



**TITLE: - FULL GLOSS POLYURETHANE FINISHING PAINT**

TRE/165

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**1.0 SCOPE**

This specification governs the quality requirements of air / oven drying Polyurethane Finishing Paint (Two pack system). This is recommended for exterior applications where it is desirable for gloss retention for long periods, chemical and corrosion resistance. This paint is suitable for both brush and spray application. The paint shall be compatible on surface primed with epoxy priming as per TRE / 166, intermediate MIO paint as per TRE / 167.

**2.0 APPLICATION**

Suitable for use in as those exterior surfaces where it is designed to retain colour and gloss for long period in addition to provide excellent chemical and corrosion resistance. Suitable for vapour phase drying operation of Transformer in solvent vapour Shellsol – H at 130<sup>0</sup> C and oven drying at 90 ± 10<sup>0</sup> C.

**3.0 COLOUR**

As specified on BHEL order.

**4.0 COMPLIANCE WITH NATIONAL STANDARDS**

The material shall comply with the requirements of the following national standard and also shall meet the requirements of this specification.  
IS : 13213 - 1991 : "POLYURETHANE FULL GLOSS ENAMEL (TWO PACK)"  
(Reaffirmed 1996) |

**5.0 FINISH**

Smooth and full glossy

**6.0 FREEDOM FROM DEFECTS**

The components of the paint shall remain free from defects like hard settling of pigments, skinning, livering (excessive viscosity build up) when kept in closed container till its shelf life.

The dried paint film shall be free from defects like bittyness, floating of pigments, surface haze, orange peeling, colour fading, wrinkles etc. when dried in oven at 90 ± 10<sup>0</sup> C for 1 hour and subjected to vapour phase operation at 130<sup>0</sup> C in Shellsol – H solvent for 72 hour.

The paint shall confirm to the requirements of ISO 14001 and shall be free from lead/ lead components.

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7.0 CHEMICAL COMPOSITION

The paint consists of two components enamel and a hardener solution to be mixed by volume. The mixing ratio of base and hardener shall be as per supplier's recommendation.

Enamel shall consist of an appropriate polyol , pigments , solvents and additives. The hardener solution shall consist of an aliphatic polyisocyanate, solvents, and additives.

Note:

- 1) The base contains acrylic resin and acid/alkalic/light fast pigments.
- 2) The mixed paint shall be stirred well for 20 minutes to mature and must be consumed within 4.0 hours after mixing.
- 3) The content and nature of the components shall be strictly same as type approved sample.

This shall be confirmed by IR spectrography / thin layer chromatography which should be provided by supplier.

8.0 TEST SAMPLES

Tender samples will not be required when once the type approval is given and the supplier concerned declares that the material for which the tender is given of the same quality as the type approved sample.

Sampling of paint shall be done as per IS: 101.

9.0 TEST METHODS

Unless otherwise specified, the samples shall be tested in accordance with relevant part and section of IS 101.

9.1 PROPERTIES

9.1.1 Drying Time

- a) Surface dry : 3.0 hours, maximum at ambient temperature
- b) Hard dry : 8.0 hours, maximum at ambient temperature
- c) Full cure : 7 days, maximum at ambient temperature
- d) Hard dry : 1hour, maximum with 15 minutes flash off time at 90 ± 10<sup>0</sup> C in oven.

9.1.2 Consistency

60 ± 10 Sec in FC4 at 27 ± 2<sup>0</sup> and Suitable for brush application.

9.1.3 Fineness of grind

10 microns, minimum

9.1.4 Gloss at 60 °

80 minimum

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**9.1.5 Scratch Hardness after full cure for 7 days under load of 2000 ± 200 gms, min.**

No such scratch as to show the bare metal

**9.1.6 Flexibility and adhesion test**

No visible damage or detachment of paint film when tested by Erichsen cupping test upto 8mm.

**9.1.7 Weight**

9.0 kg, minimum per 10 litres of mixed paint However it shall be within ± 3.0% of type approved sample.

**9.1.8 Dry film thickness per coat of application**

35.0 microns, minimum. (Refer AA 067 41 05)

**9.1.9 Volume solids**

40.0% , minimum

**9.1.10 Flash Point**

20°C, minimum of each component

**9.1.11 Chemical Resistance Test**

Painted mild steel panels shall be immersed in following chemicals after full curing.

- Sulphuric Acid 20 % by m/v for 8.0 hours at ambient temperature.
- Caustic Potash 25 % by m/v for 12.0 hours at ambient temperature.
- Insulating oil as per IS:335 for 24.0 hours at ambient temperature.
- Solvents( Xylene, Ethanol & Acetone ) for 24.0 hours at ambient temperature.
- Solvent (Shell sol – H ) for 72 hours at 130<sup>0</sup> C

After test period, the panels shall not show any signs of blistering, wrinkling and lifting. Gloss retention shall be minimum 50.0% of the original gloss value. There shall be no appreciable change in colour.

**9.1.12 Pot life at 27 ± 2<sup>0</sup> C**

4.0 hours, minimum

## 10.0 TYPE APPROVAL

### 10.1 Samples

Samples for type approval testing shall be accepted only from those manufactures whose manufacturing and testing facilities are considered satisfactory to ensure continuous supply of good product.

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### 10.2 Type Test

#### 10.2.1 Accelerated Tests (IS: 13213):

Tests shall be conducted as per procedure given below for chemical resistance to Sulphuric acid, Caustic potash, Oil & Solvents and the result shall not show any signs of bittyness, floating of pigments, surface haze, orange peeling, colour fading, wrinkles etc. Difference in gloss and colour between immersed and un-immersed area of paint film shall be minimum.

#### PROCEDURE:

Preparation of painted panels generally as per IS: 101.

Apply one coat of epoxy zinc phosphate primer (two pack) at minimum 30 microns dry film thickness by spraying and allow to dry in oven at  $90 \pm 10^0$  C for 1 hours. Dry rub with emery paper No.400 and wipe clean with a dry soft cloth. Apply 2<sup>nd</sup> coat of epoxy zinc phosphate primer (two packs) at minimum 30 microns dry film thickness by spraying and allow drying in oven at  $90 \pm 10^0$  C for 1 hour. Wet rub with water proof emery paper No.400 and allow to dry.

Apply one coat of full gloss polyurethane enamel (two pack) at minimum 35 microns dry film thickness by spraying and allow to oven dry at  $90 \pm 10^0$  C for 1 hours.

**Note:** For immersion tests prepare and paint both sides of the panels and protect the edges of the panels by sealing with chlorinated rubber paint.

#### Resistance to Sulphuric acid:

Immerse 3/4 th of the panel in 30% sulphuric acid for 24 hours. Remove the panel, wash in running fresh water and allow it to dry for an hour.

#### Resistance to Caustic potash:

Immerse 3/4 th of the panel in 20% solution of potassium hydroxide for 24 hours. Remove the panel, wash in running fresh water and allow it to dry for an hour.

#### Resistance to Oil:

Immerse 3/4 th of the panel in a insulating oil as per IS 335 for 24 hours. Remove the Panel and wipe the excess oil with cotton, wash it with mineral turpine and allow to dry for 30 minutes.

#### Resistance to Solvents:

Test one panel each for resistance to xylene, ethanol, acetone and Shellsol - H respectively.

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1. Take a clean 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 6 hours. Remove the watch glass and the soaked cotton, wipe the area with clean dry cotton.
2. Keep the painted panel in chamber filled with Shellsol – H solvent vapours at 130<sup>o</sup> C for 72 hours.

**10.2.2 Durability Test ( IS:8662)**

**10.2.2.1 Normal Outdoor Exposure Test:**

Preparation of panels for the test and tests shall be as per procedure given in Annexure. Test panels shall be exposed at an angle of 45<sup>o</sup> facing south. The test shall satisfy the requirements laid down for at least 12 months after painting.

**10.2.2.2 Accelerated Weathering Test ( IS:8662)**

The test shall satisfy the requirement laid down, after 1000 hrs. test in Xenon Arc Type Weathero Meter ( with rotating day / night device ) with a cycle of 3 minutes rainfall and 17 minutes dry period.

**PROCEDURE:**

Preparation of panels for the test shall be as per the procedure given in the Annexure. Samples of panels shall be tested in duplicate in a accelerated weathering apparatus and samples drawn from the exposed films shall be evaluated for gloss and various film properties.

The requirement of the test shall be taken to have been satisfied if the performance in respect of the film characteristics is within the limits specified below:

- a) Gloss : The film shall have a minimum gloss retention of 50% of the original value.
- b) Colour : The film shall have a minimum rating of 8.
- c) Freedom from Checking, Cracking, Flaking, Chalking, Spotting, Blistering and corrosion.

**NOTE:**

a) Test certificate of Cl.10.2.1 & 10.2.2 shall be forwarded by the supplier in line with IS:13213 and IS:8662 at the time of type approval. While supplying the material supplier shall furnish these test certificates after every two years.

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**11.0 TEST CERTIFICATES**

Unless otherwise stated, three copies of test certificates shall be supplied along with each consignment.

In addition, the supplier shall ensure to send one copy of test certificate along with their despatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

TRE / 165 : Full Gloss Polyurethane Finishing Paint.

BHEL Order No.

Manufacturer's / supplier's name.

Trade mark, if any.

Batch / lot no.

Quantity supplied.

Date of manufacture and expiry.

Test results of clause 7,9 and 10.

T.C.No & date

Mixing ratio

**12.0 KEEPING PROPERTIES**

When stored under cover in a dry place in the original sealed container under normal temperature conditions, the base and accelerator shall retain the properties of the mixed paint prescribed in this specification for period of not less than 12 months after the date of manufacture which shall not be earlier than one month of the scheduled delivery date mentioned in BHEL order.

**13.0 PACKING & MARKING**

Unless otherwise stated, base and accelerator shall be packed separately in steel containers of appropriate capacities. Each container shall bear the following information:

TRE/165 : Base / Accelerator for Full Gloss Polyurethane Finishing Paint.

BHEL Order No.

Manufacturer's / supplier's name.

Trade name mark, if any.

Batch/lot no.

Date of manufacture and expiry.

Quantity supplied.

Mixing ratio

**14.0 REFERRED STANDARDS (Latest publications including amendments):**

1) IS : 101 2) IS:335 3) IS:8662 4)IS: 13213 5) AA 067 41 05 6) AA 56142

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**ANNEXURE (Cl: 10.2.2.1)**

**PROCEDURE OF DURABILITY TEST:**

**PREPARATION OF TEST PANELS:**

The panel shall be mild steel plate of 1.25 to 3.15 mm thick and free from surface defects. Size of the panel for out door exposure test shall be 300mm x 300mm and for the Accelerated weathering test 150mm x 150mm. Panels shall be cleaned and the back and edges of the panels shall be protected with two coats of a suitable paint. The surface of the test panels to be exposed shall be prepared as follows, taking care that total dry film thickness of the complete system shall be between 75 and 150 microns. Oven drying of films shall be done at temperature  $90 \pm 10^0$  C and at a relative humidity of 65  $\pm 5$  percent.

- a) Apply one coat of ready mixed paint red oxide zinc phosphate primer by brushing and allow to oven dry at  $90 \pm 10^0$  C for 1 hour.
- b) Rub down lightly with waterproof emery paper No.280/330, wipe off the surface with a clean and dry soft cloth and then apply by brushing one coat of the under coating enamel and allow it to dry for 24 hours.
- c) Rub down, wet, with water proof emery paper No.280/320 wipe off the surface with a clean and dry soft cloth and then apply by brushing one coat of the finishing enamel and allow it to oven dry at  $90 \pm 10^0$  C for 1 hour.
- d) Rub down, wet, with water proof emery paper No.220, wash and wipe off water, and when the surface is dry, apply by brushing a second coat of the finishing enamel and allow it to dry for 7 days before subjecting to exposure test.

**OUT DOOR EXPOSURE TEST:**

Expose in open the test panels prepared as above in duplicate at an angle of 45 o facing south. Examine the condition of the exposed films at monthly intervals for the first quarter and thereafter quarterly for the rest of the period for the properties gloss, colour, checking, cracking, flaking, chalking

For the above examinations, wash the right hand half of the surface of the two test panels by pouring water and then wiping with a soft cloth or chamois leather. Examine the same half of the test panel at each examination At the end of the stipulated period for durability test examine the two halves of the test panels. The sample shall be considered satisfactory if the material surface underneath as well as condition of the film in both the halves, the one washed periodically as well as the one washed only for the final examination is satisfactory by the method of evaluation given below. Stray film failure due to extraneous causes other than climatic shall be ignored.

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**ANNEXURE - CONTINUED**

**Evaluation and Rating of Film Characteristics:**

- a) Gloss: Specular 45 o and 60 o head glossometer reading.
- b) Colour: The initial rating for a good colour match shall be 10. The colour Retention on exposure shall be expressed and recorded as the abbreviation of the type of colour change followed by numerical rating as follows:

**RATING TYPE OF COLOUR CHANGE**

- 10 - Good match D - Darkening
- 9 - Satisfactory F - Fading
- 8-7 - Slight colour change B - Blueing
- 6-5 - Definite colour change R - Reddening
- 4-3 - Bad colour change Y - Yellowing
- 2-1 - Very bad colour change L - Loss of colour
- 0 - Complete colour change

- c) Checking: Freedom for checking shall be rated as 10 for no checking and 0 for most severe and complete checking.
- d) Cracking: Freedom for cracking shall be rated as 10 for no cracking and 0 for most severe and complete cracking.
- e) Flaking: Freedom for flaking shall be rated as 10 for no flaking and 0 for most severe and complete flaking.
- f) Chalking: Freedom for chalking shall be rated as 10 for no chalking and 0 for most severe and complete chalking.
- g) Spotting: Freedom from spotting shall be rated as follows:

**Numerical value Rating**

- 10 No spotting
- 9 Satisfactory
- 8-7 Slight spotting
- 6-5 Definite spotting
- 4-3 Bad spotting
- 2-1 Very bad spotting
- 0 Complete spotting

- h) Blistering and Corrosion: The film shall remain generally free from blisters and the metal underneath shall show no signs of corrosion on exposure for 12 months. A few isolated blisters without any signs of corrosion underneath as well as one or two localized corrosion and/or rust spots shall not constitute a cause of failure.

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