in accordance with the viscosity of the material to be sprayed. The material shall be sprayed carefully so as to obtain an even and uniform coat having a dry film thickness of 35 microns minimum per coat. From the relationship (b) in Appendix-I, determine the approximate wet film thickness required to obtain the above specified dry film thickness.

3.2.6 The mixed paint shall show good spraying properties on vertical panels. The film, when dry, shall be free from sags, runs, streaks, and any other film defects.

3.2.7 The above condition holds well wherever the use of Epoxy Zinc Rich Primer, Unsaturated Polyester Putty and Epoxy based MIO Intermediate has been recommended to be used along with the Full gloss Polysiloxane for testing.

4.1 PREPARATION OF PAINTED PANELS FOR TESTING

4.1.1 For the preparation of painted panels for conducting different tests mentioned in Table-1 the details given in Table –2 shall be followed.

5.1 CONDITION IN CONTAINER

5.1.1 Each component, as delivered, shall be free of gel, coarse particles, skins, foreign matter and sediments. Any sediment, that does form, must be easy to stir up with a high speed stirrer for 10 minutes maximum, in order to give a homogeneous paint.

**TABLE 1: REQUIREMENT FOR FULL GLOSS POLYSILOXANE ENAMEL
(TWO PACK)**

S N.	Characteristics	Requirements	Test Method
2.	Drying time Surface dry, max Hard dry, max Hard dry at 70 ⁰ C	3 hrs. 5 hrs. 30 minutes with 15 minutes flash off time	IS : 101-86 (Part 3 Sec. 1)
3.	Consistency	Smooth, uniform and suitable for spray application (as per Chapter I, Para3)	IS : 101-89 (Part 1 Sec. 5)
4.	Finish	Smooth, Uniform and full glossy	IS : 101-87 (Part 3 Sec. 4)
5.	Colour	Close match to the specific IS/RAL colour or to an agreed colour where IS colour is not specified	IS : 101-89 (Part 4 Sec. 2)
6.	Dry film thickness, min	45 microns	IS : 101-89 (Part 3/ Sec. 2) By Elcometer
7.	Volume solids, % min	65.0	Appendix-I
8.	Scratch hardness (1.5 Kg Load)	No such scratch so as to show base metal	IS : 101-88 (Part 5/ Sec. 2)
9.	Flexibility & Adhesion (6.25 mm mandrel).	No visible damage or detachment of film	IS : 101-88 (Part 5/Sec. 2)
10.	Flash point (a) Component 'A' (b) Component 'B'	Above 35 ⁰ C Above 35 ⁰ C	IS : 101-87 (Part 1/ Sec. 6)
11.	Fineness of Grind, max	15 microns	IS : 101-87 (Part 3/Sec. 5)
12.	Pot life (After induction time), min at a)27± 2 ⁰ C b)40±2 ⁰ C	10 hrs. 2 Hrs.	Appendix-II
13.	Gloss value at 60 ⁰ angle of incidence, min.	85 units (Full Gloss)	IS: 101-88 (Part 4/Sec 4) Gloss should be checked after applying two coats of PU enamel.
14.	Mass in Kg/10 litres, min.	13.0	IS : 101-87 (Part 1 Sec. 7)
15.	Keeping properties	Min. 18 months	Appendix-III

16.	Theoretical spreading rate, min	12.0 Sq. m./lt. at 45 micron DFT	Appendix-I																				
18.	Viscosity (Efflux time by Ford cup No.4) of paint i.e. mix. Of two components at (27± 2) °C in Supply condition	45 Sec. max.	IS:101-89 (Part 1 / Sec.5)																				
19.	Accelerated Tests a)Resistance to 30% Sulphuric acid (weight by volume) b)Resistance to 20% caustic potash (weight by volume) c)Resistance to oil d)Resistance to solvents e)Resistance to water	The film shall not show any signs of blistering, wrinkling & lifting. Difference in gloss and colour between immersed & unimmersed area of painted panel shall be 70%, and 7 out of 10 minimum. respectively -do- -do- -do- -do-	Appendix-V																				
20.	Durability Tests Accelerated weathering test	<table border="1"> <tr> <td>Rating scale</td> <td>0-10</td> </tr> <tr> <td>Chalking</td> <td>10</td> </tr> <tr> <td>Checking</td> <td>10</td> </tr> <tr> <td>Cracking</td> <td>10</td> </tr> <tr> <td>Flaking</td> <td>10</td> </tr> <tr> <td>Spotting</td> <td>10</td> </tr> <tr> <td>Blistering</td> <td>10</td> </tr> <tr> <td>Corrosion</td> <td>No corrosion</td> </tr> <tr> <td>Colour change</td> <td>8</td> </tr> <tr> <td>Gloss</td> <td>The film shall have a minimum gloss retention of 80% of its initial value at 60° angle of incidence</td> </tr> </table>	Rating scale	0-10	Chalking	10	Checking	10	Cracking	10	Flaking	10	Spotting	10	Blistering	10	Corrosion	No corrosion	Colour change	8	Gloss	The film shall have a minimum gloss retention of 80% of its initial value at 60° angle of incidence	Appendix-VI
Rating scale	0-10																						
Chalking	10																						
Checking	10																						
Cracking	10																						
Flaking	10																						
Spotting	10																						
Blistering	10																						
Corrosion	No corrosion																						
Colour change	8																						
Gloss	The film shall have a minimum gloss retention of 80% of its initial value at 60° angle of incidence																						
21.	Resistance to sulphur di oxide (Tested as complete system)	The film shall not show any signs of blistering, wrinkling & lifting or any damages after 2000 hrs.	IS: 10493																				
22.	Humidity test(on full system)	No sign of corrosion & no sign of deterioration up to 4000 hrs	IS : 101-87(Part6/ Sec1)																				
23.	% silicone on non-volatile binder basis, (min.)	40%	ASTMD-297& APPENDIX-VIII																				
24.	Abrasion resistance test with 1.0kg load & CS-17 wheels	100 mg, max.	ASTM D4060																				
25.	Adhesion & compatibility test on full system	Shall be compatible with other components of this paint system and matches to (5A)	ASTM: D-3359 & Appendix-VII																				

**TABLE – 2: DETAILS OF PREPARING PAINTED PANELS FOR FULL GLOSS
PLOYURETHANE ENAMEL (TWO PACK)**

S. N.	Test Parameters	Type of metal panel	Size in mm	Painting detail	D.F.T	Method of application	Duration of air drying before commencement of test (Applicable for panels either air dried or dried at elevated temperature)	Special instructions
1.	Drying time	M.S.	150X100 X1.25	One coat of Polysiloxane enamel full gloss (2 components)	45 μ	By suitable spray technique(as per Chapter I, Para3)	-	-
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	150X50 X.315	-do-	-do-	-do-	7 days	Apply a load 1.5 Kg. Instead of 1.0 Kg.
6.	Flexibility & Adhesion	-do-	-do-	-do-	-do-	-do-	-do-	-
7.	Gloss	M.S.	150X100 X1.25	-do-	-do-	-do-	24 hrs.	-
8.	Accelerated tests (a) & (b)	-do-	150X100 X1.25	See Appendix-V	Min. 240 μ	-do-	7 days	Prepare and paint both sides of the panels as per Appendix-IV
	Resistance to oil	Tin	150X50 X.315	--do--	-do-	-do-	-do-	-do-
	Resistance to water	M.S	150X100 X1.25	--do--	--do--	--do--	--do--	--do--
	Resistance to solvents	M.S.	150X100 X1.25	--do--	-do-	-do-	--do--	-do-, But Prepare and paint only one side of the panels
9.	Durability Test : (ii) Accelerated weathering test	M.S.	150X75 X1.25	Appendix-VI	Min. 240μ	-do-	-do-	Prepare and paint both sides of the panels as per Appendix-IV
10.	Humidity test	M.S.	150X100 X1.25	-	-do -	-do-	-do-	-do-
11.	Abrasion resistance test	M.S.	100x100 x1.25	Two coats of Polysiloxane enamel full gloss	90μ	-do-	-do-	Prepare and paint both sides of the panels

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:

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

 - vii) Determine the specific gravity of the paint to the nearest 0.001 g/ml by using weight per gallon cup. Let it be P

 - viii) 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.

 - ix) Dry the disc in an oven for 3 hours at 105°C and cool.

 - x) Weigh the coated disc in air. Let it be W3 grams.

- xi) Suspend the coated disc in water and weigh again. Let it be W4 grams.
- xii) Calculate the volume of the coated disc as follows :

$$V_1 = \frac{W_3 - W_4}{d}$$
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 (V_d) = $V_1 - V$

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

$$V_w = \frac{W_3 - W_1}{W \times P}$$
where W = grams of non volatile matter in 1.0gm paint.
P = specific gravity of the paint.

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

$$\frac{V_1 - V}{V_w} \times 100 \text{ (OR)} \quad \frac{V_d}{V_w} \times 100$$

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

- (a) % Volume solids

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

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.

- i) Measure the viscosity initially and every hour thereafter. However, the interval may be shortened, if desired.
- ii) 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.

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APPENDIX-III

KEEPING PROPERTIES

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

APPENDIX-IV

PREPARATION OF TEST PANELS

In the painting procedure as mentioned below, the air drying of the films shall be done at temperature of $(27 \pm 2)^{\circ}\text{C}$ and a relative humidity of $(65 \pm 5)\%$. The surface of the test panels to be exposed shall be prepared as follows:-

- 1- Apply one coat of Epoxy Zinc rich primer by suitable spraying, conforming to this specification over garnet/grit blasted surface to Sa 2.5 within 3 hrs of blasting and allow it to air dry for 2 Hrs.
- 2- Rub down lightly with waterproof emery paper No.280/320, wipe off the surface using a piece of clean and dry soft cloth and then apply one coat of epoxy based MIO by suitable spraying conforming to this specification, and allow it to air dry for 5 hrs.
- 3- Rub down, wet with waterproof emery paper No.280/320, wipe off the surface using a piece of clean and dry soft cloth and then apply one coat of P.S. Full Gloss Enamel by suitable spraying, conforming to this specification, and allow it to air dry for 6 hrs.
- 4- Rub down, wet with waterproof emery paper No.220, wash and wipe off water and when the surface is dry, apply a second coat of P.S. Full Gloss Enamel by suitable spraying, conforming to this specification and allow it to air dry for 07 days before subjecting to exposure test.

Note : The Epoxy Zinc Rich Primer, unsaturated polyester putty, epoxy based MIO intermediate coat and full gloss Polysiloxane enamel shall be from the same supplier.

APPENDIX-V**ACCELERATED TESTS**

The following short term tests of chemical resistance do not categorize the type of service for which Polysiloxane coating system are intended but are included to assure the customer that the coating contains a sufficiency of cured resin to exhibit the long terms requirements.

Prepare the panels as per Appendix-IV allow the panels to air dry for seven days. For the immersion test as in (a), (b) and (c). Prepare and paint both sides of the panels and protect the edges of the panels by sealing with a suitable wax.

a) Resistance to Sulphuric Acid

Immerse $\frac{3}{4}$ th of the panel in 30% Sulphuric Acid (W/V) for 24 hours. Remove the panel, wash in running fresh water and allow it to dry for an hour and record the observation.

b) Resistance to Caustic Potash

Immerse $\frac{3}{4}$ th of the panel in 20% Potassium Hydroxide (W/V) for 24 hours. Remove the panel, wash in running fresh water and allow it to dry for an hour and record the observation.

c) Resistance to Oil

Prepare the panel as per Table 2. Immerse $\frac{3}{4}$ th of the panel in a mineral lubricating oil (As mentioned in Clause 19.1 of IS: 101-1964) for 2 hours. Remove the panel and wipe the excess oil with a pad of cotton and wash it with mineral turpentine oil (MTO) and allow to dry for 30 minutes and record the observation.

d) Resistance to Solvents

Test on panel each for resistance to xylene, ethanol and acetone respectively. Take a white sterilized cotton and soak it in the solvent and place it on the painted panel without squeezing the cotton. Immediately cover the soaked cotton with a suitable watch glass and leave it for 3 hours. Remove the watch glass and then the soaked cotton and wipe the area with a clean dry cotton and immediately record the observation.

e) Resistance to Water

Immerse $\frac{3}{4}$ th of the panel in water for 240 hours. Remove the panel, wash in running fresh water and allow it to dry for an hour and record the observation.

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APPENDIX-VI

ACCELERATED TEST FOR DURABILITY

Both sides of the panels must be prepared and painted as per Appendix-IV and S.No.9 of Table 2: Details of preparing Painted Panels for Full Gloss P.S. Enamel (Two Pack).

a) ACCELERATED WEATHERING TEST

The test is performed according to DIN53387

Test Period	:	1000 hours
Apparatus	:	Weather-o-meter, Xenon Arc Lamp with rotating Day / night device type
Cycle	:	3 Min. rainfall, 17 Min. dry period alternatively
Light exposure:		UVB 313 light exposure
Temperature	:	50°C

The requirements of this test shall be taken to have been satisfied if performance in respect of the characteristics as noted in Clause D-3.2 of IS : 8662-1993 (or corresponding clause of latest version) is within the limits.

b) ALTERNATE METHOD

The test may also be carried out as per ASTM-G-53

Test Period	:	750 hours
Apparatus	:	Operating Light and Water-Exposure Apparatus (Fluorescent UV-Condensation Type)
Cycle	:	4 Hrs. U.V. Light from UV-B lamps with a peak emission @ 313 n.m. and 4 hrs Condensation alternatively.
Temperature	:	50°C

The requirements of this test shall be taken to have been satisfied if performance in respect of the characteristics as noted in Clause D-3.2 of IS : 8662-1993(or corresponding clause of latest version) is within the limits.

APPENDIX-VII**DETERMINATION OF ADHESION AND COMPATIBILITY IN PAINT SYSTEM****1. Outline of method:**

The material is tested in a painting 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 full 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 epoxy based zinc rich primer (two pack), 50 microns, DFT as per the specification and allow to air dry for at least 2 hours, minimum. Dry rub with emery paper no. 400 and wipe clean with a dry soft cloth.
 - c) Spray/apply one intermediate coat of epoxy based MIO intermediate coat (two- pack), 75 microns, minimum DFT, as per the specification. Allow to air dry for 5 hours, minimum. Dry rub with emery paper no. 400 and clean the surface.
 - d) Apply two coats of full gloss Polysiloxane enamel (two-pack), minimum 45 microns DFT per coat, as per the specification at an interval of 6 hours, minimum between 1st and 2nd coat. Allow to air dry for at least 7 days before assessing the performance.
- 3.** The material shall be deemed to have passed the test, if the material shows good adhesion over substrate and between various coats, and compatibility between primer, intermediate coat and finish coat of the system.

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.

APPENDIX-VIII**Test Method for Silicon Content of polymer****Scope**

This test method covers the determination of the silicon content which is present in volatile portion of polymers, resins, or liquid paints.

Procedure

Mix the paint sample for 10 min on a mechanical shaker, stir with a paddle to loosen any caked pigment, if necessary, repeat until there are no lumps present and the sample is thoroughly mixed. Take 75 ml of paint in centrifuge tube; add 50 ml of solvent mixture which is listed below. Mix it until homogenous solution keeping centrifuge tubes in centrifuge machine. Set the centrifuge at min. 6,500 rpm and run for 25 minutes. After this time, decant the clear supernatant liquid (containing binder) in beaker. Refill tube with solvent mixture and spin again. Repeat for a total of 3 times. Note: Supernatant liquid should be free from pigments particle. Keep decanted liquid in oven at 60 °C until all solvent gets evaporated. Take 5-10 gm of remaining material (Resin) in porcelain crucibles. Place it in to the muffle furnace. Set temperature 600° C and keep it for 1 hr. Remove it from the furnace cool down to room temperature. Take & note weight of the crucible. Again keep it in furnace for heating for 30 min. Take weight as described earlier. Weights of crucible after heating should be constant for both otherwise repeat same cycles until constant weight is achieved. The remaining residue is called Ash. Dissolve a specimen of ash in 10 ml of HCL, rinse crucible thoroughly, dilute to 100 ml and evaporate to dryness. Bake for 1hour at 110° C. Moisten with 10 ml of HCL and 3 drops of HNO₃ and digest for 15 minutes on steam bath. Add 100 ml of water, boil, filter and wash with hot water. Dry and ignite the precipitate in porcelain crucible. Weigh to determine the silicon content, transfer to platinum crucible and add 2-3 ml of HF and few drop of H₂SO₄. Evaporate to dryness and carefully ignite at low red heat. The loss in mass is silicon content.

Calculation

$$\% \text{ Silicon content (-Si-O-Si-) } = \{[(A-B) - (D-E)] / C\} \times 100 \times 1.2$$

A = Mass of residue and porcelain crucible after ignition.

B = Mass of porcelain crucible

C = Mass of original specimen, mass of residue and platinum crucible

D = Mass of residue and platinum crucible after treatment with HF and ignition

E = Mass of platinum crucible.

Solvent Mixture to be used for Centrifuge

Isopropyl alcohol (IPA) 50%

Xylene 25%

Butyl acetate 25%

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APPENDIX-IX

DETERMINATION OF STOPPING PROPERTIES

Outline of the method:

A mild steel panel is dented with a specified numbers of dents and then coated with epoxy based zinc rich primer followed by unsaturated polyester based putty. It is then suitably examined at the dents for satisfactory Stopping properties.

Procedure:

Dent a 300 x 150 x 0.9 mm mild steel plate with the help of blunt iron ball hammer and make 10 dents of about 3 mm diameter and 1 mm deep. The dents shall be so made that they are 50 mm away from the side of the panels and 50 mm apart from one another. Roughen the panel with emery paper no. 180. Wipe this with petroleum hydrocarbon solvent, 145/205 (low aromatic) (see IS: 1745- 1978) and allow to dry. Apply one coat of epoxy based zinc rich primer to produce minimum 50 microns DFT and air dry for 2 hrs, minimum. Make 3 applications of polyester based putty giving an interval of not less than 8hrs and not more than 24 hrs between successive applications, each having dry film thickness of 300 microns, minimum. Keep the panel vertically.

The material shall be deemed to have passed the test if there is no sagging after 2 hours, after every application at the dents; it works hard in 8 hours and shows no sign of crack or shrinkage after 18 hours.

APPENDIX-X

DETERMINATION OF RUBBING PROPERTIES

Outline of the Method:

The material in a specified film thickness is applied on a mild steel panel. The film when dry is tested for its rubbing properties by rubbing with abrasive paper.

PROCEDURE:

Take 300 x 150 x 0.9 mm mild steel plate. Roughen the panel with emery paper no. 180. Wipe this with petroleum hydrocarbon solvent, 145/205 (low aromatic) (see IS: 1745- 1978) and allow to dry. Apply one coat of epoxy based zinc rich primer to produce minimum 50 microns DFT, air dry for 2 hrs, followed by one coat of polyester based putty having dry film thickness of 300 microns, minimum.

The film prepared as above shall be suitable for dry rubbing with 150 grade paper and wet rubbing with 280 grade water proof abrasive paper without any clogging of the paper. After rubbing down, the surface shall not show defects like roughness, scratches, cracks, pin holes etc. Minor pin holes or scratches which will duly be filled by subsequent coat of epoxy based MIO paint shall not be the cause for rejection.

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APPENDIX-XI

DETERMINATION OF HOLD-OUT PROPERTY IN PAINT SYSTEM

1. Outline of method:

The material is tested in a painting system and schedule simulating actual use. Finish with uniformity of colour and gloss is taken as criteria for having passed the test.

2. Procedure:

A panel of 300 x 150 x 0.9 mm, mild steel with full paint system shall be prepared as described below:

a) Clean the surface either by shot or grit blast/ Phosphating / any appropriate chemical treatment/roughen the panel with emery paper no. 180 and wipe this with petroleum hydrocarbon solvent, 145/205 (low aromatic) (see IS: 1745- 1978) and allow to dry.

b) Apply one coat of epoxy based zinc rich primer (two pack), 50 microns, minimum DFT as per the specification and allow to air dry for 2 hours, minimum. Dry rub with emery paper no. 400 and wipe clean with a dry soft cloth.

c) Make 3 applications of polyester based putty with a suitable knife, each application having a dry film thickness of 300 microns, minimum, at an interval of not less than 8hrs. and not more than 24 hrs between successive applications. The overall dry film thickness of 3 applications shall be minimum 950 microns. Allow the final coat to air dry for at least 8 hours and not more than 24 hours. Wet rub with 280 grade water proof abrasive paper and allow to dry.

d) Apply one coat of epoxy based MIO intermediate coat (two-pack) by brush, 75 microns, minimum DFT, as per the specification. Allow to air dry for 5 hours, minimum. Dry rub with emery paper no. 400 and clean the surface.

e) Apply two coats of full gloss Polysiloxane enamel (two-pack) of 45 microns, minimum DFT per coat, as per the specification at an interval of 6 hours, minimum between 1st and 2nd coat. Allow to air dry for at least 48 hours before assessing the performance.

3. The material shall be deemed to have passed the test, if the resultant finish is uniform all over the surface with regard to gloss and colour. The gloss when measured shall have a value specified in the specification.

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